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PROJECT SPECIFICATIONS

PINEVIEW PUBLIC SCHOOL RAAC Replacement & Accessibility Upgrades

Upper Canada District School Board
Tender Number 26-075

Issued for Tender/Permit

Athens, ON

Date: May 13th, 2026

File: A49 Project No. A49-CA0047030.1082

The tender for the project described as Pineview Public School – RAAC Replacement & Accessibility Upgrades located in Athens, Ontario, (UCDSB Tender No. is 26-075) is based upon those documents identified in this Appendix together with such Addenda as are listed in the tender submitted:

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Part 1 General

1.1 EXAMINATION

- .1 The Contractor and all sub-contractors shall familiarize themselves with conditions at the site. Each one shall bear complete responsibility for familiarization with conditions and the effect that same may have on work.
- .2 Every sub-contractor and the Contractor shall examine the contract documents, the conditions on site and the work in place prior to commencing the various portions of this work.
- .3 Each sub-contractor and the Contractor shall report in writing to the Consultant and the Contractor any defects affecting the work of that trade.
- .4 Commencement of work shall be construed as evidence of acceptance of underlying surfaces, conditions, arrangement and location as satisfactory.
- .5 Refer to Instructions to Tenderers and Supplementary Conditions for additional contractual information.

1.2 SUPERVISION

- .1 The overall superintendence of the project, ensuring the complete performance of all sub-contractors and suppliers as laid down in the specifications, is the responsibility of the Contractor. A fully competent site superintendent shall be responsible and always oversee all work throughout the contract. The superintendent shall study the plans and specifications in detail and be completely familiar with the project at the outset. Once conversant with the documents, he shall relate them to the existing conditions. Any errors or discrepancies in dimensions, details, etc., in the plans and specifications or their relationship to the existing conditions shall be reported to the Consultant for clarification or correction before beginning the work. Allow Consultant time for clarification or correction as required.
 - .2 Ensure that all necessary job dimensions are taken and all trades and coordinated for the proper execution of the work. Assume complete responsibility for the accuracy and completeness of such dimensions, and for coordination.
 - .3 Verify that all work as it proceeds is executed in accordance with dimensions and positions indicated, which maintain levels and clearances to adjacent work as set out by requirements of the drawings; and ensure that work installed in error is rectified before construction continues. Verify that all work as it proceeds is executed in accordance with dimensions and positions indicated, which maintain levels and clearances to adjacent work as set out by requirements of the drawings; and ensure that work installed in error is rectified before construction continues.
 - .4 Check and verify all dimensions referring to the work and the interfacing of all services. Verify with the trade concerned all dimensions pertaining to the work of other trades.
 - .5 Any errors, discrepancies, or trade conflicts arising during construction shall, when necessary, be referred to the Consultant for clarification and/or decision. Allow Consultant time for deliberation as required.
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1.3 COOPERATION AND COORDINATION

- .1 Coordinate all sub-contractors and suppliers so that work proceeds smoothly without interruption and in strict accordance with reviewed schedules. Coordinate so that work is executed in proper sequence, items to be built-in are built-in on time, erected work is protected against damage from the work of other trades and defective work is removed and made good to the satisfaction of the Consultant.
- .2 Study all documents which describe, or are related to, any operation before commencement of that operation. Report discrepancies discovered between elements of documentation and obtain ruling on required interpretation before beginning work. Allow Consultant at least 5 (five) full working days to make ruling.
- .3 Ensure that material, equipment, services and operations are brought to site at proper times, in sufficient quantity and quality and in accordance with requirements of work.
- .4 Contractor shall ensure that each subcontractor informs him of requirements for site conditions and surfaces necessary for the execution of the work and that he provides setting drawings, templates and all other information necessary for the location and installation of material, holes, sleeves, inserts, anchors, accessories, fastenings, connections and access panels. The Contractor shall inform other sub-contractors whose work is affected by these requirements and preparatory work.
- .5 Contractor and sub-contractors shall cooperate fully with other contractors and sub-contractors working on this project. Perform necessary coordination to install equipment supplied or supplied and installed by Owner.
- .6 Remove and replace ceilings as required to accommodate the installation of phone, data, security and other service lines in ceiling space which are installed by other contractors.
- .7 Consultant's normal hours of operation are between 8:00am and 5:00pm Monday to Thursday, and between 8:00am and 12:00 noon on Friday. Account for these hours of operation when communicating with the Consultant, when providing the Consultant with sufficient notice, and/or when allowing the Consultant time for deliberation as required.

1.4 SCHEDULING AND CONTRACTORS USE OF SITE:

- .1 Use of site for execution of the work and as otherwise noted or indicated.
- .2 Dates and Hours of work.
 - .1 During July and August the school is available from 7:00 am to 10:30 pm each day.
 - .2 Refer to "General Construction Phasing" drawing A002. Coordinate with UCDSB Project Manager for all scheduling.
 - .3 For after hours work and weekend work, coordinate exact times with UCDSB Project Manager for scheduling.
- .3 Custodian work hours are from 7:00 am to 3:00 pm during July and August. Contractor may be responsible to disarm and arm the security system each day. Arrange with UCDSB Project Manager for security codes and access.

- .4 Confine operation, storage access and parking to owner's discretion. Exact location to be confirmed by UCDSB Project Manager.
- .5 Do not unreasonably encumber site with materials or equipment.
- .6 Move stored products or equipment which interfere with operations of owner or other contractors.
- .7 Obtain and pay for additional storage or work areas needed for operations.
- .8 Maintain project grounds and public areas free of rubbish and waste materials.

1.5 DOCUMENTS REQUIRED

- .1 Maintain at job site, copies of contract drawings, specifications, addenda, regulatory authority approved drawings, permits and orders, change orders, site instructions, other modifications to contract, field test reports, inspection reports, job minutes, reviewed schedule, manufacturers' installation and application instructions, Material Safety Data Sheets, set of drawings for as-builts, latest copy of Ontario Building Code, Occupational Health and Safety Act and Regulations for Construction Projects.

1.6 PROJECT MEETINGS

- .1 Hold project/site meetings as required, frequency, and locations as directed by Consultant and/or UCDSB Rep. Notify all parties concerned of meetings. When requested by the Consultant, ensure requested sub-contractors attend.
- .2 Record minutes of meetings. Within (3) three days of the meeting, distribute draft copies of the minutes by email to the Owner and Consultant for review and comment. Allow (3) days from their receipt of draft minutes for the Owner and Consultant to respond with revisions. Within (3) three days of receipt of revisions, incorporate Owner and Consultant's revisions in revised meeting minutes and distribute to all parties. At each site meeting provide hard copies of previous site meeting minutes to Owner and Consultant.

1.7 INSPECTION, TESTS AND APPROVAL

- .1 At least forty-eight hours' notice shall be given to the Consultant in order that all inspections and tests called for by these specifications may be implemented. Failure to give such notice will result in complete retesting if deemed necessary by the Consultant.

No work shall be covered up until inspection and acceptance by the Consultant or Inspector.

1.8 BUILDING AND OTHER PERMITS

- .1 The Owner shall apply for the main building permit and pay for permit fees. Apply for and pay all other required fees such as, road cut fees, ESA plans review, Hydro Inspection fees, landfill dumping fees, and the like. The Owner will make the building permit application in advance of tender award to facilitate approval process.
- .2 Provide Authorities with such plans and information as may be required for the issuance of Acceptance Certificates.
- .3 Obtain all Inspection Certificates required by Authorities having jurisdiction. Hand over

copies of same to Consultant.

1.9 SETTING OUT LINES AND LEVELS

- .1 Contractor shall confirm all elevations and/or dimensions of existing conditions on site and allow for same in tendering price.
- .2 Verify and record on the record drawings, elevation of footing bearing surfaces, top of footings, new services, existing utilities encountered; all related to finished floor elevation or geodetic elevations.
- .3 Install substantial batter boards, lines, stakes, etc, as required during the progress of the work.

1.10 CUTTING AND PATCHING

- .1 Execute cutting (including excavation), fitting and patching required to make the work fit properly together. Cut and patch for process, mechanical and electrical work.
- .2 Coordinate work with other trades so that there is a minimum of cutting, fitting and patching.
- .3 Drilling, cutting, fitting and patching and making good where necessary due to failure to deliver items to be built in time or installation in wrong location, shall be executed as directed at no cost to the Owner.
- .4 Drilling and cutting of load bearing structural members shall be done on prior express written permission of the Consultant for each instance.
- .5 Cut holes accurately, with smooth, true, clean edges. Fit units to tolerances specified or shown or, if not noted, to best standard practice for applicable work.
- .6 Holes in blockwork shall be drilled and/or saw cut, and not made with a hammer gun.
- .7 Patched work shall be invisible. Size holes and openings for pipes so as to allow for expansion and contraction of such pipes.
- .8 Employ tradesmen skilled in the work and execute work to standards specified for that work on this project.
- .9 Patch as required to maintain integrity of fire separations, ratings and assemblies. Patch as required to maintain air and moisture tightness of construction.

1.11 CONCEALMENT

- .1 Conceal pipes, ducts, and wiring in floor, wall and ceiling construction except where indicated otherwise on architectural drawings.

1.12 LOCATION OF EQUIPMENT AND FIXTURES

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

- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Consultant of impending installation and obtain his acceptance for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment.
- .5 The Contractor will take all necessary steps to have equipment that was removed or replaced as part of any Work disposed of or decommissioned in accordance with appropriate disposal or decommissioning processes, applicable laws, and in accordance with commercially reasonable environmental practices.
- .6 The contractor will provide before and after pictures of equipment nameplates.
- .7 The Contractor must submit written proof or evidence or acknowledgement that the disposal of all materials was done in accordance with all current disposal requirements.
 - .1 Acceptable Documents are invoices OR disposal certificates from the disposal facility. This documentation must be on the disposal facility's letterhead, invoice, or certificate. Minimum Information Required:
 - .1 building name and address
 - .2 equipment description (lamps, motors, cooling equipment, etc.)
 - .3 equipment quantities
 - .4 disposal facility name

1.13 INSERTS, SLEEVES AND ANCHORS

- .1 Provide all sleeves, inserts, anchors, hangers, supports, adhesives and the like necessary for execution of the work.
- .2 Co-ordinate work with other trades. Arrange and pay for installation of sleeves, inserts, anchors, etc. by appropriate trade.
- .3 Employ workmen skilled in the work and execute work to the standards specified for that work on the project.

1.14 PUBLIC AND PRIVATE UTILITIES AND SERVICES

- .1 Verify limitations imposed on project work by presence of utilities and services, and ensure no damage occurs to them.
- .2 Notify service authorities concerned so that they protect, remove, relocate, or disconnect them as they may require.
- .3 Make arrangements and pay for connection charges for services required for project work.
- .4 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.

1.15 SURVEY PINS

- .1 Property markers, iron pins and square iron pins, bars, etc., disturbed or lost in the course of construction shall be replaced by an Ontario Land Surveyor at no cost to the Owner.

1.16 RUBBISH

- .1 Do not burn or bury rubbish and work materials on site.
- .2 Dispose of rubbish and surplus material off site.
- .3 Do not dispose of volatile or corrosive materials in sewers and drains.
- .4 Dispose of waste in a manner not detrimental to public, private or Owner's property, or to any portion of the Work completed or under construction.
- .5 Except if expressly stated otherwise, materials indicated for removal become the Contractor's property and shall be taken from the site.
- .6 Dispose of rubbish and waste in accordance with governing regulations.

1.17 RECYCLING

- .1 In accordance with Ontario Regulation 102/94;
 - .1 Conduct a solid Waste Audit before construction begins;
 - .2 Prepare a solid Waste Reduction Workplan and post summary visible to all workers.
- .2 In accordance with Ontario Regulation 103/94;
 - .1 Establish Source Separation Programs to collect, handle and store;
 - .1 brick, concrete block and concrete
 - .2 corrugated cardboard
 - .3 wood
 - .4 drywall
 - .5 steel
 - .2 Ensure;
 - .1 use of programme
 - .2 that materials are recycled
 - .3 that workers are instructed on how to source separate, what is to be collected, and in what form materials will be collected.
- .3 Submit record copy of solid Waste Reduction Workplan to Consultant within 21 days of contract award.

1.18 OCCUPANCY PERMIT

- .1 Prior to acceptance and take over by the Owner, obtain and submit to the Owner an Occupancy Permit for the Work.

1.19 SMOKING POLICY

- .1 Smoking is not permitted within the building at any time and/or on School property.

Part 2 Products

2.1 NOT USED

- .1 Not Used

Part 3 Execution

3.1 NOT USED

.1 Not Used

END OF SECTION

Part 1 General

1.1 ACCESS AND EGRESS

- .1 Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders and scaffolding, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

1.2 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of adjacent premises. Make arrangements with UCDSB (Upper Canada District School Board) Representative to facilitate work as stated.
- .2 Maintain existing services to adjacent buildings and provide for personnel and vehicle access.
- .3 Closures: protect work temporarily until permanent enclosures are completed.

1.3 EXISTING SERVICES

- .1 Notify UCDSB Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where work involves breaking into or connecting to existing services, give UCDSB Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.
- .3 Provide for pedestrian and vehicular traffic.
- .4 Construct barriers in accordance with Section 01 56 00 – Temporary Facilities.

1.4 SPECIAL REQUIREMENTS

- .1 Ensure that Contractor personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .2 Keep within limits of work and avenues of ingress and egress.

1.5 PHOTOGRAPHY

- .1 Photography of work is not permitted without express written consent of UCDSB.
- .2 Owner reserves right to photograph Work to document progress.

1.6 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions: Smoking is not allowed on site.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 Inclusion of Allowances in Tender Price is not to be construed as implying that any or all the Allowances will be expended.

1.2 INSPECTION AND TESTING SERVICES

- .1 Unless noted otherwise, inspection and testing will be carried out by independent inspection companies appointed by the Owner and invoices will be paid by Owner directly. Inspection and testing required in Mechanical and Electrical Division of the specifications to be carried out and paid for by their respective trade.
- .2 Include in Contract Price all costs associated with testing services, including provision of materials, coordinating assistance, overhead and profit.
- .3 Refer to Section 01 45 00, Quality Control and the following sections of the specifications for further details:
.1 Section 31 05 16 and 31 23 33 and 32 11 16 and 32 11 23 Compaction Tests.

1.3 CASH ALLOWANCES

- .1 Cash allowances cover only the net cost to the Contractor of the items, materials, services or contract referred to, as verified by invoices to be submitted.
- .2 The Contract Price, and not the cash allowance, includes all construction machinery and equipment, unloading, handling, storage, installation, coordination, supervision, overhead and profit and other costs necessary to incorporate the products, services, or contracts into the project, except as otherwise noted.
- .3 A schedule to be prepared by the Contractor, to the Consultant's acceptance, to show when items called for under cash allowances to be authorized by the Consultant for ordering purposes so that the progress of the work will not be delayed.
- .4 Provide the following cash allowances.
.1 UCDSB

Part 2 Products

2.1 NOT USED

- .1 Not Used

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 Refer to Instructions to Tenderers and Supplementary Conditions for additional contractual information concerning submittals.
- .2 Refer to individual sections of specifications for detailed information on submittal requirements.
- .3 Schedule submissions at least two (2) weeks before dates reviewed submission will be needed.
- .4 Do not proceed with work until relevant submissions are reviewed and returned.
- .5 Shop drawings which have not been requested will be returned to the Contractor with no action taken by the Consultant. Shop drawings to which the Consultant's standard "Received" stamp is affixed, have not been reviewed by the Consultant.

1.2 IDENTIFICATION OF SUBMITTALS

- .1 In the top right hand corner on the body of each submittal clearly identify the project name (LSPS), applicable specification section number in NMS format (eg. 05 50 00), description of contents (eg. access ladders), the Owner's name (UCDSB), Consultant's name (A49/WSP), Contractor's name, sub-contractor's name, supplier's name, and the date of submission, all in that order. Indicate origin and intended use in work.
- .2 Accompany each submittal with a transmittal letter recording the information listed in .1 above.
- .3 Permanently identify samples with the information listed in .1 above.
- .4 For electronic submittals, provide electronic file names that identify name of project (LSPS) applicable specification section number in NMS format (eg. 05 50 00), description of contents where applicable (eg. accessladders) and the date (eg YYMMDD), separating each field with an underscore (eg. LSPS_055000_accessladder_100521.pdf).

1.3 DOCUMENTATION REQUIRED BEFORE CONSTRUCTION START

- .1 Refer to Upper Canada District School Board's Tender Document for a complete list.

1.4 STATUTORY DECLARATION

- .1 Submit, with each monthly progress claim, a Statutory Declaration certifying that all payments for any liability for which Owner might become responsible if unpaid, have been paid.
- .2 Statutory Declaration shall be a form CCDC 9A or 9B.

1.5 WSIB CLEARANCE CERTIFICATES

- .1 Submit with each monthly progress claim, Workplace Safety and Insurance Board Clearance Certificate.
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1.6 CONSTRUCTION SCHEDULE

- .1 Within fourteen (14) days of authorization to proceed, submit an electronic copy of proposed construction schedule for Consultant's acceptance.
- .2 Schedule shall be in Microsoft Office Project 2007. File under Tender No.(as per UCDSB), Project No.229-00335-00 with date and .MPP format. Show clearly proposed progress of all main items. Indicate each trade or operation separately. Order chronologically for beginning of each item of work. Identify first workday of each week. Identity critical sequence of work.
- .3 Include or show separately shop drawing review, decision dates for allow a fabrication and delivery lead time. Show dates for beginning and completion of each element of construction including subtrade work, concrete placement, equipment installation and testing.
- .4 Include or show separately delivery dates for equipment and materials which have a critical delivery period.
- .5 Identify work of separate blocks or phases, or other logically grouped activities. Show projected percentage of completion for each item of work as of 1st day of each month.
- .6 Predicate schedule on basis of substantial performance prior to date stated in agreement.
- .7 Revise or elaborate on schedule if required by Consultant and submit 6 copies of approved schedule for distribution to Owner.
- .8 Revise and update schedule monthly during construction to reflect actual progress and email to all parties or provide a disk to the Owner.

1.7 SCHEDULE OF VALUES

- .1 Conform to Owner's (UCDSB) contract documents and relevant conditions.
- .2 Itemize separately: individual sections of specifications, different phases of the work, bonds & permits, mobilization field supervision and layout, temporary facilities and controls, major equipment, material costs delivered, installation costs, each allowance, clean up, hand over and commissioning.

1.8 SHOP DRAWINGS & PRODUCT DATA

- .1 Submit shop drawings for Owner's and Consultant's review in accordance with Owner's contract documents.
- .2 The Consultant's review is for conformity to the design concept and general arrangement only. The Consultant's review shall not relieve the Contractor, his sub-contractors and suppliers of their responsibility for errors or omissions, or for the Consultant's failure to observe any deviations in the shop drawings or for meeting all requirements of the Contract Documents. It is the Contractor's responsibility to verify all dimensions and conditions on the site.
- .3 For non-custom items of equipment, manufacturer's publications or catalogue excerpts are acceptable if suitably annotated in ink, crossing out all non-applicable information, and clearly noting model name, model number, and performance/power criteria.

- .4 Submit all shop drawings in PDF (Portable Document Format).
- .5 In the top right hand corner on the body of each shop drawing submittal clearly identify the project name (LSPS), Contractor's name, applicable specification section number in NMS format (eg. 05 50 00), description of materials and items (eg. access ladders), the date of submission (YY/MM/DD) and complete identification of all locations in which materials/items are to be installed.
- .6 Accompany shop drawings by transmittal letter containing information outlined in .5 along with the number of drawings in the submission, the title of each drawing, a description of each drawing and other pertinent data.
- .7 For electronic shop drawing submittals, provide electronic file names that identify name of project (LSPS) applicable specification section number in NMS format (eg. 05 50 00), description of contents where applicable (eg. accessladders) and the date (eg YYMMDD), separating each field with an underscore (eg. LSPS_055000_accessladder_100521.pdf).
- .8 Submitted shop drawings which have not been thoroughly reviewed, coordinated, stamped, dated and signed by a responsible person in Contractor's office will be returned without review for resubmittal. Shop drawings that are stamped, dated and signed by a responsible person in the Contractor's office but that contain errors or oversights that a thorough review would have noted, and/or that do not contain mark-ups that a thorough review would have noted will be returned without review for resubmittal.
- .9 Present submittals in SI metric units; where printed material is provided in imperial units, clearly convert all values to metric.
- .10 Individual submissions will not be reviewed until all related information is available. Incomplete submissions will be rejected and returned to Contractor and Contractor may be charged for Consultant's time and expense involved.
- .11 Delete product data information not relevant to project.
- .12 Supplement standard information to provide details applicable to project.
- .13 Submit electronic PDF submissions to the appropriate Consultant address as listed on the front page of the document, to the attention of the appropriate individual.

1.9 SAMPLES

- .1 Submit samples requested in various sections of specification and as may be reasonably required by Consultant.
- .2 Submit samples of adequate size and range of colours or textures to represent material in intended use on project.
- .3 Unless the precise colour and pattern is specifically described in the contract documents, wherever a choice of colour or pattern is available in a specified product, submit accurate colour and pattern charts to the Consultant for selection and acceptance. Submit manufacturer's printed colour charts- do not submit colour charts electronically.
- .4 Material used on project shall match accepted samples for quality, colour and texture, finish and performance. Do not proceed with work until samples are reviewed and returned with Consultant's signed stamp marking them "reviewed" or "reviewed as

noted." If samples are marked "reviewed as noted" incorporate and address review notes before proceeding with the work.

1.10 MOCK-UPS

- .1 Mock-Up: Field erected example of work complete with specified materials and workmanship.
- .2 Provide mock-ups requested in various sections of specifications and as may be reasonably required by the Consultant.
- .3 Erect mock-ups at locations acceptable to Consultant.
- .4 Reviewed and accepted mock-ups will become standards of workmanship and material against which installed work will be verified.

1.11 RECORD DRAWINGS

- .1 Maintain contract drawings at site office for record purposes. Record accurately deviations from contract documents caused by site conditions, change orders, site instructions, and addenda. Mark in red ink. Provide one table for this set to be placed on.
- .2 Include depth of various elements of foundation, horizontal and vertical location of new, maintained, rerouted and abandoned underground utilities and of utilities concealed in construction. All unseen or hidden components must be located by dimension.
- .3 Ensure that drawings are up to date and in good condition at all times.
- .4 Submit as built record drawings in electronic PDF format and in Autocadd format on USB Thumb drive or Flash drive and two hard copies to Consultant just prior to Substantial Completion.
- .5 Consult Mechanical and Electrical Divisions for other particular requirements.

1.12 PROGRESS REPORTS

- .1 Contractor shall prepare daily reports of his operations. Daily report shall contain at least the following information:
 - .1 weather conditions
 - .2 manpower on the job in each trade
 - .3 major items of equipment on the job
 - .4 a brief summary of work accomplished that day
 - .5 materials, equipment, of construction related work items arriving or leaving site
 - .6 inspection reports
 - .7 significant events
 - .8 any tests made and their final results, if known
 - .9 any oral instructions received
 - .10 visitors to the job
- .2 Contractor shall maintain a file of copies of all daily reports on the site and make it available to Consultant or Owner upon request.

1.13 MANUALS OF INSTRUCTION AND MAINTENANCE

- .1 Prior to substantial performance, inspection, submit to Consultant, one (1) hard copy and one (1) USB drive (i.e. thumb or flash drive) in PDF format of Instruction and Maintenance Manuals as follows:
 - .1 Bind data in 215 x 279mm, vinyl covered three-ring loose-leaf binders.
 - .2 Enclose title sheet, labelled "Instruction and Maintenance Manual" with project name, list of contents, date and names of Owner, Consultant, and Contractor.
 - .3 Organize contents into applicable sections of work to parallel project specification breakdown. Mark each section by labelled tabs protected with celluloid covers fastened to hard paper dividing sheets.
- .2 All operation and maintenance manuals to be submitted in English only.
- .3 Neatly type lists and notes. Use clear drawings, diagrams or manufacturer's literature.
- .4 Contents:
 - .1 As called for in individual sections of these specifications.
 - .2 Maintenance instructions for exterior and interior floor, wall, and ceiling surfaces as well as all installed fittings as printed by manufacturer.
 - .3 Operating and maintenance instructions for mechanical and electrical equipment, bound separately.
 - .4 Colour schedule; hardware schedule.
 - .5 Copies of all guarantees and warranties.
 - .6 Complete set of final approved shop drawings, bound separately, indicating corrections and charges made during fabrication and installation.
 - .7 Names, addresses, and phone numbers of sub-contractors and suppliers.
 - .8 WHMIS Manual described in Section 01 35 30.
 - .9 All contents listed to be also in PDF format and submitted on USB drive (thumb or flash drive).

1.14 MAINTENANCE MANUALS

- .1 Turn over materials and spare parts for items noted in various sections of specifications to Owner's authorized representative and obtain receipt. Submit receipt to Consultant. Submit materials in unbroken cartons or if not available in cartons, strongly packed. Identify colour, room number, unit number or area materials used.

1.15 DOCUMENTS REQUIRED BEFORE SUBSTANTIAL PERFORMANCE

- .1 Documents required prior to Substantial Performance include:
 - .1 As-built record Drawings.
 - .2 Manuals of Instruction and Maintenance including:
 - .1 Warranties
 - .2 Final approved shop drawings
 - .3 Schedules
 - .4 WHMS Manual.
 - .3 Mechanical
 - .1 Testing, Adjusting and Balancing (TAB) reports
 - .2 Operation and Maintenance Manual
 - .3 Demonstration and Operating and Maintenance Instruction
 - .4 Individual equipment certification and training session outlined in Mechanical Sections.
 - .4 Electrical

- .1 Operation and Maintenance Manual
- .2 Electrical Inspection Certificate
- .3 F/A verification certificate (where applicable)
- .4 Demonstration and Operating and Maintenance Instruction

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SAFETY REGULATIONS

- .1 The Contractor shall comply with the latest edition and amending regulations of the following documents, and in the case of conflicts between documents, the more stringent rule shall apply:
- .1 National Building Code, Part 8: Safety Measures at Construction and Demolition Sites.
 - .2 Occupational Health and Safety Regulation for Construction Projects, Revised Statutes of Ontario, Chapter 321, as amended Regulation 691.
 - .3 The Workplace Safety & Insurance Act, latest edition, and regulations as amended.
 - .4 Ontario Building Code, latest edition.
 - .5 Ontario Fire Prevention & Protection Act; Bill 84.
 - .6 Regulation 309 - Environmental Protection Act, revised Ontario Regulation 464/85.
 - .7 Bill 79 - An Act to amend the Occupational Health and Safety Act, Chapter 29, Statutes of Ontario, 1987.
 - .8 Bill C-70, An Act to Amend the Hazardous Projects Act and the Canada Labour Code, June 1987.
 - .9 Workers' Compensation Board First Aid Regulations (950).
 - .10 The Occupational Health and Safety Act - Revised Statutes of Ontario, Revised Regulation 692/80.
 - .11 All other applicable Laws.
 - .12 Designated Substance Reports, Hazardous Projects Act and the Canada Labour Code, most recent edition.

1.2 TEMPORARY STAIRS, HOISTS, SCAFFOLD, ETC.

- .1 Furnish and maintain all equipment such as stairs, ladders, ramps scaffolds, hoists, runways, derricks, chutes, elevators, etc., as required for proper execution of work.
- .2 Construct and maintain scaffolding in rigid, secure and safe manner. Erect scaffolding independent of walls. Remove promptly when no longer required.
- .3 Where such structures are of a complicated nature, employ the services of a Registered Professional Engineer to design such scaffolding, framework, or other temporary supports.
- .4 Provide all necessary temporary barricades, fencing, guardrails, night lights, and barriers as necessary for the work.

1.3 SAFETY EQUIPMENT

- .1 Enforce use of CSA approved hardhats and safety boots for all entering or working on construction site. Refuse admission to those refusing to conform to this regulation.
 - .2 Provide and maintain adequate lighting where workmen or public may be subject to hazards and in all working areas.
 - .3 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials,
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and regarding labelling and the provision of material safety data sheets.

- .1 Establish and maintain a manual for WHMIS. Include all WHMIS data sheets as required above. Turn over the complete manual to Consultant at completion of the work.
- .2 WHMIS manual to include, but not be limited to all:
 - .1 adhesives
 - .2 solvents
 - .3 sealants
 - .4 sprayed on fireproofing
 - .5 resilient flooring
 - .6 carpet, paint, varnish, other coatings
 - .7 membrane waterproofing and air barriers
 - .8 special coatings, sealers, waxes
 - .9 solder, brazing and welding and other metal filler
 - .10 pressure treated wood and surface treatment of cuts
 - .11 other products where particles or vapours may become air borne after installation
- .4 In addition to the requirements of the Occupational Health and Safety Act, and Regulations for Construction Projects, provide temporary safeguards and protection against:
 - .1 Accident or injury to any workmen or other persons on the site, adjacent work and property, roads and walks.
 - .2 Damage to any part of the work and to any adjoining or adjacent structure, properties, pavements, walks, services, and other similar items by frost, weather, overloading, and any other cause resulting from the execution of the work.
- .5 Make good with material identical with existing and adjoining surfaces any damage resulting from the execution of the work to any part of the work or any buildings, pavements, landscaping, poles, hydrants, services, etc., on or surrounding.
- .6 Post Construction Signs. (e.g. "Hardhats and Safety Shoes Worn to be worn beyond this point").

1.4 FALL PROTECTION

- .1 Comply with Occupational Health and Safety Act and Regulations for Construction Projects, Section 26, as described herein but limited too:
 - .1 Fall protection will be required when a worker is exposed to a fall of more than 3 meters.
 - .2 Fall protection shall be in the form of:
 - a. Guardrail system
 - b. Travel restraint system
 - c. Fall restricting system
 - d. Fall arrest system
 - .3 The components of any system listed above shall be designed by a professional engineer in accordance with good engineering practice, and shall meet the requirements of any of the National Standards of Canada that are applicable.
- .2 A wood guardrail system shall consist of a top rail, intermediate rail, and a toe

board. The top rail shall be located at least 0.9m but no more than 1.1m above the surface on which the system is installed. The toe board shall extend at least 89mm above the surface on which the system is installed. The maximum distance between two adjacent posts of the guardrail system shall be 2.4m. Wood shall be SPF construction grade quality or better. Members shall be at least 38mm by 89mm. Members to resist prescribed point loads.

- .3 A travel restraint system shall consist of a full body harness (with adequate attachment points) or a safety belt. The full body harness or safety belt shall be attached by a lifeline or lanyard to a fixed supportable able to resist the prescribed static and dynamic forces.
- .4 A fall restrict system shall consist of assembly of components attached to a fixed support able to resist the prescribed static and dynamic forces. Worker's free fall distance must not exceed 0.6m.
- .5 A fall arrest system shall consist of a full body harness with adequate attachment points and a lanyard equipped with a shock absorber. The fall arrest system shall be attached by a lifeline or lanyard to a fixed support able to resist the prescribed static and dynamic forces. The fall arrest system shall be arranged so that a worker cannot hit the ground or an object or level below the work. The worker who falls not be subjected to a fall arrest force greater than 8 kilonewtons.

1.5 SAFETY AND SECURITY REQUIREMENTS

- .1 Enforce use of CSA approved hardhats and safety boots for all entering or working on construction site.
- .2 The Contractor shall remove from the site any persons not observing or complying with safety requirements.
- .3 The Contractor will report to the Owner's representative, and jurisdictional authorities, any accident or incident involving the Contractor, the Owner's staff, or the public; personnel and/or property, arising from the Contractor's execution of the work.
- .4 The Contractor will include all provisions of the Contract in so far as they are pertinent in any agreement with Sub-Contractors and hold all Sub-contractors equally responsible for safe work performance.
- .5 Delays in the progress of the Work arising out of infractions of legislation or Contract health and safety requirements are the responsibility of the Contractor.
- .6 Provide and maintain adequate lighting where workmen or public may be subject to hazards and in all working areas.
- .7 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials, and regarding labelling and the provision of material safety data sheets.
- .8 In addition to the requirements of the Occupational Health and Safety Act, and Regulations for Construction Projects, provide temporary safeguards and protection against:
 - .1 Accident or injury to any workmen or other persons on the site, adjacent work and property, roads and walks.
 - .2 Damage to any part of the work and to any adjoining or adjacent structure,

properties, pavements, walks, services, and other similar items by frost, weather, overloading, and any other cause resulting from the execution of the work.

- .9 Make good with material identical with existing and adjoining surfaces any damage resulting from the execution of the work to any part of the work or any buildings, pavements, landscaping, poles, hydrants, services, etc., on or surrounding the site.
- .10 Fire extinguisher must be on hand at all times when propane torch or other flame/heat producing device is being used.
- .11 Adhere to Owner's site-specific Health and Safety policies, as applicable, which include the following:
 - .1 Use of hard hats and safety boots
 - .2 WHMIS: training, staff awareness of chemicals on site, emergency plan
- .12 The Contractor shall be responsible to ensure that all individuals accessing the roof is properly trained in "Working at Heights" as required by the Ministry of Labour of Ontario. Anyone not in possession of a certification card should not be allowed on the roof.
- .13 The Contractor shall abide by all Workplace Health and Safety regulations. Should the Contractor, in the opinion of the Consultant, fail to meet those regulations, one written warning will be given to the Contractor. Further non-compliance will be written in the inspection report and result in the notification of the Ministry of Labour by the Consultant.
- .14 The Contractor shall provide, in writing, a company safety plan and a site-specific safety plan prior to commencing any work.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

1 General

1.1 SECTION INCLUDES

- .1 Requirements and limitations for cutting and patching the Work.

1.2 RELATED SECTIONS

- .1 Section 01 73 60 – Selective Demolition Procedures.
- .2 Individual Product Sections: cutting and patching incidental to work of the section. Advance notification to other sections required.
- .3 Refer to mechanical and electrical Specifications and Drawings for removal, capping, and alterations to the work of the Mechanical and Electrical Divisions e.g. conduit, wiring, fixtures, ducts, piping and other service lines.
 - .1 Protect active services that are intended to remain, and which pass through spaces involved in alterations and repairs.

1.3 SUBMITTALS

- .1 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of any element of Project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of any operational element.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of 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.

2 Products (Not Applicable)

3 Execution

3.1 PREPARATION

- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2 After uncovering, inspect conditions affecting performance of work.
- .3 Beginning of cutting or patching means acceptance of existing conditions.

- .4 Provide supports to assure structural integrity of surroundings; devices and methods to protect other portions of project from damage.
- .5 Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.

3.2 GENERAL PATCHING REQUIREMENTS

- .1 After cutting is completed, patch and re-finish surfaces to the nearest break in surfaces, such as inside and outside corners or minimum 5'-0" beyond patched area, whichever is nearest. Match patch finish to existing adjacent finished surfaces to completely conceal the patch.
- .2 Perform patching work using trades skilled in materials being applied and in accordance with the Contract Documents.
- .3 Conceal capped services unless specifically indicated to remain exposed.
- .4 Patch parts of the Work to match adjacent construction and finishes unless otherwise specified or indicated on Drawings.
 - .1 Provide patching products equal to existing surfaces.
 - .2 Join new work to existing assemblies in neat, accurate manner.
 - .3 Provide soundproof interior junctions.
 - .4 Provide weatherproof exterior junctions.

3.3 CUTTING AND PATCHING - EXECUTION

- .1 Execute cutting, fitting, and patching to complete the Work.
- .2 Fit the several parts together, to integrate with other work.
- .3 Uncover work to install ill-timed work.
- .4 Remove and replace defective and non-conforming work.
- .5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical work.
- .6 Execute work by methods to avoid damage to other work, and which will provide proper surfaces to receive patching and finishing.
- .7 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .9 Restore work with new products in accordance with requirements of Contract Documents.
- .10 Fit work to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

- .11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material, full thickness of the construction element.
- .12 Refinish surfaces to match adjacent finishes: For continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.

3.4 REPAIRS/ RENOVATIONS

- .1 Repair adjacent construction and surfaces that are damaged or disturbed as a result of alterations.
- .2 Provide products, materials, construction, workmanship and finish to match existing unless indicated otherwise.

3.5 CUTTING AND PATCHING - STRUCTURAL ALTERATIONS

- .1 Prior to cutting and drilling through structural and load bearing members, (e.g. slabs, columns, beams and shear walls), obtain the Consultant's review and written acceptance of the cut location and layout.
- .2 Provide openings as indicated on drawings.

3.6 CUTTING AND PATCHING - FIRE SEPARATION ALTERATIONS

- .1 Maintain fire separations for the duration of the work of this Section.
- .2 Provide fire and smoke penetration sealants at alterations and repairs in accordance with the Section 07 84 00 - Firestopping.
- .3 Provide continuous and solid framing, blocking or masonry work around service penetrations through fire separations in accordance with the fire penetration sealant design to maintain the continuity of the fire separation.

3.7 CUTTING AND PATCHING - MECHANICAL AND ELECTRICAL ALTERATIONS

- .1 Provide cutting and patching required for access to execute services alterations. Conceal capped services unless specifically indicated to remain exposed. Patch to conceal altered and capped services. Repair adjacent construction and surfaces or disturbed as a result of alterations.
- .2 Provide products, materials, construction, workmanship and finish to match existing unless indicated otherwise.
- .3 Where cutting and patching is required to complete mechanical/electrical tie-ins to main building systems outside the immediate scope of work, patch and repair all damaged surfaces to match existing adjacent construction and finishes.

3.8 REMOVAL OF FLOORING AND PREPARATION OF THE SUBSTRATE

- .1 Remove flooring and adhesive/setting bed materials completely, down to the concrete substrate except as noted on drawings. Fill voids in locations where existing entry mats are scheduled for removal. Ensure level transition at all areas where new flooring abuts existing flooring to remain.
- .2 Remove ridges and trowel marks and scrape the substrate to a smooth level surface.
- .3 Fill new and existing depressions, dished areas, low spots, voids, gaps, cracks, joints, holes and other substrate defects with skim coat and self-levelling topping to achieve a flat substrate to within the following tolerances:
 - .1 3mm total maximum deviation + and - along a 3000mm straight edge applied omni-directionally over the entire floor area.
- .4 Provide skim coats, primers and bonding agent slurries to neutralize residue adhesives and setting beds and to provide a suitable substrate to receive scheduled floorings.

3.9 REMOVAL OF MASONRY WALLS AND TERRAZZO FLOOR BASES

- .1 Remove masonry walls and terrazzo floor bases completely back to structural substrate where indicated on drawings.
- .2 Remove sufficient material to provide a depression for levelling toppings to achieve a flat substrate to receive new finishes.
- .3 Terrazzo floor base shall be removed completely in association with wall demolition as shown on the drawings. Terrazzo floor base removal shall include the provision for and supply of concrete topping.
- .4 Where existing masonry walls are indicated to be removed, ensure adjacent walls are braced securely and all structural and decorative elements removed to the underside of the structure above.

3.10 REMOVAL OF CONCRETE TOPPINGS AND TERRAZZO FLOORING

- .1 Remove concrete toppings and terrazzo flooring completely back to structural substrate.
- .2 Remove concrete toppings to structural slab, remove all loose material and provide a bonding agent to adhere new concrete infill to receive new floor finishes.
- .3 Remove terrazzo flooring to a sufficient depth to provide a depression for levelling topping to be flush with surrounding floor slab or sufficient to receive new flooring.

3.11 REMOVAL OF DEBRIS

- .1 Clear away dirt, rubbish, and loose litter resulting from the Work of this Section, at a minimum daily.
- .2 Control dust to a minimum. Wet down debris from time to time to control dust.
- .3 Maintain the Place of the Work clean at all times and do not obstruct roads, driveways, corridors, stairways, doorways, exits and access to exits.
- .4 Debris shall be removed with a covered buggy within the School Building or by enclosed chute as approved by the Owner.
- .5 Maintain roadways, lanes and street sidewalks in the vicinity of the Place of the Work safe and clear.
- .6 Arrange and pay for disposal of the products of demolition off site.
- .7 Locate waste disposal bin as coordinated with the UCDSB Representative. **Co-ordinate exact location with Owner.**

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 Specific testing & inspection requirements are outlined in various sections of specifications.

1.2 APPOINTMENT

- .1 Owner shall appoint an independent testing company or companies to conduct tests and/or perform inspections of materials and workmanship under this contract, unless noted otherwise.

1.3 OTHER TESTING

- .1 Where no testing requirements are specified but Owner decides that testing is required, Owner reserves right to have such testing or inspections performed.
- .2 Payment for extra testing requested by Owner shall be an addition to the contract as outlined in Part 6, Changes in the Work.

1.4 SCHEDULING

- .1 Notify Consultant at outset of project of requirements for testing services so that requisite testing and inspection activities can be coordinated into work on schedule.

1.5 NOTIFICATION

- .1 Notify Consultant two weeks in advance of date when the first work will be ready for inspection.
- .2 Notify testing company at least 24 hours before such inspection or test is required.
- .3 When testing laboratory is ready to test according to the above notification, but is prevented from testing or taking specimens due to incompleteness of work, all extra costs for testing attributable to the delay shall be deducted by Owner from contract price.

1.6 COOPERATION

- .1 Provide representatives of testing company with access to work at all times. Permit testing laboratory to take materials and specimens required for testing and assist as requested. Deliver samples of material to testing company as specified.
- .2 Make good work disturbed by inspection & test.

1.7 REPORTS

- .1 Testing company shall promptly issue test reports simultaneously and directly to Contractor (1 copy), Owner (1 copy), Consultant (1 copy).

1.8 FAILURE TO MEET REQUIREMENTS

- .1 Non-compliance: When initial tests indicate non-compliance with contract documents, costs of initial test associated with non-compliance shall be deducted by Owner from
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contract price.

- .2 Re-testing: When initial tests indicate non-compliance with the contract documents, all subsequent re-testing occasioned by non-compliance shall be performed by same testing company and costs thereof deducted by Owner from contract price.

1.9 CONTRACTUAL RESPONSIBILITY

- .1 Review of construction by the Consultant and inspection and testing by an independent Inspection and Testing Agency, are precautions against oversight or error and to satisfy the Owner that the work is in conformity with the Contract Documents. This is not intended to be the means of quality control. Review, inspection, and testing, are based on representative samples of the work and do not relieve the Contractor from carrying out his own quality control and for completing all work in accordance with contract documents.
- .2 Costs for uncovering and making good work that is covered before required inspection or testing is completed and approved, are the Contractor's responsibility.
- .3 Contractor shall furnish all labour and facilities and be responsible for:
 - .1 Inspection and testing required by laws, ordinances, rules, regulations or order of public authority.
 - .2 Inspection and testing performed exclusively for Contractor's convenience.
 - .3 Testing, adjustment and balancing of conveying mechanical and electrical equipment and systems.
 - .4 Mill tests and certificates of compliance.
 - .5 Tests specified to be carried out by the Contractor.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

CONTRACTOR'S SAFETY & ENVIRONMENTAL REQUIREMENTS

.1 General

- .1 For the purpose of the OH&S Act, the Contractor shall be deemed the "Constructor" and shall assume the responsibilities of the Constructor as set out in the Occupational Health and Safety Act and its Regulations. The Contractor shall observe and enforce all construction safety measures as contained in the OH&S Act and Regulations for Construction Projects, Health Care and Residential Facilities, Industrial Establishments, current Ministry of Environment Regulations and any other federal, provincial and municipal requirements and other authorities having jurisdiction. In the event of conflict between any of the provisions of statutes, regulations and by-laws and any other requirements of authorities including UCDSB policies and procedures, the most stringent provisions shall apply. Contractors are fully responsible to advise, monitor and enforce these requirements with their subcontractors. Any exceptions and waivers of these requirements shall be in writing and signed by both the Contractor's Supervisor and the UCDSB's Project Manager or the UCDSB'S Designated Representative.
- .2 Contractors are to review and be fully familiar with the requirements herein prior to submitting a proposal for work, or performing work at the School. All costs associated with safety, environmental and site requirements are to be included in the cost of work.
- .3 Where required, the Contractor shall file a notice of project with the Ministry of Labour, as outlined in the Occupational Health and Safety Act.
- .4 The Contractor's Supervisor must be in responsible control of the Job Site at all times while the job is in progress.
- .5 Where required, the Contractor shall appoint a health and safety representative/safety committee as required under the OH&S Act.
- .6 Contractors/workers not abiding by the OH&S Act and its regulations or other applicable legislation will be asked to remove themselves from the project(s), and this until appropriate corrective action has been taken or compliance has been achieved. The UCDSB also reserves the right to stop work if it has reason to believe that dangerous circumstances exist on the project or portions thereof. The UCDSB reserves the right of removal from the project any Contractor in non compliance of these and any other UCDSB health and safety requirements.
- .7 All Contractors/Sub-contractors shall follow the UCDSB's proper sign in procedure unless otherwise approved by the UCDSB's Project Manager or UCDSB's Designated Representative.
- .8 Smoking is not allowed within the School.
- .9 The use, sale, manufacture, distribution, purchase, possession, dispensing, or being under the influence of illegal drugs and alcohol on School premises are prohibited. The taking of prescription medicine in this manner prescribed by a physician, which does not impair a person's ability to perform his/her job, is an exception to this policy.
- .10 Cameras and recording devices are not allowed unless approved by the UCDSB Rep..
- .11 A confined space entry permit is required to enter areas such as tanks, manholes, pits, or other confined areas. Only workers trained in confined space entry as outlined in the OH&S Act and its Regulations shall enter confined space. The permit shall be co-signed by competent

representatives designated by the UCDSB and the Contractor. All requirements as outlined in O. Reg. 67/30 shall be strictly adhered to.

- .12 Insulation material is not to be disturbed without the prior approval of the UCDSB's Project Manager. The Contractor shall review the UCDSB's Asbestos Report prior to commencement of any work.
- .13 No waste of any type is permitted to be placed in any sewer, discharged to any surface water or to land area, or moved to any other location for storage, treatment or disposal without first obtaining the approval of UCDSB's Project Manager.
- .14 All trash, debris, soil, rubble and scrap materials and other waste shall be removed from the worksite daily, and a general cleanup of the area shall be performed at least weekly. All Contractors shall keep their respective area clean and hazard free. Failure to do so may result in a back charge to the Contractors involved for cleanup directly by the UCDSB's Project Manager.
- .15 Compliance with all applicable Environmental Protection Laws and Regulations is required. Compliance with UCDSB environmental policies and procedures is also required. Any questions about what laws and regulations apply must be answered by the UCDSB's Project Manager before work begins.
- .16 During construction meetings, a general review of work approaches or set-ups shall be conducted with the UCDSB to assure that due consideration has been given to concerns for the safety and protection of both school and the Contractor's personnel and property. The Contractor's safety representative/worker co-chair JOH&S Committee shall be present during the safety portion of these weekly meetings.
- .17 The Contractor shall make a daily inspection of the site or project and shall ensure that all safety measures have been taken and that the site or work area is in the safest possible conditions.
- .18 No workers (other than apprentice as defined in the Trades Qualification Act) shall carry out any work in the following trades unless the worker holds a subsisting certificate of qualification in the following trades or a valid equivalent certificate of qualification issued by the province of Quebec unless exemptions apply. Affected trades are as follows:
 - .1 Electricians, branch 1: construction and maintenance
 - .2 Fuel and electrical system technician
 - .3 Hoisting engineer, branch 1 and branch 2: mobile crane operator
 - .4 Hoisting engineer, branch 2: tower crane operator
 - .5 Plumber
 - .6 Refrigeration and air-conditioning mechanics
 - .7 Sheet metal worker
 - .8 Steamfitter
- .19 Copies of CERTIFICATIONS FOR SPECIALIZED TRAINING required to perform certain types of hazardous work or operate certain tools and equipment may be required to be submitted prior to work commencing.
- .20 The Contractor shall ensure that all workers at the project wear all required personal protective equipment (PPE) in order to perform their work safely and maintain compliance with the OH&S Act. All equipment shall be in good working order and all defective equipment shall be discarded and removed offsite immediately.

- .21 As a minimum, all workers on the project shall wear the following personal protective equipment at all times:
 - .1 CSA approved Grade 1 Safety Boots (i.e. Construction grade)
 - .2 CSA approved Class B hard hat. Alterations or modifications of hat or liner shall be prohibited.
- .22 Hearing protection shall be worn at all times in areas where noise levels exceed 85 dBA, or where posted.
- .23 The Contractor must implement a RESPIRATORY PROTECTION PROGRAM per OH&S ACT standards as required by their respective trades and working conditions in field.
- .24 "HORSEPLAY" on the job site is strictly prohibited. No running on job site unless warranted by extreme emergencies. Fighting on the premises will result in immediate dismissal of employee, who shall be excluded from all UCDSB projects.
- .25 Contractor shall provide FALL PREVENTION barricades, covers, rails, etc. to protect all roof, floor or wall openings, pits, holes, etc. as outlined in O. Reg. 67/93. Unsafe conditions must be corrected immediately.
- .26 Contractor shall be provide FALL PROTECTION (safety belts/harnesses with tie off, etc..) as required for their employees where permanent or temporary fall prevention is not in place.
- .27 All TOOLS, whether company or personal, must be in good condition and properly grounded. Defective tools must not be used and should be removed offsite (i.e. chisels with mushroom heads, hammers with split or loose handles, saws or grinders missing guards, etc..).
- .28 BURNING AND CUTTING EQUIPMENT shall be inspected daily before being used. All hoses and manifolds shall be removed from bottles and protective caps replaced at the end of each day.
- .29 ELECTRICAL "HOTWORK" is not allowed without written approval from the UCDSB. Proximity work to electrical equipment is also not allowed without written approval from the UCDSB's Project Manager.
- .30 Contractor shall provide its own LADDERS, which must conform to the OH&S Act. All ladders must be in safe condition without broken or defective rungs, rails and hardware. No metal ladder shall be used in or around and electrical work. Ladders shall be secured top and bottom and extend three feet (3') past the walking surface at the top.
- .31 FLAMMABLE LIQUIDS shall be stored in approved safety cans and contents shall be labeled as per WHMIS standards. Indoor storage of flammable or combustible liquids shall not exceed 25 gallons unless stored in approved cabinets.
- .32 The Contractor shall provide VENTILATION METHODS whenever hazardous substances such as dusts, fumes, mists, vapors or gases are produced in the course of the Contractors work. Provide fans, ducts or other means of exhaust substances to an outside area that will not effect other work environments adversely.
- .33 FUEL STORAGE is not permitted on site. Diesel fuel and gasoline will be provided at the Contractor's expense as required.

- .34 UCDSB will disclose the presence of Designated Substances on the project.
- .35 The Contractor shall disclose the other prospective Contractors or Sub-contractors, the presence of designated substances on the project.

.2 WHMIS–Workplace Hazardous Materials Information System:

- .1 Comply with the WHMIS Regulation and the OH&S Act.
- .2 Before commencement of work and for the full term of the contract, provide and maintain in good order a list of hazardous materials complete with Material Safety Data Sheets (MSDS) of all materials proposed for use on the project.
- .3 Label hazardous materials used and/or supplied on the project in accordance with WHMIS requirements.
- .4 Provide detailed procedures for safe handling, storage and use of hazardous materials. List special precautions and safe clean up and disposal procedures. Conform to Environment Protection Act, Transportation of Dangerous Goods Act, Municipal Sewer Regulations, Ontario Regulation 347 and other authorities for disposal and clean up requirements.
- .5 Obtain from the owner, where applicable a list and MSDS of hazardous materials (including details and precautions for Designated Substances) that may be handled, stored or used by owner's employees or other Contractors retained by owner at location where work under this contract will be performed.
- .6 Ensure that those who handle, and/or are exposed to or are likely to handle or be exposed to hazardous material are fully instructed in accordance to WHMIS requirements. Provide proof of training to UCDSB.

.3 Protection

- .1 The Contractor shall take all necessary precautions to safeguard school employees, students and visitors against hazard or injury on the site or adjacent work or property.
- .2 Provide and maintain necessary temporary enclosures, hoarding, covered walkways, fences, gates, barriers, guards, hoists, stairs, ladders, and scaffolding, walks, roadways, platforms, staging, protection as necessary for the work and protection of workers, public and other from injury, to protect public and private property from damage and for public access to adjacent building areas. All such apparatus shall meet requirements of applicable regulations and standards thereto.
- .3 Hoarding shall enclose work area and shall be completed with lockable doors and gates for access to site by workers, vehicles, consultants, owner and owner's security personnel. All temporary hoarding shall provide a 1 hr fire resistance rating.
- .4 Provide secure, rigid guard railings, hoarding and barricades around excavations, open shafts, open stair wells, open or exposed edges of floors and roofs, and other openings, as required by authorities and to maintain safety.
- .5 Provide where required for safe work practice, warning lights, safety posters etc.

- .6 Provide and maintain access facilities as may be required for access to the work. Maintain free, protected clear passage to and from building and portions thereof and work areas. Maintain access to and from areas of building.
- .7 Provide adequate first aid facilities on site at all times. Locate in prominent, easily accessible location.
- .8 COMPRESSED GAS CYLINDERS must conform to applicable regulations. Cylinders must be held in place, in a vertical position, with noncombustible restraints, i.e. chain and cable.
- .9 ROADWAY AND FIRE ACCESS shall not be blocked off without permission of the UCDSB's Project Manager. If the work presents hazards to PEDESTRIAN or VEHICLE TRAFFIC, the work area shall be barricaded, and flashers or lighting installed to prevent accidental entry.

FIRE SAFETY

.1 General

- .1 The following directions are not meant to be all-inclusive; they are provided as a general guideline. It remains the Contractor's Responsibility to maintain a fire safe working environment within the School as well as not causing any false fire alarms.

.2 Hot Work

- .1 This means any work where sparks are produced or flames are present which would pose a fire hazard to the surrounding environment. Examples are, but not limited to, welding (electric or acetylene), cutting of material such as pipes, hangers, metal objects etc. Using a torch or saw/grinder which could create a hazard.
- .2 The Contractor must obtain a HOTWORK PERMIT for all work that creates a ignition source (i.e. open flame, welding, cutting, or grinding) or as required by the UCDSB's Project Manager. During welding, burning, soldering, cutting, grinding, or using gas heaters or salamanders, adequate fire prevention precautions must be implemented, consisting of removal of flammables and combustibles, protection of adjacent areas, appropriate fire extinguishers or standpipes, and similar measures. A fire watch, equipped with an approved portable fire extinguisher is required during, and for a sufficient time after (not less than 60 minutes), the welding, burning, cutting or grinding operation.
- .3 When any hot work is carried out, there is to be a Fire Watch person dedicated specifically for duties as a fire watch. The Fire Watch is to be fully conversant with the usage of fire safety equipment and what procedures to follow should a fire occur. This person is not to be involved in other duties. Should the hot work create a situation where there is a possibility of heat transmission which would pose a fire hazard; then a fire watch is required on the other side of the area where the work is being carried out, i.e. cutting pipe in wall. A fire watch is required where the cutting is actually being done and on the other side of the wall, or ceiling/floor.
- .4 All work is to be carried out in accordance with local by-laws, Ontario Fire Code, Occupational Health and Safety Act, NFPA 51B and Regulations for (Construction Projects) as well as the requirements stipulated within this document. Whichever requirement is most stringent, then that is the requirement which must be met.

.3 Procedure

.1 Fire Alarm System:

- .1 The School fire alarm system cannot be shut down on a moment's notice. Being a School, it is important that all life safety systems are operating as required under the Ontario Fire Code. False alarms are a nuisance, which under the majority of situations can be avoided.
- .2 If the Contractor, Sub-contractor or their employees are found to be responsible for a false alarm which in the opinion of the UCDSB Project Manager or his representative could have been avoided, then cost recovery action will be taken against the responsible Contractor (s).

.4 Components – Fire Alarm System

.1 Smoke Detectors:

- .1 Smoke detectors are designed as a life safety device. As such, these devices are very sensitive and subject to alarms. Situations which cause these smoke detectors to go into alarms are; by-products of combustion such as from gas engines, fire producing devices i.e. torches; grinding of doors, metal etc; dust such as from wood sanding, wall sanding, floor sanding, spray operations etc.
- .2 Smoke detectors are located through the school (located in rooms, corridors) and in the ventilation system.
- .3 Prior to conducting any work which would cause any of the above, please consult with UCDSB Representative to review area. This practice will lessen the chance of nuisance alarms.

.2 Heat Detectors:

- .1 These devices are a property safety device and as such are, in most cases, not as sensitive as smoke detectors. Contractors must be aware there are two types of heat detectors within the school; the fixed temperature and the combination rate of rise/fixed temperature.
- .2 Any work to be carried out in the vicinity of a **Fixed Temperature Heat Detector** is to be reviewed first. These detectors will go into alarm if subject to jarring or contact with flame and/or direct heat. Normally it is fairly safe to conduct work up to within three (3) feet of this type of detector.
- .3 **Rate of rise/fixed temperature**; if this type of detector is present in your work are; ask for it to be isolated. These detectors are very sensitive to sudden air pressure changes, sudden heat changes (your hand on the detector will activate it), shock from hitting or jarring it will cause alarm.

.5 Hose stations and School fire extinguishers:

- .1 This equipment is UCDSB property, for use by School staff only. If Contractors require fire safety equipment, they, the Contractors, are to supply their own.
- .2 Should the Contractors (s) damage any equipment which must be repaired or replaced, the Contractor (s) will be responsible for all costs associated with the repair and/or the replacement of the fire equipment.

.6 Shutdown of Fire Protection Systems:

- .1 Where temporary shutdown (also called an impairment) of sprinkler systems, standpipe systems or other fire protection systems is necessary due to alterations, repairs or extensions, the appropriate requirements in the Fire Code must be observed.

**GUIDELINES FOR MAINTAINING FIRE SAFETY
DURING CONSTRUCTION IN EXISTING BUILDINGS**

The following typical conditions usually arise during construction and could present serious unsafe conditions in case of a fire emergency.

.1 Closing of Exits:

- .1 All exits, including stairways and exterior doors to the outside, serving the existing building must be maintained. Where an exit is blocked off or deleted due to construction activities, an acceptable alternative exit must be provided.
- .2 Where it is absolutely necessary for access to be gained through the construction area to an exit, the access must be clearly defined and protected so that it is separated from the construction area by a reasonable smoke tight fire separation equivalent to 1 hour fire resistance rating.

.2 Intersecting Corridors – Existing Corridors on Occupied Floor Areas Exposed to New Corridors Under Construction:

- .1 Temporary fire separations of steel studs and gypsum board construction equivalent to 1 hr fire resistance rating must be erected.
- .2 Where access is desired, a door of solid core wood or hollow steel construction equipped with self-closing and latching hardware must protect the opening.
- .3 Should such temporary fire separation cut off or eliminate required access to exits, alternative access must be provided.

.3 Fire Department Access:

- .1 The location of a building addition and the construction activities must not obstruct the access roadways designated for fire department equipment.

- .2 If it is necessary that existing access be obstructed or deleted, alternative access, acceptable to the Fire Department, must be pre-planned and provided prior to commencement of construction.

The Ontario Building Code provides the design criteria for required access routes.

.4 Control of Combustible Materials:

- .1 The stockpiling of construction materials adjacent to the existing building must be carefully controlled.
- .2 The Fire Code prohibits such storage where the materials create a fire hazard to the existing building or its occupants.
- .3 Materials stored and equipment used in the portion of the building under construction could create a fire hazard; for instance, the storage of excessive amounts of foam plastic insulation or the placement of open flame portable heating appliances.
- .4 The control of combustibles on a construction site is also regulated under the Occupational Health and Safety Act.

.5 Exposure of Construction in Progress to Existing Occupied Areas:

- .1 Existing exterior walls with windows of plain glazing when exposed to construction in progress must be protected by 16mm gypsum board on suitable framing for the duration of the construction.
- .2 Other openings in the existing exterior walls such as doors, louvers, etc. must be similarly protected or replaced with doors of solid core wood or hollow steel construction.
- .3 In some cases, permanent revisions to the emergency procedures are required when the construction is completed.
- .4 Materials and closures in the temporary fire separations mentioned in the above are suggested examples only. Other materials acceptable to the owner and/or fire department may, of course, be used.
- .5 Should there be questions arising from any of the above situations, Owner and the local fire department representative are to be informed and consulted to ensure that minimum life safety will be maintained.
- .6 Note: Partial occupancy of a building is regulated under the Ontario Building Code and comes under the authority of the Municipal Building Department.

.6 Openings Created Through Floors or Other Fire Separations:

- .1 Openings in existing floor assemblies and vertical fire separations necessitated by installation of equipment systems or construction in general must be temporarily sealed with fire barrier materials such as mineral wool or other non-combustible insulation.

.7 Modification and Extension to Existing Fire Alarm Systems:

- .1 Maintaining the fire alarm system in operating condition during the construction of the addition will require careful planning especially when the extension to the fire alarm system is carried out in phases.
- .2 A technical representative from the fire alarm manufacturer should be assigned to the project to coordinate the different stages of the extension.
- .3 Whenever a changeover time occurs, which is an outage time of at least a portion of the fire alarm system, the Fire Department and UCDSB Rep. must be notified of the temporary shutdown and alternative measures must be devised.

FIRE SAFETY PLAN:

1. Depending on the nature of the construction, it may become necessary to modify the fire emergency procedures required under the Fire Safety Plan, as outlined in the Ontario Fire Code.
2. Such changes may be of temporary nature to accommodate revised exits, modifications to the fire alarm system operation, etc. in which case, the procedures must be returned to the original format at the completion of the project.

CONSTRUCTION SAFETY

.1 Procedure

- .1 Particular attention shall be paid to prevention of fire and elimination of fire hazards which would endanger new work or existing premises.
- .2 Cooperate fully with UCDSB Rep. and all UCDSB personal.
- .3 Before any open flames work or welding is done:
 - .1 Discuss the work with the UCDSB's Project Manager and receive his agreement of procedures to be taken.
 - .2 Have sufficient hand operated fire extinguishers on hand at the location of such work to extinguish fires which could result.
 - .3 Ensure that an additional man is at site of work ready to operate fire extinguishers, should this become necessary.
 - .4 When the work involves cutting with a torch or work area is confined an additional man is required who's responsibility is exclusively that of fire watch.

FIRE SAFETY REQUIREMENTS

.1 Procedure:

- .1 Comply with all fire and safety regulations required by authorities.
- .2 Comply with all directives issued by the UCDSB's Project Manager.

- .3 Except as otherwise specified herein, soldering, welding and cutting operations shall be carried out in areas free of combustible and flammable contents.
- .4 When it is not practicable to undertake welding and cutting operations in areas described in the previous paragraph, combustible and flammable materials shall either be removed thirty-five (35) feet from the work area or otherwise protected against ignition by sheet metal or other noncombustible material.
- .5 When soldering, welding or cutting is to be carried out near piping containing flammable gas, the section of piping located within thirty-five (35) feet of the torch or other source of combustion shall be covered with wet noncombustible insulating material ¼ in. thick.
- .6 Prior to initiating any open flame work or welding operation, Contractor shall:
 - .1 Discuss the proposed work with UCDSB Project Manager and Consultant and receive their authorization before proceeding.
 - .2 Take all necessary precautions to prevent inadvertent activation of the School's fire alarm system by first advising the UCDSB's Project Manager who will initiate necessary action as it pertains to the fire alarm system.
 - .3 Have sufficient suitable hand operated fire extinguishers on hand near the work area.
 - .4 Ensure that additional person (Fire Watch) is readily available to operate fire extinguishers should the need arise.
 - .5 Do not perform work which will activate operational life safety systems. Do not perform any form of smoke or "smoke bomb" tests.

.2 Fire Protection:

- .1 Take necessary precautions to eliminate fire hazards and to prevent damage to work, building materials, equipment and other property both public and private having to do with work. Inspect work at minimum weekly intervals for this purpose.
- .2 Store and locate products and equipment packed in cardboard cartons, wood crates and other combustible containers in orderly and accessible manner.
- .3 Tarpaulins shall be fire-resistant.
- .4 Open fires and burning of rubbish are not permitted on site or property.
- .5 Provide and maintain in working order, ULC labeled fire extinguishers or other approved fire extinguishing equipment, locate in prominent positions, in accordance with requirements of authorities and insurance companies having jurisdiction, codes, regulations and bylaws in the building.
- .6 When carrying out soldering, welding or cutting procedures, be it in shop or in the field, the workers shall:
- .7 Wear appropriate protective clothing such as gloves, leather aprons and/or arm spark guards, etc.
- .8 Wear appropriate goggles or face shields as the case may be.
- .9 Protect co-workers from eye or other injuries through the use of fire-proof portable shielding devices.

- .10 All shop soldering, welding or cutting procedures shall be carried out under a fume hood and/or portable fume eliminator when conditions so dictate.
- .11 Contractor to provide and use a portable fume eliminator at all times during soldering, welding or cutting operations within the confines of the school.
- .12 Fume eliminator shall be used to:
- .13 Prevent the inhalation of toxic fumes by those persons in the working areas.
- .14 Prevent infiltration of toxic fumes into the school's ventilation system.

DUST NUISANCE:

.1 Procedure:

- .1 Prevent nuisance to adjacent existing areas and properties near the work from dust by taking appropriate anti-dust measures at such times as found necessary, and at other times complaints of dust are received from the public, authorities, Owner or Consultant.
- .2 Provide dust tight screens or partitions to localize dust generating activities for the protection of workers, staff, students, employees, equipment, adjacent and finished areas of work. Maintain and relocate protection until work is complete.
- .3 Provide daily vacuuming of construction dust from corridors and connecting areas as work progresses. This shall be considered a minimum requirement; increase vacuuming as necessary. The UCDSB may have vacuuming work done by others and cost deducted from Contractor's progress payments if this requirement is not fulfilled.

NOISE NUISANCE:

.1 Procedure:

- .1 Take measures to control noise generated by work; take appropriate noise control measures at times found necessary, and at other times complaints of noise are received from the public, authorities, UCDSB or Consultant.
- .2 Limited construction noise is permitted within regular working hours, regular week working days. Approval shall be sought for permitting construction noise at times other than regular working hours.
- .3 These requirements shall not be construed as cause for elimination or restriction of Contractor's working schedule, claims for delay of work, nor additional costs.

If the work requires deactivation of any portion of a FIRE PROTECTION SPRINKLER SYSTEM, the shutdown of the System will be done by UCDSB maintenance personnel after proper notice is given. The deactivation period will be minimized, and in no circumstances will the system be left in inoperable state beyond the agreement period.

End of Section

Part 1 General

1.1 CONSTRUCTION OFFICES

- .1 Contractor cannot use any room as a Construction office.

Provide the latest and any necessary documentation and drawings to facilitate the work and construction and for site meetings on reference including but not limited to; Tender drawings, tender or latest specifications, shop drawings, change orders, Site reports, site instructions, construction schedule, etc. Prior to site meeting, accommodation for 6-10 people furnished with table and chairs (coordinate with school staff for temporary supply of furnishings if required).

Contractor requires a temporary site construction trailer(s), it is to be provided at contractors cost and coordinate location(s) with UCDSB. Provide documentation and furnishings as per 1.1.1 above.

1.2 STORAGE SHEDS

- .1 Provide and maintain, in accepted locations on site, temporary offices and sheds for storage of materials, tools and equipment. Construct temporary buildings with raised floors, weatherproof, of neat appearance and subject to Consultant's acceptance.
- .2 Store materials and equipment in areas on site designated by UCDSB.

1.3 SANITARY FACILITIES

- .1 The Contractor is to provide temporary portable washroom facilities similar to "porta-pottie" for the duration of the work.

1.4 FENCING

- .1 Provide temporary fencing for construction site as required and wherever required by applicable laws and by-laws and as shown on drawings.
- .2 Unless otherwise noted, temporary fencing to be 51mm x 102mm welded wire mesh panels with interlocking frames made from 16 gauge 32mm square metal tubing c/w stabilizing feet pinned in place with reinforcing bars, or similar system approved by UCDSB. Panels to be no less than 1829 high. Fasten interlocking panels together with tamper resistant fence clamps to prevent dismantling, and provide lockable gates as required for access. Snow fencing will not be permitted as a substitute.
- .3 Construct/erect fencing and other protection at least to Municipal and provincial standards.

1.5 ENCLOSURE

- .1 Provide temporary enclosures as required by construction operations and to ensure continuous execution of the work.
- .2 Provide temporary weathertight enclosures and protection for exterior openings until permanent exterior doors, windows and roof closures are installed.
- .3 Erect enclosures to allow accessibility for installation of materials and working inside of enclosure.
-

- .4 Design enclosures to withstand wind pressure.

1.6 TEMPORARY POWER AND LIGHT

- .1 Provide and pay for all temporary power and lighting for use of trades as required to perform the work except as otherwise permitted.
- .2 Pay for all permits and/or installation costs and make necessary arrangements.
- .3 Electrical power and lighting systems installed under this contract may be used for construction requirements provided that guarantees are not affected thereby. Make good damage. Replace lamps which have been used over a period of 3 months.

1.7 DEWATERING

- .1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.
- .2 Dispose of water in a manner not detrimental to public and private property, or any portion of work completed or under construction.

1.8 WATER SUPPLY

- .1 Provide and pay for temporary water supply for use of all trades, except as otherwise permitted.
- .2 Pay for all permits and/or installation costs and make necessary arrangements.
- .3 Permanent water supply system installed under this contract may be used for construction requirements where guarantees are not affected thereby. Make good any damage.

1.9 TEMPORARY HEATING AND VENTILATION

- .1 Provide and pay for temporary heat, ventilation, telephone, fax, data hook up lines and equipment necessary for own use and use of UCDSB and Consultant.
- .2 Include costs of installation, fuel, operating, maintenance, and removal of equipment. Use of direct-fired heaters discharging waste products into work areas will not be permitted unless prior acceptance is given by UCDSB.
- .3 Provide and pay for temporary heat required to ensure ground below footings or grade beam is not and will not become frozen and to ensure ground is and continues unfrozen under interior concrete slabs.
- .4 Construction heaters used inside building to be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.
- .5 Provide temporary heat and ventilation in enclosed areas as required to:
 - .1 Facilitate progress of Work.
 - .2 Protect Work and products against dampness and cold.
 - .3 Prevent moisture condensation on surfaces.
 - .4 Provide ambient temperatures and humidity levels for storage, installation and

- curing of materials.
- .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .6 Maintain temperatures of minimum 10 degrees Celsius in areas where construction is in progress or higher where specified as soon as finishing work is commenced and maintain until take over by the UCDSB .
- .7 Ventilating:
 - .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
 - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
 - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
 - .4 Ventilate storage spaces containing hazardous or volatile materials.
 - .5 Ventilate temporary sanitary facilities.
 - .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful elements.
- .8 Permanent heating system of building may not be used unless written acceptance of UCDSB and the Consultant is received, and provided provisions relating to guarantee, operation, and maintenance are satisfactory to the UCDSB and Consultant.
- .9 Activate permanent heating system under direction of UCDSB & Consultant to provide temporary heat after taking precautions to assure proper operation of system.
- .10 Protect duct system with filters, replace as necessary. Finally, vacuum clean entire duct system and renew filters.
- .11 Ensure Date of Substantial Performance and Warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Consultant.
- .12 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
 - .1 Conform with applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .5 Vent direct-fired combustion units to outside.
- .13 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.10 TEMPORARY COMMUNICATION FACILITIES

- .1 Provide and pay for temporary telephone, fax, data hook up, lines and equipment necessary for own use and use of UCDSB and Consultant.

1.11 STREETS AND TRAFFIC

- .1 Provide all necessary flagmen, detour signs, warning lights, signs and barricades, necessary to direct and protect pedestrian and vehicular traffic during the work.
- .2 Conform to all Provincial, Regional, and Municipal Regulations and requirements.

- .3 Remove mud and clay from vehicles leaving site so as to meet Municipal regulations.
- .4 Provide dust control to meet Municipal regulations.

1.12 ACCESS

- .1 Provide and maintain adequate access to project site.
- .2 Supplement municipal snow clearing operations as required to keep access and work areas and adjacent walkways free of snow and ice.
- .3 Maintain the temporary access in a suitable condition to suit construction and access for automobile and construction vehicle access.
- .4 Provide all additional temporary roads and access around the building to facilitate operations on site. Remove same where requires for landscaping or other finishing operations.
- .5 Permanent Road systems may be constructed for temporary access but there to meet specification for final grade, compaction and thickness.

1.13 SHUTDOWN

- .1 Should work be stopped for any cause, provide protection for work and all necessary cold weather heating during work stoppage.

1.14 POLLUTION CONTROL

- .1 Contractor shall provide their own dumpster and any associated disposal fees as required. Confirm with UCDSB exact placement of dumpster location. Upon dumpster removal, if existing asphalt is damaged, provide new asphalt and compacted sub grade material as required at no cost to the UCDSB. Upon dumpster removal, if existing grass is damaged, provide new sod and 100mm thick topsoil all as required at no cost to the UCDSB.
- .2 Cover dry materials and rubbish to prevent blowing dust and debris.

1.15 FIRE PROTECTION

- .1 Provide and maintain temporary fire extinguishing equipment until UCDSB 's extinguishing equipment is in place.
- .2 Keep all fire hydrants free of obstructions of all kinds.
- .3 Maintain fire protection systems in operation at all times except for local area being worked on.
- .4 Organize work to maintain required fire exit paths in safe condition.
- .5 Keep fire routes clear for emergency access. Keep clear of snow and obstructions. Do not store materials nor park vehicles in fire routes.
- .6 Relocate or cover combustible materials in the vicinity during welding, cutting or other hot work including foam plastic insulation, in walls and roofs.

1.16 ROOFING PROTECTION

- .1 Provide and maintain protection from anything that may damage or be detrimental to the waterproofing qualities of the various membranes. Include protection from construction work such as falling objects, wheel and foot traffic, failure to remove debris, scaffolding, hoisting equipment.
- .2 Minimum Protection: 6mm waferboard over 25mm Type 1 polystyrene over 6 mil polyethylene.

1.17 PROTECTION OF OFF-SITE AND PUBLIC PROPERTY

- .1 Protect surrounding private and public property from damage during performance of work, including, but not limited to, existing buildings, wells, septic systems, trees and other plants, lawns, fencing, service poles, wires, rail tracks, underground services, pavement, survey benchmarks and documents which may be affected by the Work.
- .2 In the event of damage, be responsible for any damage incurred, and immediately make repair to match or exceed pre-construction conditions, to the satisfaction of the Consultant and UCDSB .

1.18 DUST SCREENS

- .1 As the work progresses erect temporary enclosures to divide off areas of finishing work from other areas. Enclosures to be neatly constructed and dust tight.

1.19 REMOVAL OF TEMPORARY FACILITIES

- .1 Remove all temporary facilities from site, including pre-existing temporary fencing, and roads when directed by Consultant.
- .2 Repair or replace items damaged by temporary facilities to Consultant's acceptance.

1.20 OVERLOADING

- .1 Ensure no part of Work is subjected to loading that will endanger its safety or will cause permanent deformation.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 CODES AND STANDARDS

- .1 Conform to or exceed the minimum requirements of the National Building Code, Ontario Building Code Act, CMHC Residential Standards, Ministry of Housing Guide for Family Housing, and all Provincial and Municipal By-Laws and regulations affecting the work and working conditions. Latest editions and revisions and most conservative provisions, in the opinion of the Consultant, apply.
- .2 Part 3 of the Ontario Building Code shall serve as a minimum quality of work and materials.
- .3 All materials or assembly of materials or manufactured items or tests of these shall conform to applicable requirements of the Canadian Standards Association, the Canadian General Standards Board specifications, or in the absence of these, the standards of the American Society for Testing and Materials.
- .4 Where contract documents exceed these minimum code standards, specified standards, and referenced documents, perform the work in accordance with the additional requirements of the Contract Documents.
- .5 Wherever in this document codes and standards are referenced, the latest addition or amendment in effect at the time of tender, shall apply.

1.2 ALTERNATE OR EQUIVALENT MATERIALS AND PRODUCTS

- .1 Where the specifications stipulate a product, equivalent products will not be considered.
- .2 Where the terms "equivalent" and/or "alternate" are used, named manufacturers or unnamed product models, and non-named manufacturers may submit their product information and samples to the Consultant for review and consideration for approval at least 10 days in advance of tender close.
- .3 Submissions noted in .2 above MUST be accompanied by a typed sheet clearly listing the pertinent characteristics and performance requirements of the specified piece of equipment, fixture or material, and then clearly demonstrating equivalence of the proposed alternate or equivalent to the specified piece of equipment, fixture or material. Submissions must also clearly note the specific model number, name, make, performance characteristics, power requirements and all other pertinent data related to the proposed alternate or equivalent as required by the Consultant and/or Owner to make an appropriate determination of equivalence. Submissions failing to include any of the above will be rejected outright and not considered.
- .4 Clarifications and acceptance of "equivalents" or "alternates" will be issued in the form of an addendum during the tender period, a copy of which will be forwarded to those firms who have taken out documents and to the OCA plans examination room. If proposed "alternates" or "equivalents" are not issued in the form of an addendum, provide specified products only.

1.3 V.O.C.'S

- .1 Adhesives and cleaning agents, shall whenever possible, and consistent with performance requirements, be V.O.C. free or of low V.O.C. content.
-

1.4 UNIFORMITY OF SOURCE

- .1 Unless otherwise indicated in the specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .2 Like products visible in the finished work shall be identical in appearance, colour, texture, sheen, configuration, arrangement and other characteristic affecting uniformity of appearance in the work.

1.5 TRADE NAMES

- .1 Wherever an item or class of material is specified exclusively by trade names or by names of the maker by catalogue reference, only such items shall be used approval of the substitution is secured through an addendum.

1.6 MANUFACTURER'S DIRECTIONS

- .1 All manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as recommended by the manufacturer.
- .2 Do not rely on labels or enclosures provided with products. Obtain written instructions from manufacturers.
- .3 Notify Consultant in writing of any conflict between these specifications and manufacturer's instructions. Consultant will determine which document is to be followed.

1.7 WORKMANSHIP

- .1 Execute work in accordance with the best standard practice utilizing mechanics skilled in their trades. Adequately brace and anchor with proper provision for expansion shrinkage. Erect work true to lines, levels, dimensions, square and plumb. Finish surfaces to be without perceptible sag, warp or surface defects and suitable for the purpose intended. Work shall conform to site conditions and measurements.

1.8 PATCHING

- .1 In patching and making good, and in extending existing construction match in colour and texture all finishes visible within one area and all items of a similar nature to the full satisfaction of the Consultant.

1.9 HANDLING

- .1 Deliver, store and handle all material and products in a manner to prevent damage and deterioration. Ensure they are not exposed to an environment which would increase their moisture content beyond that specified.
- .2 Package materials and products to protect them from damage or adulteration. Packaging shall be secure and retained unopened and with labels intact until use. Label packages with manufacturer's name, and to describe contents, quantity, location in building if applicable, and other information as may be specified.
- .3 Handle equipment in accordance with manufacturer's and supplier's recommendations.

- .4 Repair or replace damaged material as directed by Consultant.

.10 PROTECTION

- .1 Protect all work against damage until takeover by the Owner. Remove and replace, at own expense, any damaged work that cannot be repaired or restored to the Consultant's satisfaction.
- .2 Provide protection against spread of dust and dirt beyond work areas.
- .3 Take particular care of all finished work as construction progresses and cover it with the necessary protective materials. Inspect all surfaces, wash and clean as directed upon removal or protective coverings.
- .4 Note all buried services and take care not to damage them.

1.11 CONFINING OF OPERATIONS

- .1 All materials and equipment shall be confined so as to prove no hazard to those frequenting the site. It is the responsibility of each trade to ensure that all materials, equipment, plant, tools, etc., that have not been incorporated into the construction are safely stored.

1.12 LOCAL INDUSTRY

- .1 Obtain specified construction materials and equipment from suppliers in the same locality as the project in-so-far as possible.

1.13 FASTENINGS

- .1 Supply all fastenings, anchors, supports and accessories required for fabrication and erection work.
- .2 Where exposed use metal fastenings and accessories, etc., of same texture, colour and finish as base metal on which they occur.
- .3 Use metal fastenings of same material as the metal component they are anchoring and of metal which will not set up an electrolytic action which would cause damage to the fastening or metal component under moist conditions. Use isolating material to permanently prevent the occurrence of electrolysis due to materials being fastened. In general, use non-corrosive or hot dip galvanized steel anchors for exterior anchors for windows, sheet metal roofing and anchors occurring on or in exterior walls or slabs.
- .4 Use fastenings of such type and size and install in such a manner to provide positive permanent anchorage of the unit to be anchored in position. Install anchors at required spacing to provide required load bearing or shear capacity.
- .5 Keep exposed fastenings to a minimum, evenly spaced and neatly laid out.
- .6 Supply adequate instructions and/or templates, and if necessary, supervise installation where fastenings or accessories are required to be built into work performed by other subcontractors or suppliers.
- .7 Fastenings shall be of a permanent type. Do not use wood plugs.

- .8 Do not use fastenings which cause spalling or cracking of material to which anchorage is being made.
- .9 Do not use powder activated fastenings on any portion of the work except in conformance with Occupational Health and Safety Act, the Regulations for Construction Projects.
- .10 Protect all metals from other materials which may cause corrosion or deterioration - example, concrete on aluminum.

1.14 CLEANING: GENERAL

- .1 Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
- .2 Store volatile wastes in covered metal containers, and remove from premises daily.
- .3 Prevent accumulation of wastes which create hazardous conditions.
- .4 Provide adequate ventilation during use of volatile or noxious substances.
- .5 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

1.15 CLEANING DURING CONSTRUCTION

- .1 Maintain project grounds and public properties free from accumulations of waste materials and rubbish.
- .2 Provide on-site dump containers for collection of waste materials, and rubbish.
- .3 Remove waste materials and rubbish from work on a daily basis and remove from site on a regular basis.
- .4 Vacuum clean interior of building areas of this contract's dirt when ready to receive finishes and continue vacuum cleaning at least daily until building is ready for substantial completion or occupancy. Sweep floors and pavements clean on a daily basis.
- .5 Schedule cleaning operations so that resulting dust and other contaminants will not fall on wet, newly painted surfaces.

1.16 FINAL CLEANING

- .1 In preparation for substantial completion or occupancy, conduct inspection of sight-exposed interior and exterior surfaces.
 - .2 Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials, from sight exposed interior and exterior finished surfaces including glass and other polished surfaces.
 - .3 Clean lighting reflectors, lenses, and other lighting surfaces.
 - .4 Clean and polish all glass, mirrors, hardware, tile, chrome, aluminum, stainless steel, plastic laminate and plumbing, mechanical and electrical fixtures and equipment.
-

- .5 Broom clean paved surfaces; rake clean other surfaces of grounds.
- .6 Remove debris and surplus materials from roof areas and accessible concealed spaces.
- .7 Remove snow and ice from all access routes to exits and exits from building.
- .8 Replace heating, ventilating and air conditioning filters, clean ductwork and clean coils.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

1 General

1.1 SUMMARY

- .1 Work of this Section consists of selective demolition, removal, cutting and patching of portions of existing building to accommodate new construction and remodelling, as indicated on the drawings, as specified herein, and as necessary for a complete and finished project, including but not limited to:
 - .1 wall, ceiling and floor finishes;
 - .2 interior partitions;
 - .3 doors and frames;
 - .4 mechanical and electrical items;
 - .5 relocation of specified items to owner's storage area as applicable;
 - .6 offsite disposal of demolished materials as applicable.
- .2 Remove items indicated to be salvaged complete with all specialized fasteners and accessories, relocated and stored on site at a location indicated by Consultant.
- .3 Carefully remove and handle items indicated on drawings as to be turned over to Owner.
 - .1 Make good all damage to items listed.
 - .2 Where items are indicated for re-installation, leave items ready for reinstallation under separate sections or other contracts.

1.2 SELECTIVE DEMOLITION WORK SPECIFIED ELSEWHERE

- .1 Relocation of pipes, conduits, ducts and other mechanical and electrical work is specified in the Mechanical and Electrical Divisions.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- .1 Division 01 General Requirements - Restrictions on use of adjacent roads, walks and property; restrictions on noise, dust, interference with use of building.
- .2 Requirements for remodelling construction work and patching are included in the respective sections of specifications.

1.4 STANDARDS

- .1 Comply with Ontario Building Code, Construction Safety Measures at Construction and Demolition sites, provincial requirements and requirements of authorities having jurisdiction.

1.5 RESTRICTIONS

- .1 Perform cutting, coring, chipping and grinding of concrete and masonry outside of Owner's normal hours of operation, except as specifically permitted by the Owner.

1.6 SUBMITTALS

- .1 Submit the following items in accordance with the requirements of Division 01.
- .2 Submit schedule indicating proposed sequence of operations for selective demolition work to Consultant for review prior to start of work.
 - .1 Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control.
 - .2 Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
 - .3 Coordinate with Owner's continuing occupation of portions of existing building and with Owner's partial occupancy of completed new addition.
- .3 Submit photographs of existing conditions of structure, surfaces, equipment and adjacent improvements that might be misconstrued as damage related to removal operations. File with Consultant prior to start of work.

1.7 EXISTING CONDITIONS

- .1 Owner will occupy portions of the building immediately adjacent to areas of selective demolition. Conduct selective demolition work in a manner that will minimize need for disruption of Owner's normal operations. Provide minimum 1 week in advance notice to Owner of demolition activities that will affect Owner's normal operations.
- .2 Owner assumes no responsibility for actual condition of items or structures to be demolished.
- .3 Take over areas and materials to be demolished based on their condition at time of examination prior to bidding. Minor variations within structure may occur resulting from Owner's removal and salvage operations prior to start of selective demolition work.
- .4 Prior to commencing work, examine the site to determine the nature and extent of materials to be removed and site conditions affecting operations. Advise Consultant in writing of problems affecting execution of the Work prior to start of work.

1.8 ASBESTOS AND OTHER DESIGNATED SUBSTANCES

- .1 Refer to Hazardous Designated Substances reports.

1.9 COORDINATION

- .1 Coordinate selective demolition to minimize disruption of operations of existing occupied areas.
- .2 Coordinate selective demolition to ensure continued access to and use of building.
- .3 Coordinate selective demolition, removals and cutting and patching with subcontractors to minimize areas affected and disruption to building and occupants.
- .4 Coordinate selective demolition and removal of building envelope assemblies to maintain protection of building interior and envelope assemblies.
- .5 Coordinate cutting and coring concrete and masonry for piping, ducts, and conduits with the respective mechanical and electrical subcontractors.

1.10 PROTECTION

- .1 Provide temporary barricades and other forms of protection as necessary to protect Owner's personnel and general public from injury due to selective demolition work.
- .2 Provide protective measures as necessary to provide free and safe passage of Owner's personnel and general public to occupied portions of the building.
- .3 Erect temporary covered passageways as required by authorities having jurisdiction.
- .4 Provide temporary, covers, railings, supports and other protection as required.
- .5 Provide interior and exterior bracing, shoring or support to prevent movement, settlement, or other damage to adjacent assemblies, utilities, and adjacent facilities or work to remain.
- .6 Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.
- .7 Protect floors with suitable coverings as necessary to prevent marring, soiling or other damage.
- .8 Keep noise, dust, and inconvenience to occupants to minimum.
- .9 Take precautions to ensure that dust and debris do not contaminate adjacent corridors, offices, patient areas or services.
- .10 Construct temporary insulated dust-proof partitions where necessary to separate areas where noisy or extensive dirt or dust operations are performed.
 - .1 Equip partitions with dust-proof doors and security locks.
- .11 Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.
- .12 Protect building systems, services and equipment.
- .13 Prevent debris from blocking drainage systems, ventilation systems, mechanical and electrical systems which must remain in operation.
- .14 Remove protections at completion of work.

1.11 SHOP DRAWINGS

- .1 Before proceeding with demolition or breaking out of load bearing walls or of other walls requiring shoring, submit shoring and underpinning drawings prepared by Registered Professional Engineer showing proposed method.

1.12 NOTICE

- .1 Notify Owner in writing 1 week before disrupting building access, services and occupied areas.
- .2 Schedule demolition work to cause minimal disruption to normal use of building in accordance with Section 01 31 00.

- .3 Restrict demolition activities to hours between 7:30 a.m. and 4:30 p.m., or after-hours with written approval of Owner.
- .4 Prior to demolishing, removing or cutting through concrete, structural masonry, steel framing and other load bearing members, including floors, ceilings, columns, beams and walls, obtain written acceptance from project design structural engineer.

1.13 DAMAGE

- .1 Promptly repair damages to adjacent facilities caused by demolition work.

1.14 TRAFFIC

- .1 Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks and other adjacent occupied or used facilities.
- .2 Do not close, block, or otherwise obstruct streets, walks or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

1.15 FLAME CUTTING

- .1 Do not use cutting torches without prior notification of Owner.
- .2 Do not use cutting torches for removal until work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations.
 - .1 Maintain adequate portable fire suppression devices immediately available during flame cutting operations.
 - .2 Maintain fire watch after flame cutting operations, to satisfaction of Owner's fire safety representative.
 - .3 Fill in and submit to Owner for approval, the attached "Hot Work Permit" prior to commencing any open flame or other hot work.

1.16 UTILITY SERVICES

- .1 Maintain existing utilities and services indicated to remain in service and protect them against damage during demolition operations.
- .2 Do not interrupt utilities and systems serving occupied or used facilities, except when authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to authorities having jurisdiction.
- .3 Maintain fire protection services and systems during selective demolition.
- .4 Take precautions to avoid false alarms.

1.17 CONCEALED CONDITIONS

- .1 If unanticipated mechanical, electrical or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict.

- .2 Submit written and accurately detailed report to Consultant.
- .3 Pending receipt of directive from Consultant, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.

1.18 ENVIRONMENTAL PROTECTION

- .1 Comply with governing regulations and requirements of authority having jurisdiction pertaining to environmental protection.
- .2 Provide services for effective air and water pollution controls as required by authorities having jurisdiction.
- .3 If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws and ordinances concerning removal, handling, and protection against exposure or environmental pollution.

2 Products (not applicable)

3 Execution

3.1 PREPARATION

- .1 Provide interior and exterior shoring, bracing and support to prevent movement, settlement or collapse of areas to be demolished and adjacent facilities to remain.
- .2 Cease operations and notify Consultant immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.
- .3 Cover and protect furniture, equipment and fixtures from soiling and damage when demolition is performed in areas where such items have not been removed.
- .4 Erect and maintain dust-proof partitions and closures as necessary to prevent spread of dust or fumes to occupied areas of the building.
 - .1 Where selective demolition occurs immediately adjacent to occupied portions of the building, construct dust-proof partitions of minimum 90 mm studs, 13 mm drywall (with joints taped) on occupied side, 13 mm (fire-retardant) plywood on demolition side. Fill partition cavity with sound-deadening insulation.
- .5 Provide weather-proof closures for exterior openings resulting from demolition work.
- .6 Locate, identify, stub off and disconnect electrical and telephone lines and other utility services entering work to be demolished in accordance with utility requirements.
- .7 Disconnect and cap mechanical services and distribution systems entering area of work and piping and ductwork serving fixtures to be removed, in accordance with utility requirements and requirements of authority having jurisdiction.
- .8 Provide bypass connections as necessary to maintain continuity of service to occupied areas of building.

3.2 DEMOLITION

- .1 Remove parts of existing building to permit new construction and alterations.
- .2 Perform selective demolition work in a systematic manner. Use such methods as necessary to complete the work indicated on the drawings in accordance with the demolition schedule and governing regulations.
- .3 Locate demolition equipment and demolished materials throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors or framing.
- .4 Demolish back to structural members and slabs and exterior wall backup, unless specified otherwise.
- .5 Remove items to be reused, protect from damage, store as directed by Consultant, and reinstall under appropriate section of specification.
- .6 Demolish concrete and masonry in small sections.
- .7 Cut concrete and masonry at junctures with construction to remain using power driven masonry saw or hand tools. Do not use power-driven impact tools.
- .8 For concrete floor slabs, use removal methods that will not crack or structurally disturb adjacent slabs or partitions. Use power saw where possible.
- .9 Make cuts square and parallel with adjacent surfaces and features.
- .10 Make cuts vertical and minimize run of cut past area of opening.
- .11 Remove equipment, services, and obstacles, noted as existing to remain, as required for demolition, remodelling, refinishing or making good existing surfaces, and replace as work progresses.
- .12 At end of each day's work, leave work in safe condition so that no part is in danger of toppling or falling or otherwise creates a hazard for building occupants.
- .13 Protect interiors of parts not to be demolished from exterior elements at all times.
- .14 Lower demolition materials and debris to ground through enclosed chutes. Do not create a falling materials hazard.
- .15 Control dust at all times and prevent the spread of dust beyond area where Work is being performed.
- .16 Demolished and removed products, materials, fixtures, equipment become the property of the Contractor at the time of their removal from their original location in the existing structure, unless specified otherwise.

3.3 CUTTING TO ACCOMMODATE DEMOLITION AND REMOVALS

- .1 Execute cutting neatly and carefully, no larger than necessary, employing workers skilled in the erection of the part of the Work, or the part of the existing building, being cut.
- .2 Maintain integrity and continuity of fire separations at all times. Provide fire and smoke penetration seals in cut parts of the Work, equal to existing.
- .3 Saw-cut floors, walls and ceilings accurately. Provide holes and openings no larger than necessary to accommodate new work. Core drill circular holes in concrete. Accurately

cut new holes for mechanical and electrical devices and fixtures and for other recessed items.

- .4 Provide cutting necessary for execution of alterations to mechanical and electrical services and systems.

3.4 PATCHING ADJACENT TO DEMOLITION AREAS

- .1 After cutting is completed, patch and re-finish existing surfaces to remain to the nearest break in surfaces, such as inside and outside corners or a minimum of 5'-0" horizontally and full height of walls from floor to ceiling. Match patch finish to existing adjacent finished surfaces to completely conceal the patch.
- .2 Perform patching work using trades skilled in materials being applied and in accordance with the Contract Documents.
- .3 Conceal capped services unless specifically indicated to remain exposed.
- .4 Patch parts of the Work to match adjacent construction and finishes unless otherwise specified or indicated on Drawings.
 - .1 Provide patching products equal to existing surfaces.
 - .2 Join new work to existing assemblies in neat, accurate manner.
 - .3 Provide soundproof interior junctions.
 - .4 Provide weatherproof exterior junctions.

3.5 SALVAGED MATERIALS

- .1 Where items indicated on the drawings are indicated to be removed and delivered to Owner, carefully remove indicated items, clean, store and turn over to Owner and obtain receipt. Allow for transport to main shipping and receiving loading dock.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- .1 Clear away demolished materials, debris, dirt, rubbish, and loose litter resulting from Work of this Section, minimum daily.
- .2 Remove from building site debris, rubbish and other materials resulting from demolition operations. Transport from site.
- .3 Dispose of removed materials off site, except where specified otherwise, legally and in accordance with authority having jurisdiction.
- .4 Handle and dispose of hazardous materials in accordance with applicable legislation and requirements of authorities having jurisdiction.
- .5 Burning of removed materials is not permitted on project site.

3.7 CLEANUP AND REPAIR

- .1 Upon completion of demolition work remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom clean.
- .2 Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start of operations of this section.

Repair adjacent construction and surfaces soiled or damaged by selective demolition, alterations or removals.

END OF SECTION

Part 1 General

1.1 TAKE-OVER PROCEDURE

- .1 Refer also to Owner's contract documents and/or relevant conditions for take over procedures.

1.2 OCCUPANCY

- .1 Owner reserves the right to occupy and use portions of work whether partially or entirely completed, or whether completed on schedule or not.
- .2 Partial completion shall not imply acceptance of work in whole or in part, nor shall it imply acknowledgement that the terms of Agreement are fulfilled.

1.3 SYSTEM DEMONSTRATION

- .1 Prior to Substantial Performance:
 - .1 Demonstrate operation of each system to Owner and Consultant.
 - .2 Instruct personnel in operation, adjustment and maintenance of equipment and systems, using provided operation and maintenance data as basis for instruction.

1.4 WARRANTIES

- .1 Provide extended warranties called for in specifications.
- .2 Refer to individual sections of the specifications for specific requirements of the warranties.
- .3 If validity of extended guarantee is related to proper maintenance and servicing of equipment, etc., full details must be provided in maintenance manuals.

1.5 SUBMITTALS

- .1 Refer to Section 01 33 00 for submissions required at project completion.

1.6 FINAL CLEANING

- .1 Refer to Section 01 61 00.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

- .1 Procedures for demonstration and instruction of equipment and systems to Owner's personnel.

1.2 DESCRIPTION

- .1 Demonstrate scheduled operation and maintenance of equipment and systems to Owner's personnel at times indicated in the specifications.
- .2 Owner will provide list of personnel to receive instructions and will coordinate their attendance at agreed-upon times.

1.3 QUALITY CONTROL

- .1 Coordinate the Work in accordance with Section 01 45 00 – Quality Control.
- .2 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Owner's personnel, and provide written report that demonstration and instructions have been completed.

1.4 SUBMITTALS

- .1 Submit documentation in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks before designated dates, for Consultant's acceptance.
- .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .4 Give time and date of each demonstration, with list of persons present.

1.5 CONDITIONS FOR DEMONSTRATIONS

- .1 For training during installation, confirm dates for installation have not changed.
 - .2 For training after completion of construction ensure:
 - .1 Equipment has been inspected and put into operation in accordance with specifications.
 - .2 Testing, adjusting, and balancing has been performed and equipment and systems are fully operational.
 - .3 Copies of completed operation and maintenance manuals for use in demonstrations and instructions are provided.
-

1.6 PREPARATION

- .1 Verify that conditions for demonstration and instructions comply with requirements.
- .2 Verify that designated personnel are present.

1.7 DEMONSTRATION AND INSTRUCTIONS

- .1 Demonstrate start-up, operation, control, adjustment, troubleshooting, installation, servicing, and maintenance of each item of equipment at agreed upon times, at the designated location.
- .2 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.
- .3 Review contents of manual in detail to explain all aspects of operation and maintenance.
- .4 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

- .1 Safety Requirements: Section 01 54 50

2. PRODUCTS

- .1 N/A

2.1 MATERIALS

- .1 Dispose of demolished materials off the site except where noted otherwise.

3. EXECUTION

3.1 SAFETY CODE

- .1 Unless otherwise specified, carry out demolition work in Accordance with Occupational Health and Safety Act, latest issue and Regulations for Construction Projects.

3.2 DEMOLITION

- .1 Refer to Asbestos Abatement Specifications for extent of work of removals.
- .2 Refer to Hazardous Building Materials Assessment reports.
- .3 Remove windows, doors, glazings, door & window hardware, shades, blinds, blockings, with supports and the like as indicated on the drawings to accommodate the installation of new work.
- .4 Remove existing services and obstacles where required for refinishing or making good of existing surfaces and replace same as work progresses.
- .5 Carry out demolition in orderly and careful manner. At end of each day's work, leave work in safe condition so that no part is in danger of toppling or falling.
- .6 Use demolition methods to minimize dusting. Clean dust and debris from brick or other building surfaces required to remain, to the satisfaction of the Consultant.
- .7 Protect building and surrounding grounds from debris. Where necessary cover windows with plywood.
- .8 Removals shall mean the removal of all unwanted materials off-site to a designated and licensed landfill site. Pay for all applicable tipping fees.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Masonry Procedures: Section 04 05 00
- .2 Mortar and Grout for Masonry: Section 04 05 12

1.2 REFERENCES

- .1 Definitions:
 - .1 Raking: removal of loose/deteriorated mortar to a depth suitable for repointing until sound mortar, and/or 3x joint thickness and/or a specified mm depth mm is reached.
 - .2 Repointing: filling and finishing of masonry joints from which mortar is missing has been raked out or has been omitted.
 - .3 Tooling: finishing of masonry joints using tool to provide final contour.
 - .4 Low-pressure water cleaning: water soaking of masonry using less than 350 kPa (50 psi) water pressure, measured at nozzle tip of hose.
- .2 CSA International
 - .1 CAN/CSA A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
 - .2 CAN/CSA A179-04(R2009), Mortar and Grout for Unit Masonry.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
 - .1 Provide labelled samples of materials used on project for approval before work commences.
- .4 Test and Evaluation Reports:
 - .1 Provide certified test reports showing compliance with specified performance characteristics and physical properties.
 - .2 Provide laboratory test reports certifying compliance of mortar ingredients with specifications requirements.

1.4 QUALITY ASSURANCE

- .1 Masonry Contractor:
 - .1 Use single Masonry Contractor for masonry work.
 - .2 Masonry contractor to have 10 years experience minimum in brick masonry work on projects of similar size and complexity to Work of this Contract.
 - .3 Masonry contractor to have good level of understanding of structural behaviour of masonry walls when masonry work involves replacing or repairing brick which are part of structural masonry work.
 - .2 Masons:
 - .1 Mason to have certificate of qualification with 10 years minimum experience in brick masonry work.
-

- .2 Masons to have proof of license certification for propriety restoration mortars.
- .3 Cement grouting: grouting activities should be undertaken by experienced workers in manipulation and cement grouting methods.
- .4 Obtain approval from Consultant for changes to qualified personnel.
- .5 Mock-ups:
 - .1 Construct mock-up in accordance with Quality Control.
 - .2 Construct mock-up at areas determined by Owner/Consultant to demonstrate raking, repointing, and "toothing" in of masonry procedures for each type of exterior or interior masonry material specified in locations designated by Consultant for items including but not limited to: grills, diffusers, lintels, etc..
 - .3 Notify Consultant minimum of 24 hours prior to construction of the mock-up.
 - .4 Perform mock-up of masonry cleaning with low pressure 15 to 45 psi clean water and soft natural bristle brush.
 - .5 Construct mock-up under supervision of Consultant to demonstrate a full understanding of specified procedures, techniques and formulations is achieved before work commences.
 - .6 Construct mock-up where directed by Consultant.
 - .7 Work not to proceed prior to approval of mock-up. Allow 24 hours for inspection of mock-up by Consultant before proceeding with masonry repointing work.
 - .8 Accepted mock-up will demonstrate minimum standard for this work. Mock-up will remain as part of finished work.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
 - .2 Store cementitious materials and aggregates in accordance with CAN/CSA A23.1.
 - .3 Store lime putty in plastic lined sealed drums.
 - .4 Keep material dry. Protect from weather, freezing and contamination.
 - .5 Ensure that manufacturer's labels and seals are intact upon delivery.
 - .6 Remove rejected or contaminated material from site.

1.6 AMBIENT CONDITIONS

- .1 Maintain masonry temperature between 10°C and 25°C for duration of work.
- .2 When ambient temperature is below 10°C:
 - .1 Store mortar materials for immediate use within heated enclosure in accordance with 04 Section. Allow mortar materials to reach minimum temperature of 10°C before use.
 - .2 Ensure only sand aggregate and water are heated before use:
 - .1 Heat and maintain sand or aggregate temperature to minimum 10°C and maximum 30°C.
 - .2 Heat and maintain water temperature to minimum of 20°C and maximum of 30°C:
 - .3 Provide hot water to a maximum 30°C on site during cold weather.
- .3 Maintain sand or aggregate temperature between 10°C and 30 degrees.

- .4 Do not mix cement with water or with aggregate or with water-aggregate mixtures having higher temperature than 30°C.
- .5 Maintain mortar mix temperature between 10°C and 30°C.

Part 2 Products

2.1 MORTAR

- .1 Mortar: in accordance with CAN/CSA A179.
- .2 Proportion Specification:
 - .1 In accordance with CAN/CSA A179.
- .3 Property Specification:
 - .1 Exterior walls: Type S.
 - .1 Bedding mortar: Type S.
 - .1 Mortar compressive strength at 7 days: minimum 5MPa.
 - .2 Mortar compressive strength at 28 days: minimum 8.5MPa, maximum MPa.
 - .3 Air entrainment: 8-12%.
 - .4 Flexural bond strength: minimum 0.2 MPa.
 - .2 Pointing mortar: Type S.
 - .1 Mortar compressive strength at 7 days: minimum 5MPa, maximum MPa.
 - .2 Mortar compressive strength at 28 days: minimum 8.5MPa, maximum MPa.
 - .3 Air entrainment: 8-12%.
 - .4 Flexural bond strength: minimum 0.2 MPa.
 - .5 Match existing colour of mortar

Part 3 Execution

3.1 SITE VERIFICATION OF CONDITIONS

- .1 Report in writing to Consultant areas of deteriorated masonry not previously identified.

3.2 SPECIAL TECHNIQUES

- .1 Examine mortar joints.
 - .1 Examine horizontal and vertical joints to determine which were struck first and whether they are the same style, as well as aspects of workmanship which establish authenticity of original work.
 - .2 Replicate the style selected by Consultant.
- .2 Test mortar joints.
 - .1 Procedure of testing: examine joints visually for obvious signs of deteriorated masonry.
 - .2 Test joints not visually deteriorated as follows:
 - .1 Test for voids and weakness by using hammers or other approved means.
 - .2 Perform testing in co-operation with Consultant so that unsound joints can be marked and recorded.

3.3 RAKING JOINTS

- .1 Use manual raking tool or power tool approved by Consultant prior to work to obtain clean masonry surfaces.
 - .1 Remove deteriorated and adhered mortar from masonry surfaces to full depth of deteriorated mortar but in no case less than 3x joint thickness. Precautions should be taken to stop at least 10mm from the edges of the masonry units. Leaving square corners and flat surface at back of cut.
 - .2 Clean out voids and cavities encountered.
- .2 Remove mortar without chipping, altering or damaging masonry units.
- .3 Clean surfaces of joints by compressed air or with non-ferrous brush without damaging texture of exposed joints or masonry units.
- .4 Flush open joints and voids; clean open joints and voids with low pressure water and if not free draining blow clean with compressed air.
- .5 Leave no standing water.

3.4 REPOINTING:

- .1 Dampen joints and porous masonry units.
- .2 Keep masonry damp while pointing is being performed.
- .3 Completely fill joint with mortar.
 - .1 If surface of masonry units has worn rounded edges keep pointing back from surface to keep same width of joint
 - .2 Avoid feather edges.
 - .3 Pack mortar solidly into voids and joints.
- .4 Build-up pointing in layers not exceeding 12 mm in depth.
 - .1 Allow each layer to set before applying subsequent layers.
 - .2 Maintain joint width.
- .5 Tool joints to match existing profile.
 - .1 Tool, compact and finish using jointing tool to force mortar into joint.
- .6 Remove excess mortar from masonry face before it sets.

3.5 PROTECTION DURING CURING PROCESS

- .1 Cover completed and partially completed work not enclosed or sheltered at end of each work day.
 - .1 Membranes should extend to 0.5 m over surface area of work and be tightly installed to prevent finished work from drying out too rapidly.
- .2 Cover with waterproof tarps to prevent weather from eroding recently repointed material.
 - .1 Maintain tarps in place for minimum of 2 weeks after repointing.
 - .2 Ensure that bottoms of tarps permit airflow to reach mortar in joints.
- .3 Anchor coverings securely in position.
- .4 Damp cure:
 - .1 Provide damp cure for pointing mortars.
 - .2 Install and maintain wetted burlap protection during the curing process:

- .1 Minimum 3 days.
- .3 Wet mist burlap only - ensure no direct spray reaches surface of curing mortar.
- .4 Shade areas of work from direct sunlight and maintain constant dampness of burlap.
- .5 Protect from drying winds. Pay particular attention at corners of structure.
- .6 Maintain ambient temperature of minimum 10 degrees C after repointing masonry for:
 - .1 Minimum 7 days in summer.
 - .2 Minimum 30 days in cold weather conditions using dry heated enclosures.

3.6 CLEANING

- .1 Clean surfaces of mortar droppings, stains and other blemishes resulting from work of this contract as work progresses.
- .2 Remove droppings and splashings using clean sponge and water.
- .3 Do further cleaning using stiff natural bristle brushes after mortar has attained its initial set and has not fully cured.
- .4 Clean masonry with stiff natural bristle brushes and plain water only if mortar has fully cured.
- .5 Clean masonry with low pressure 15 to 45 psi clean water and soft natural bristle brush.
- .6 Obtain approval Consultant prior to using other cleaning methods for persistent stains.

3.7 PROTECTION OF COMPLETED WORK

- .1 Protect adjacent finished work against damage which may be caused by on-going work.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section includes new and restoration masonry work.

1.2 REFERENCES

- .1 Definitions:
 - .1 Refer to ASTM E2260-30 for definition of the following terms specific to this Section: In-Situ Mortar, Repointing, Raking.
 - .2 Tooling: Finishing of masonry joints using tool to provide final contour.
 - .3 Low-Pressure Spray: 690 to 2750 kPa; 0.25 to 0.4 L/s.
- .2 ASTM International
 - .1 ASTM A 276-04: Specification for Stainless Steel Bars and Shapes
 - .2 ASTM A 580/A 580M, Specification for Stainless Steel Wire
 - .3 ASTM C 954-11: Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.84 mm to 2.84 mm in Thickness
 - .4 Thickness ASTM E2260-03 (2012), Standard Guide for Repointing (Tuckpointing) Historic Masonry
- .3 CSA International
 - .1 CAN/CSA-A179-04(R2009), Mortar and Grout for Unit Masonry.
 - .2 CAN/CSA-A370-04(R2009), Connectors for Masonry.
 - .3 CAN/CSA A371-04(R2009), Masonry Construction for Buildings.
 - .4 CSA S304.1-04(R2010), Design of Masonry Structures.
- .4 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 01.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit WHMIS MSDS in accordance with Division 01.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Placing drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.
- .4 Test Reports: Mortar
- .5 Quality-Control Program for Masonry Repointing
- .6 Cleaning Program

1.4 QUALITY ASSURANCE

- .1 Masonry Contractor:
 - .1 Use single Masonry Contractor for masonry work.
 - .2 Experienced in performing historic brick masonry work on projects of similar complexity to Services of this Contract.
- .2 Masons: Specializing in masonry installations with a certificate of qualification with 5 years minimum historic brick masonry work on projects of similar size and complexity to Services of this Contract.
 - .1 Masons employed on this project must demonstrate ability to reproduce mock-up standards.
- .3 Quality-Control Program For Masonry Repointing: Prepare a written quality-control program for masonry repointing to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage due to worker fatigue.
- .4 Cleaning Program: Prepare a written cleaning program for Cleaning of Existing Brickwork that describes cleaning process in detail, including materials, methods, and equipment to be used, protection of surrounding materials, and control of runoff during operations.
- .5 Cleaning and Repair Appearance Standard: Cleaned and repaired surfaces are to have a uniform appearance as viewed from 15 m away by Consultant. Perform additional general cleaning, and spot cleaning of small areas that are noticeably different, so that surface blends smoothly into surrounding areas.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Division 01.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

1.6 SITE CONDITIONS

- .1 Ambient Conditions:
 - .1 Assemble and erect components when temperatures are above 4 degrees C.
 - .2 Perform cleaning operations when temperatures are above 4 degrees C and predicted to remain so for at least seven days after completion of cleaning
 - .2 Weather Requirements: to CSA-A371 and to IMIAC - Recommended Practices and Guide Specifications for Hot and Cold Weather Masonry Construction.
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- .3 Cold weather requirements:
 - .1 To CSA-A371 with following requirements.
 - .1 Maintain temperature of mortar between 5 degrees C and 50 degrees C until batch is used or becomes stable.
 - .2 Maintain ambient temperature of masonry work and its constituent materials between 5 degrees C and 50 degrees C and protect site from windchill.
 - .3 Maintain temperature of masonry above 0 degrees C for minimum of 7 days, after mortar is installed.
 - .4 Preheat unheated wall sections in enclosure for minimum 72 hours above 10 degrees C, before applying mortar.
 - .2 Hot weather requirements:
 - .1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.
 - .2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.
 - .3 Do not apply mortar to substrates with a temperature of 32 degrees C and above unless otherwise indicated.
 - .3 Spray mortar surface at intervals and keep moist for maximum of three days after installation.

1.7 SEQUENCING AND SCHEDULING

- .1 Perform masonry restoration work in the following sequence:
 - .1 Remove plant growth
 - .2 Rake out mortar from joints surrounding masonry to be replaced and from joints adjacent to masonry repairs along joints.
 - .3 Repair masonry, including replacing existing masonry with new masonry materials.
 - .4 Rake out mortar from joints to be repointed.
 - .5 Point mortar and sealant joints.
 - .6 Inspect for open mortar joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
 - .7 Remove paint.
 - .8 Clean existing brickwork.

Part 2 Products

2.1 MATERIALS

- .1 Brick Units: single fired extruded clay brick units in accordance with ASTM C-1405, Grade S, Type I, Class Exterior, Division Solid. Provide brick units to match existing.

2.2 REINFORCEMENT AND CONNECTORS

- .1 Masonry ties and connectors: to CSA-A370 and CSA-S304. Adjustable anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall.

2.3 MORTAR – REPOINTING AND REBUILDING

- .1 Repointing Mortar:
 - .1 Comply with CAN/CSA-A179, Proportion Specification, Type N unless otherwise indicated; with cementitious material limited to portland cement and lime.
 - .2 Colour: Ground coloured natural aggregates of colour necessary to produce mortar colour matching existing as determined by the Consultant. Use colouring admixture not exceeding 10% of cement content by mass, or integrally coloured masonry cement
 - .3 Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match
- .2 Rebuilding (Setting) Mortar: Same as pointing mortar except mortar pigments are not required.

2.4 MIXES

- .1 Coloured mortars: Incorporate colour and admixtures into mixes in accordance with manufacturer's instructions.
 - .1 Use clean mixer for coloured mortar.
- .2 Pointing mortar: Prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 hour nor more than 2 hours then remix with sufficient water to produce mortar of proper consistency for pointing.

2.5 CLEANING MATERIALS

- .1 Water: Potable.
 - .2 Hot Water: Water heated to a temperature of 60 to 71 deg C.
 - .3 Job-Mixed Detergent Solution: Solution prepared by mixing 0.5 L of tetrasodium polyphosphate, 125 mL of laundry detergent, and 20 L of hot water for every 20 L of solution required.
 - .4 Job-Mixed Mold, Mildew, and Algae Remover: Solution prepared by mixing 0.5 L of tetrasodium polyphosphate, 5 L of 5 percent sodium hypochlorite (bleach), and 15 L of hot water for every 20 L of solution required.
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Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections are acceptable for product installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate and inform Consultant of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Do masonry work in accordance with CAN/CSA-A371 except where specified otherwise.
 - .1 Bond and Coursing height: Match existing.
 - .2 Tooling: Tool where exposed to provide smooth compressed concave profile to match existing.
 - .1 Tooling of repointed joints to match standard of acceptance established in mock-up.
- .2 Build masonry plumb, level, and true to line, with vertical joints in alignment.

3.3 CONSTRUCTION

- .1 Exposed masonry:
 - .1 Remove chipped, cracked, and otherwise damaged units, in exposed masonry and replace with undamaged units.
 - .2 Make cuts straight, clean, and free from uneven edges.
- .2 Building-in:
 - .1 Install masonry connectors and reinforcement where indicated on drawings.
 - .2 Build in items required to be built into masonry.
 - .3 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.
 - .4 Install loose steel lintels where indicated.
- .3 Provision for movement:
 - .1 Built masonry to tie in with stabilizers, with provision for vertical movement.
 - .2 Control Joints: Leave 12 mm wide vertical joint clear of mortar, full depth wythe of masonry.
 - .1 Install control joint backing rod, sealant to face of control joints at locations indicated, maximum 6 m o.c., full height of wall.
- .4 Build in flashings in masonry in accordance with CAN/CSA-A371.

3.4 BRICK REMOVAL AND REPLACEMENT

- .1 At locations indicated, remove bricks that are damaged, spalled, or deteriorated or are to be reused. Carefully demolish or remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
 - .1 When removing single bricks, remove material from center of brick and work toward outside edges.
- .2 Support and protect remaining masonry that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.

- .3 Notify Consultant of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.
- .4 Remove in an undamaged condition as many whole bricks as possible.
 - .1 Remove in-situ mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.
 - .2 Remove sealants by cutting close to brick with utility knife and cleaning with solvents.
 - .3 Store brick for reuse. Store off ground, on skids, and protected from weather.
 - .4 Deliver cleaned brick not required for reuse to Owner unless otherwise indicated.
- .5 Clean bricks surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.
- .6 Replace removed damaged brick with other removed brick in good quality, where possible, or with new brick matching existing brick, including size. Do not use broken units unless they can be cut to usable size.
- .7 Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
 - .1 Maintain joint width for replacement units to match existing joints.
 - .2 Use setting buttons or shims to set units accurately spaced with uniform joints.
- .8 Lay replacement brick with completely filled bed, head, and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks. Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.
 - .1 Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.
 - .2 Rake out mortar used for laying brick before mortar sets and point new mortar joints in repaired area to comply with requirements for repointing existing masonry, and at same time as repointing of surrounding area.
 - .3 When mortar is sufficiently hard to support units, remove shims and other devices interfering with pointing of joints.

3.5 REPOINTING MASONRY

- .1 Repoint joints to the following extent:
 - .1 All joints in areas indicated.
- .2 Remove in-situ mortar from joints as follows, according to procedures demonstrated in approved mock-up:
 - .1 Remove mortar from joints to depth of between 2 and 2-1/2 times joint width, but not less than that required to expose sound, unweathered mortar.
 - .2 Remove mortar from masonry surfaces within joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
 - .3 Do not spall edges of masonry units or widen joints. Replace or patch damaged masonry units as directed by Consultant.
 - .1 Cut out center of mortar bed joints using angle grinders with diamond-impregnated metal blades. Remove remaining mortar by hand with chisel and resilient mallet. Strictly adhere to submitted quality-control program.

- .3 Notify Consultant of unforeseen detrimental conditions including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.
- .4 Pointing with Mortar:
 - .1 Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
 - .2 Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 9 mm until a uniform depth is formed. Fully compact each layer thoroughly and allow to become thumbprint hard before applying next layer.
 - .3 After low areas have been filled to same depth as remaining joints, point all joints by placing mortar in layers not greater than 9 mm. Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing masonry units have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed masonry surfaces or to featheredge the mortar.
 - .4 When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
 - .5 Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours including weekends and holidays.
 - .6 Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

3.6 REINFORCING AND CONNECTING

- .1 Install masonry connectors and reinforcement in accordance with CAN/CSA-A370, CAN/CSA-A371 and CSA S304.1 unless indicated otherwise.
- .2 Prior to placing mortar, obtain Consultant's approval of placement of reinforcement and connectors.

3.7 BONDING AND TYING

- .1 Bond walls of two or more wythes using metal connectors in accordance with CAN/CSA-A371, CSA S304.1 and as indicated.
- .2 Tie masonry veneer to backing in accordance with NBC, CAN/CSA-A371, CSA S304.1 and as indicated.
- .3 Concrete and Steel back-up:
 - .1 Fasten ties to CIP concrete back-up with metal fasteners required by masonry supplier's engineer. Use two fasteners per location.

3.8 ANCHORS

- .1 Supply and install metal anchors as indicated.

3.9 LATERAL SUPPORT AND ANCHORAGE

- .1 Supply and install lateral support and anchorage in accordance with CSA S304.1 and as indicated.

3.10 SITE TOLERANCES

- .1 Tolerances of CAN/CSA-A371 apply.

3.11 3.11 FIELD QUALITY CONTROL

- .1 Consultant will observe progress and quality of portion of the Services completed. Allow Consultant use of lift devices and scaffolding as needed.
- .2 Notify Consultant in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until Consultant have had reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location.
- .3 Site Tests, Inspection: in accordance with Division 01 supplemented as follows:
 - .1 Test and evaluate mortar prior to construction and during construction in accordance with CAN/CSA A179.

3.12 CLEANING EXISTING BRICKWORK

- .1 General:
 - .1 Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water will not wash over cleaned, dry surfaces.
 - .2 Use only those cleaning methods indicated.
 - .1 Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that cleaning methods do not damage masonry.
 - .1 Equip units with pressure gages.
 - .2 For water-spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
 - .3 For heated water-spray application, use equipment capable of maintaining temperature between 60 and 71 deg C at flow rates indicated.
 - .3 Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, and that produces an even effect without streaking or damaging masonry surfaces.
 - .4 Water-Spray Applications: Unless otherwise indicated, hold spray nozzle 150 mm from surface of masonry and apply water in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.
 - .2 Detergent Cleaning:
 - .1 Wet masonry with hot water applied by low-pressure spray.
 - .2 Scrub masonry with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that masonry surface remains wet.
 - .3 Rinse with cold water applied by low-pressure spray to remove detergent solution and soil.
 - .4 Repeat cleaning procedure above where required to produce cleaning effect established by mockup.
 - .3 Mold, Mildew, and Algae Removal:
 - .1 Wet masonry with hot water applied by low-pressure spray.
 - .2 Apply mold, mildew, and algae remover by brush.
 - .3 Scrub masonry with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for
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mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that masonry surface remains wet.

- .4 Rinse with cold water applied by low-pressure spray to remove mold, mildew, and algae remover and soil.
- .5 Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

3.13 CLEANING

- .1 Progress Cleaning: clean in accordance with Division 01.
 - .1 Leave Services area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 01.

3.14 PROTECTION

- .1 Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from masonry work.
- .2 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.
- .3 Repair damage to adjacent materials caused by masonry products installation.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 Masonry Repointing: Section 04 03 07
- .2 Caulking: Section 07 92 10

1.2 REFERENCES

- .1 CSA A179 Mortar and Grout for Unit Masonry.
- .2 CAN3-A371 Masonry Construction for Buildings.
- .3 CSA-A165 Series, Standards on Concrete Masonry Units.

1.3 INTENT

- .1 It is the intent of the Owner to insist on top quality workmanship particularly with respect to the masonry work. To this end, there will be extensive masonry testing performed by the Owner's representative or independent testing firm. Products and workmanship not complying with the specified standards shall be removed and redone.

1.4 JOB MOCK-UP

- .1 Construct mock-up of exterior masonry "toothing in" and/or re-pointing work for areas as directed by owner and Consultant. Show jointing, coursing, mortar, and workmanship. Conduct no other masonry work until mock-up is reviewed and approved by Owner and Consultant.
- .2 This mock-up will form the standard for the project and all work shall meet this standard. The mock-up can remain as part of the final Project.

1.5 SOURCE QUALITY CONTROL

- .1 Submit laboratory test reports in accordance with Section 01 33 00 certifying compliance of masonry units and mortar ingredients with specification requirements.
- .2 For clay units, in addition to requirements set out in referenced CSA and ASTM Standards include data indicating initial rate of absorption for units proposed for use.
- .3 Specified reference standards and standards noted elsewhere in the specifications, will be strictly enforced. Work that does not comply with the standards shall be removed and rebuilt at the contractor's expense.

1.6 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to job site in dry condition.
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- .2 Keep materials dry until use, except where wetting of bricks is specified.
- .3 Remove factory installed plastic wrap and store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids. Plastic wrap to be removed minimum of 72 hrs prior to block installation.

1.8 COLD WEATHER REQUIREMENTS

- .1 Supplement CAN3-A371 with following requirements: When air temperature is below 5°C take following precautions in preparing and using mortar:
 - .1 Dry materials to be maintained in sealed mortar silo prior to mixing.
 - .2 Heat water to 70°C maximum prior to mixing.
 - .3 After combining heated ingredients maintain temperature of mortar between 5°C and 50°C until used.
 - .4 Protect mortar from rain and snow.
 - .5 Mortar must be used and placed in its final position within 1.5 hours after mixing when the air temperature is 25°C or higher and within 2.5 hrs when the air temperature is below 25°C.
- .2 Maintain dry beds for masonry and use dry masonry units only. Do not wet masonry units in cold weather.
- .3 When air temperature is below -4°C protect and heat masonry on both sides of walls to maintain air temperature above 0°C during operations and for period of forty-eight (48) hours after.
- .4 When air temperature is above -4°C, erect windbreaks to prevent differential freezing of walls.

1.9 HOT WEATHER REQUIREMENTS

- .1 Supplement CAN3-A71 with the following requirements:
 - .1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

1.10 PROTECTION

- .1 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.
- .2 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

Part 2 Products

2.1 MATERIALS

- .1 Masonry Clay Brick: It is the intent of this scope of work to re-use existing brick (size of existing is approximately +/-193mm x +/-57mm x +/-90mm.
- .2 Where existing brick is noted to be removed, store on site at a location to be determined later. Note: The present school building has approximately three major additions, which is: 1968, 1986 and 1991. Existing brick will be removed and re-installed only in the 1968

and 1986 additions. (Refer to drawing for location of areas of date of Additions). The 1968 addition brick has approximately four different shades/texture of brick. The 1986 addition also has approximately four different shades/texture of brick and different than that of 1968. General Contractor to coordinate with Masonry Contractor and ensure that when replacing brick, to maintain color contrast as the rest of the adjacent colors around areas where brick is being replaced. Take precaution to remove bricks carefully. Temporarily store brick on site at a location determined by owner. Protect temporary stored brick. Do not install any damaged brick. Failure to consent by these directions will not in any way incur costs to the owner.

- .3 Concrete Block:
 - Standard cellular masonry units shall conform to CAN-A165 Series-04.
 - .1 Classification: H/15/A/M for standard weight, hollow units.
 - .2 Size: as required to match existing. Refer to drawings for locations to be used.
 - .3 Special shapes.
 - .1 Provide purpose made shapes for lintels, bond beams, tops of free-standing walls, corners and 190mm long units. Provide bullnose units for all vertical and horizontal corners. All corner units shall have 190mm return.

Part 3 Execution

3.1 PRE-COMMENCEMENT MEETING

- .1 Prior to commencement of the work, a mandatory meeting shall take place in which, the Consultant and the Owner will review procedures and standards that will be strictly enforced on this Project. No masonry work shall proceed on site prior to this meeting.

3.2 WORKMANSHIP

- .1 Do masonry work in accordance with CAN3-A371 except where specified otherwise.
- .2 Build masonry plumb, level, and true to line, with vertical joints in alignment.
- .3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.
- .4 Full head joints shall be attained by buttering both ends of each unit. Slushing of head joints after the unit is in place is not permitted.

3.3 TOLERANCES

- .1 Tolerances in notes to Clause 5.3 of CAN3-A371 apply and as noted below.
- .2 Deviation in joint thickness: $\pm 3\text{mm}$ (1/8").

3.4 EXPOSED MASONRY

- .1 Remove chipped, cracked, and otherwise damaged units in exposed masonry and replace with undamaged units.

3.5 JOINTING

- .1 Allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, compressed, uniformly concave joints (no raked joints). Use stainless

steel jointing tools.

- .2 Strike flush all joints concealed in walls and joints in walls to receive plaster, tile, insulation, or other applied material except paint or similar thin finish coating.
- .3 Where necessary to temporarily stop horizontal runs of masonry, and in building corners:
 - .1 Step back masonry diagonally to lowest course previously laid.
 - .2 Do not "tooth" new masonry.
 - .3 Fill in adjacent courses before heights of stepped masonry reach 1200mm.

3.6 CUTTING

- .1 Cut out neatly for electrical switches, outlet boxes, and other recessed or built-in objects.
- .2 Make cuts straight, clean, and free from uneven edges.
- .3 Carefully and neatly sawcut out existing bricks only as required (and store for re-installation). Maintain same coursing, mortar joint size and mortar jointing appearance as per existing. Make good surfaces upon completion of work.

3.7 BUILDING-IN

- .1 Build in items required to be built into masonry.
- .2 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.
- .3 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.

3.8 WETTING OF BRICKS

- .1 Except in cold weather, wet bricks having an initial rate of absorption exceeding 1 g/minute/1000 mm²: wet to uniform degree of saturation, 3 to 24 hours before laying, and do not lay until surface dry.
- .2 Wet tops of walls built of bricks qualifying for wetting, when recommencing work on such walls.

3.9 GROUTING

- .1 Use grout to CSA A179 where grout is used in lieu of solid units. Reference Section 04 05 12 Part 2.4.
- .2 Install metal lath strips below voids to be filled with grout; keep strips 25mm back from faces of units.
- .3 Use high lift or low lift grouting in accordance with specified standards.
- .4 Walls shall be at least 12 hours old before grouting commences.

3.10 PROVISION FOR MOVEMENT

- .1 Leave 6mm space below shelf angles.

- .2 Leave 25mm space between top of non-load bearing walls and partitions and structural elements unless noted otherwise. Do not use wedges.

3.11 LOOSE STEEL LINTELS

- .1 Install loose steel lintels. Centre over opening width. Lintels to be hot-dipped galvanized. Provide minimum bearing of 150mm unless noted otherwise.

3.12 FILLING CORES

- .1 Place and grout reinforcing in accordance with CSA A371 and as indicated.
- .2 Grout all block cores which are reinforced.
- .3 Parapet walls to be filled solid.
- .4 Grout block cores solid for two courses below bearing points of structural and stair members, and as indicated on drawings.

3.13 OPENINGS

- .1 At all openings form, brace, and set lintel blocks for concrete block lintels. Provide min. 200mm bearing. Install reinforcing and grout as per structural drawings or if not shown, contact the Consultant for clarification.
- .2 At all openings in block masonry walls exceeding 600mm in depth, fill core at each side and for 600mm past the top and bottom of opening with grout and reinforce with reinforcing as specified for wall. Similarly treat openings over 1200mm in depth but extend grout and reinforcement the full storey height.

3.14 CONTROL JOINTS

- .1 Provide continuous vertical shrinkage control joints in block masonry walls at locations indicated on structural drawings in accepted locations and between masonry walls supported on slab on grade and walls supported on structural foundation. Rake out 8mm, ready for caulking.
- .2 Provide continuous vertical control joints in brickwork at locations indicated on drawings or at max. 5m o.c., at max. 0.6m from wall corners and in accepted locations.
- .3 Keep control joints free of mortar.
- .4 Stop horizontal masonry reinforcing 25mm from each side of control joints.
- .5 Bond beam reinforcing at underside of bearing locations to be continuous across control joints. Intermediate bond beam reinforcing to stop at each side of control joint. Provide half block and vertical joint across bond beam.
- .6 Caulk joint.

3.15 LAYING CONCRETE MASONRY UNITS

- .1 Bond: running, except where shown otherwise on drawings.

- .2 Coursing height: +/- 200mm for one block and one joint as per existing conditions.
- .3 Jointing: concave where exposed or where paint or other finish coating is specified, flush for precast masonry interior raised sills.
- .4 All intersections of walls and partitions provide a control joint but carry reinforcement through joint.
- .5 Provide control joints at locations where block is supported on a foundation wall on one side and slab on grade on the other side of the control joint. Provide Hohmann & Barnard Inc. Slip-Set Stabilizer @ 400 o.c. between walls.
- .6 Lay blocks with voids and webs aligned with the block below.
- .7 Lay blocks in a full bed of mortar. The full bed of mortar must cover the webs of all blocks as well as the outer and inner walls. Slushing of head joints after the unit is placed shall not be permitted. Whenever it is found that this provision is not carried out, walls shall be taken down and rebuilt, or, at the Consultant's discretion, all voids shall be filled with 20 MPa concrete grout.
- .8 Where blockwork is to be exposed, courses shall be level, and alternate vertical joints shall be aligned.
- .9 Chipped or deformed blocks shall not be used where blockwork, either painted or unpainted, is to be exposed.
- .10 The maximum joint thickness shall be 10mm. Where the specified horizontal reinforcing will cause the joint thickness to exceed 10mm, cut the webs of the blocks to accommodate the reinforcing and to achieve a maximum joint thickness of 10mm.
- .11 Machine cut with a carborundum saw all exposed masonry units which are adjusted in size and leave straight, clean and even edges.
- .12 Build-in all openings, sleeves, fire dampers, or chases required by other trades. Make good around all conduits or pipes that occur in masonry work. Masonry shall close tightly around all penetrations in ceiling spaces. Take special care to ensure that final finish of masonry is presentable; secure the cooperation of other trades to ensure this result.
- .13 As required, break out sections of block webs in order to install horizontal and vertical reinforcing as specified.
- .14 Set bearing plates for joists, beams etc. at locations and elevations indicated on the structural drawings. Report any discrepancies to Consultant.
- .15 Carry up all walls in a uniform manner without any one wall raised more than 1200mm above another at one time.
- .16 Carry all walls and partitions up to the underside of construction above and finish against underside of roof deck or floor slab above (in accordance with details shown on the drawings). Pack all voids between top of walls or partitions and metal deck with firestopping material.
- .17 Where shown on the drawings or called for in the specifications, build-in reglets to receive flashings. Leave reglet free of mortar.

- .18 Cut and make good all openings or chases required by other trades. Where conduits or pipes occur in masonry work, take special care to ensure that final finish of masonry is presentable; secure the cooperation of other trades to ensure this result.
- .19 Where mechanical or electrical work occurs in walls, the walls shall be thickened to suit and to maintain required fire, smoke, and sound separations. Refer to mechanical and electrical drawings. Do not form horizontal chases.
- .20 Build-in sleeves as required.
- .21 As required, all conduits, etc., provided and erected by other trades, shall be built-in without breaking bond.
- .22 Close masonry walls tightly around all penetrations which occur through them in ceiling spaces. Build in around fire dampers in accordance with the requirements of the Underwriters' Laboratory.
- .23 At all openings in masonry walls completely fill hollow units with concrete at the jambs, and reinforce vertically.
- .24 Provide lintel blocks with steel reinforcing at all openings in masonry walls unless shown otherwise on the drawings.
- .25 Provide hot dipped galvanized steel angle lintels at all openings in 90mm masonry veneers unless shown otherwise on the drawings.
- .26 Build-in steel door frames and fill frames with mortar as walls are brought up.
- .27 As required, break out block cores in order to install horizontal and vertical reinforcing as specified.
- .28 Provide temporary bracing of walls during and after erection until permanent lateral support is in place.
- .29 Where copper piping is in contact with masonry, ensure that piping is wrapped with polyethylene.

3.16 CAVITY-WALLS

- .1 Provide purpose made grey plastic weep hole vents. Provide above shelf angles, beams, dampproof courses and flashings and at bottom of cavities. Locate at max. 600mm o.c.
- .2 Place 9mm dia. plastic vent tubes in exterior joints at top of cavities. Provide at 400mm o.c. Slope to drain out at 1:4.
- .3 Provide proprietary mortar-control devices such as a mortar net screen be positioned within cavity as per mortar net manufacturer's written instructions.
- .4 In accordance with paragraph 12.3 of CSA A371-2014, keep cavity free of mortar and mortar droppings. Backslope mortar beds at cavities just sufficient to minimize mortar projection into cavity. Place wood strip on ties or reinforcement to catch all mortar droppings and remove as work progresses.

3.17 FIELD QUALITY CONTROL

- .1 Inspection and testing will be carried out by testing laboratory designated by the Owner.
- .2 Cost of testing will be paid for by Owner.

END OF SECTION

PART I – GENERAL

1.01 SUMMARY

- .1 Framing shall be a strut type metal framing system (Strut System)
- .2 Strut System shall be used:
 - .1 To support mechanical and electrical equipment and devices.
 - .2 For structural applications as applicable.
- .3 Strut System and components must be supplied from a single approved Manufacturer.

1.02 QUALITY ASSURANCE

- .1 Manufacturer's qualifications:
 - .1 The manufacturer shall have at least 10 years experience in manufacturing Strut Systems.
 - .2 The manufacturer must certify in writing all components supplied have been produced in accordance with an established quality assurance program.
- .2 Work shall meet the requirements of the following standards:
 - .1 Local codes
 - .2 American Iron and Steel Institute (AISI) Specification for the Design of ColdFormed Steel Structural Members 2001 Edition
 - .3 American Society for Testing And Materials (ASTM)
 - .4 Metal Framing Manufacturer's Association (MFMA)

1.03 SUBMITTALS

- .1 Provide stamped shop drawings
 - .1 Provide submittals in accordance with Section 01 33 23 - Shop Drawings Product Data and Samples.
 - .2 Submit manufacturer's instructions, printed product literature and data sheets for Unistrut system. Include product characteristics, performance criteria, physical size, finish and limitations.
 - .3 Submit technical data sheets for each product used.
 - .4 Submit shop drawings. Include the following:
 - .1 Submit shop drawings stamped by Professional Engineer licensed to practice in the Province of Ontario.
 - .2 Include reflected ceiling plans. Indicate lay out of channels. Indicate layout and description of inserts and hangers including fastener details.

- Indicate connection details for suspension system to building structure, connection from suspension system to channels. Indicate location of access points, change in level details. Indicate support details for electrical and mechanical equipment located in ceiling.
- .3 Indicate and provide detail layout variations. Indicate lateral bracing and accessories.
 - .4 Indicate system dimensions, framed opening requirements and tolerances, clearance to adjacent construction, anticipated deflection under load, affected related Work, expansion and contraction joint location and details.
 - .5 Indicate assembly details and dimensions of fabrication. Indicate how the individual panels will be connected to the suspended structural components and how the panels will be removable for maintenance and service.
 - .6 Indicate locations of all mechanical, electrical and equipment in ceiling. Respect indications on drawings and symmetry and alignment rules.
 - .7 Provide independent seismic certification from a Professional Engineer registered in Province of Ontario. Certify that the design of the ceiling systems conforms to OBC requirements related to seismic forces.
 - .8 Indicate channel sizes, materials, gauges, finishes, openings, fastening methods to adjacent structure, details and field assembly methods.
 - .9 Description of design criteria.
 - .10 Stress and deflection analysis.
 - .11 Assembly drawings necessary to install the Strut System in compliance with the Contract Drawings.
 - .12 Pertinent manufacturers published data.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- .1 All material is to be delivered to the work site in original factory packaging to avoid damage to the finish.
- .2 Upon delivery to the work site, all components shall be protected from the elements by a shelter or other covering.

1.05 WARRANTY

- .1 Manufacturer shall warrant for 1 year from the shipment date that products will be free from defects in material or manufacture. In the event of any such defect in violation of the warranty, Manufacturer shall have the option to repair or replace any such defective product.
- .2 Installer shall warrant for 1 year from the date of completion of work that the work will be free of defects in installation. In the event of any such defect in violation of the warranty, Installer shall have the option to repair or replace any such defective product.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- .1 Strut System and components shall be UNISTRUT®. Selection of framing members, fittings, and accessories Unistrut International 16100 S. Lathrop Ave. Harvey, IL 60426

Phone: 708-339-1610 800-882-5543 Fax: 708-339-7814 www.unistrut.com

2.02 MATERIALS

.1 All channel members shall be fabricated conforming to one of the following ASTM specifications:

.1 Pre-Galvanized Carbon Steel: A653/A653M-23 Grade 33

.2. All fittings shall be fabricated conforming to one of the following ASTM specifications:

1. Carbon Steel: All carbon steel fittings shall be fabricated from steel that meets/exceeds the physical requirements of ASTM A1011/A1011M-23 SS Grade 33 and conforms to one of the following ASTM specifications:

- a. A575-20
- b. A576-25
- c. A36/A36M-19
- d. A635/A635M-22
- e. A1059/A1059M-24
- f. A1046/A1046M-23

.3 Any substitutions of product or manufacturer must be approved in writing ten days prior to bid date by the Professional of Record.

2.03 FINISHES

.1 PRE-GALVANIZED per ASTM A653/A653M-23

.1 Zinc coated by hot-dipped process prior to roll forming at the steel mill

.2 Zinc coating thickness shall be G90 (0.75 mil = 0.45 oz./ sq. ft. surface area)

PART 3 - EXECUTION

3.01 EXAMINATION

.1 The installer shall inspect the work area prior to installation. If work area conditions are unsatisfactory, installation shall not proceed until satisfactory corrections are completed.

3.02 INSTALLATION

- .1 Installation shall be accomplished by a fully trained manufacturer authorized installer.
 - .2 Set Strut System components into final position true to line, level and plumb, in accordance with approved drawings.
 - .3 Anchor material firmly in place and tighten all connections to their recommended torques.
 - .4 Install Unistrut channels and accessories in accordance with manufacturer's printed instructions.
-

- .5 Lay out system in accordance with reflected ceiling plan.
- .6 Finished ceiling system to be square with adjoining walls and level within 3 mm in 3650 mm.
- .7 Level members with supporting hangers tensioned to prevent any subsequent downward movement when ceiling loads imposed.
- .8 Ensure suspension system is coordinated with location of related components.
- .9 Completed system to support super imposed loads, such as lighting fixtures, diffusers, grilles and speakers. Support at light fixtures and diffusers with additional suspension hangers.
- .10 Finished ceiling system to be square with adjoining walls and level within 1:1000.
- .11 Erect ceiling level, straight, rigidly supported, and securely fastened to abutting surfaces, free from superimposed loads.
- .12 Bolt panels to suspended beams and to each other to create rigid assembly. No welding of panels to suspension components will be permitted.
- .13 No site welding will be permitted.
- .14 Locate fasteners on concealed surfaces where possible.
- .15 Repair damaged finishes with manufacturers touch-up paint.

3.03 CLEANUP

- 1. Upon completion of this section of work, remove all protective wraps and debris. Repair any damage due to installation of this section of work.

3.04 PROTECTION

- .1 During installation, it shall be the responsibility of the installer to protect this work from damage.
- .2 Upon completion of this scope of work, it shall become the responsibility of the general contractor to protect this work from damage during the remainder of construction on the project and until substantial completion.

END OF SECTION

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PART 1 – SCOPE OF WORK

- | | |
|---|--|
| <u>1.1</u>
<u>Related</u>
<u>Sections</u> | <ul style="list-style-type: none">.1 General Requirements – See applicable specification section.2 Safety Requirements – See applicable specification section.3 Preformed Metal Cladding – Section 074650.4 Modified Bitumen Membrane Roofing – Section 075200.5 Sheet Metal Flashing – Section 076200.6 Electrical and Mechanical Requirements – See applicable specification section |
| <u>1.2</u>
<u>General</u> | <ul style="list-style-type: none">.1 Provide wood blocking for roofing, equipment curbs and sheet metal work as indicated on Drawings and as required to provide a finished product. |
| <u>1.3</u>
<u>Anchors &</u>
<u>Fasteners</u> | <ul style="list-style-type: none">.1 Co-ordinate the location and installation of anchors and fasteners. Confirm types of fasteners to be utilized with Consultant..2 Do not use metals in combination that may cause galvanic corrosion..3 Use non-corrosive or galvanized steel fastenings as approved by Consultant, or as otherwise specified..4 Space anchors within load bearing or shear capacity. |
| <u>1.4</u>
<u>Quality</u>
<u>Assurance</u> | <ul style="list-style-type: none">.1 Lumber shall bear the grading stamp of an agency certified by the Canadian Lumber Standards Administration Board..2 Plywood identification; by grade mark in accordance with applicable CSA Standards..3 Ontario Building Code (OBC) – current edition |
| <u>1.5</u>
<u>Precautions</u> | <ul style="list-style-type: none">.1 All wood blocking must be sealed in with self-adhering vapour barrier membrane, as detailed, the same day any wood blocking is installed. Refer to Sections 07 52 00.3.4.1 & 07 52 00.4.4.1. |

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PART 2 – MATERIALS

2.1 **Dimensional** **Lumber &** **Plywood**

- .1 To CAN/CSA-0141 (latest revision) and CAN3-086-M (latest revision) and to National Lumber Grades Authority Standard Grading Rules (latest revision)-grade Category as follows:
- .2 Roofing framing and blocking: species group **PRESSURE TREATED – “CONSTRUCTION GRADE”**
- .3 To CSA 0151 (latest revision), Canadian Softwood Plywood, species group – **PRESSURE TREATED - “CONSTRUCTION GRADE”**
- .4 **Note: All plywood to be 19mm unless noted otherwise.**

2.2 **Fasteners**

- .1 **All fasteners must be designed and approved for use with ACQ/CCA Pressure-Treated Lumber**
- .2 **Wood Construction:** Construction Screws #8 or greater carbon steel with duradize treating and approved for use with ACQ/CCA (Pressure-Treated) lumber. Standard of Acceptance: **Paulin Flat-Head Socket Deck Screw or approved equivalent**
- .3 **Steel Deck Attachment:** Corrosion resistant # 12 hex head screws with Cathodic epoxy e-coat and approved for use with ACQ/CCA (Pressure-Treated) lumber. Standard of Acceptance: **Dekfast #12 Hex Head or approved equivalent.** Contractor to consider fastener spacing @ 300mm (12”) OC staggered.
- .4 **Concrete Deck Attachment:** Fasteners designed to securely anchor to the concrete deck and approved for use with ACQ/CCA (Pressure-Treated) lumber. Standard of Acceptance: **Heavy-Duty Tapcon Screw Anchors or approved equivalent (Anchors to be a minimum of 3/8” diameter).** Testing with fasteners to be completed on site prior to the final securement of any item. Contractor to consider fastener spacing @ 300mm (12”) OC staggered.
- .5 **Concrete / Masonry Wall Attachment:** Fasteners designed to securely anchor to the concrete / masonry wall. Zinc plated steel pin & zinc-aluminium anchor body. Minimum ¼” diameter. Anchors must be suitable length to securely fasten new material to substrate. Standard of Acceptance: **Nail Drive Anchors / Pin Bolts by Ucan or approved equivalent.**

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2.2 Cont'd

- .6 **Misc. Fasteners: to steel** - use self-drilling screws; **to solid masonry or concrete** - use expansion shields, friction fit pins or lag bolts. Use lead or in-organic fibre plugs with specified screws in concrete or masonry.

2.3
Wood
Preservative

- .1 Surface-applied wood preservative: copper naphthenate or 5% Pentachlorophenol solution, water repellent preservative To CSA 080-M1983 (latest revision). – Standard of Acceptance: **Copper-Green Wood Preservative or approved equivalent**

2.4
Gypsum
Sheathing

- .1 Gypsum sheathing board ASTM C1396/C1396M. Board to be 13mm thick, exterior grade sheathing formulated to be fire-resistant

PART 3 – APPLICATION

3.1
Securement

- .1 Secure to substrate with fasteners as specified above and designed for use with ACQ/CCA pressure treated lumber. Fasteners placed in a minimum of two (2) rows at 300mm centers or as otherwise detailed.
- .2 Fasteners should penetrate substrate a minimum of 13mm.
- .3 Double the amount of fasteners required for a distance of 2.4m from all outside corners.

3.2
Fastening

- .1 All screws shall be long enough so that not less than half their length penetrates into the second member.
- .2 Splitting of wood members shall be minimized by staggering the fasteners in the direction of the grain and by keeping nails well in from the edges.

3.3
Wood
Blocking

- .1 Comply with more stringent requirements as required by drawings or Ontario Building Code requirements. Increase number and spacing of all fasteners by 50% for 2400 mm from all outside roof corners.
- .2 Install fasteners to the design intent to hold all wood blocking permanently in place to prevent warping, deflection and to resist all wind and weather conditions.

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3.3 Cont'd

- .3 Secure wood to metal deck in a staggered pattern with each row spaced at maximum 300 mm OC with specified fasteners at maximum 300 mm OC. Secure bottom plate / member with minimum two rows of No. 12 galvanized / coated steel screws at maximum spacing of 300 mm OC. Screws shall be of sufficient length to penetrate top flute of decking a minimum 13 mm and a maximum of 19 mm.
- .4 Install fasteners in two rows in the direction of the grain, offset one to another in a staggered fashion by approximately 50%. All fasteners shall be placed minimum 10 mm from any edge of framing.
- .5 Unless specified otherwise, the number of fasteners shall be doubled at all outside parapet corners, for a distance of 3 m from the corner.
- .6 For any exposed fastening, provide touch-up paint as required to coat all exposed surfaces of screws damaged during the driving process.

3.4
Plywood

- .1 Install plywood where indicated on drawings.
- .2 Leave a space of 2mm between sheets to allow for material expansion.
- .3 Every piece shall have a minimum of 2 fasteners. Minimum distance between 2 fasteners shall be half their length and the minimum distance from the edge of the plywood shall be a quarter of their length

3.5
Wood
Preservative

- .1 Treat surfaces of material with wood preservative, before installation
- .2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum (three) 3-minute soak on lumber and (one) 1-minute soak on plywood.
- .3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.
- .4 **Applied preservative must be completely dry/cured prior to the installation of any subsequent overlying material layers**

3.6
Gypsum
Sheathing

- .1 Mechanically fasten boards to interior of curbs, hatches, and skylights. Install joint tape over all joints. Plaster with a minimum of two coats of drywall compound, sand and paint as indicated on the drawings.

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3.7
New
Construction

- .1 Maximum spacing between studs to be as indicated on drawings.
Align and plumb faces of furring and blocking to tolerance of 1:600.
- .2 **Roof Curbs:** build curbs to a minimum height of 400mm above finished roof surface or as indicated. Most stringent requirement shall govern
- .3 **Walls, Control Joints & Expansion Joints:** build walls / joints to a minimum height of 150mm above the finished roof surface or as indicated. Match height of parapet as indicated on drawings. Most stringent requirement shall govern
- .4 **Parapet Walls:** build parapet walls to a minimum height of 150mm above the finished roof surface or as indicated. Parapet wall heights to match between adjacent / N.I.C. & contract roof areas. Most stringent requirement shall govern
- .5 **Mechanical Sleepers:** build sleepers to a minimum height of 400mm above finished roof surface or as indicated. Most stringent requirement shall govern

-END OF SECTION-

Part 1 General

1.1 RELATED SECTIONS

- .1 Roof Insulation: Section 07 52 00

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM E96/E96M-24/24a, Standard Test Methods for Water Vapour Transmission of Materials.
- .2 Canadian General Standards Board (CGSB)
 - .1 CGSB 71-GP-24M-77(R1983), Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.
- .3 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S701.1-2025, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.
 - .2 CAN/ULC-S704.1-2023, Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittals.
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittals. Indicate VOC's insulation products and adhesives.
- .2 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.

Part 2 Products

2.1 INSULATION

- .1 **Type A** – Non-combustible, lightweight, water repellent, rigid insulation board with rigid upper surface to ASTM C612 Type IVB for use in rainscreen cavity wall.
 - .1 Size: 610 x 1219 mm, thickness: 102mm.
 - .2 Location: Where indicated on drawings.
 - .3 Acceptable material: ROCKWOOL, CAVITYROCK.

2.2 ADHESIVE

- .2 Adhesive for Bonding Insulation: to CGSB 71-GP-24.
 - .1 Type 1: flexible synthetic rubber base, solvent type, suitable for bead application by caulking gun, fungi resistant, application temperature -12C to 50C
 - .2 Compatible with insulation, and substrate.

2.3 ACCESSORIES

- .3 Fasteners: Manufacturer's recommended corrosion protected, self-drilling screws for metal stud framing.
- .4 Insulation Washers: 45 mm diameter tapered plate plastic washer, with flat bottom for flush mounting.
- .5 Spray Foam Sealant: General purpose material to Section 07 21 19 - Foamed in Place Insulation.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 WORKMANSHIP

- .1 Install insulation after building substrate materials are dry.
- .2 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.
- .4 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
- .5 Offset both vertical and horizontal joints in multiple layer applications.

3.3 EXAMINATION

- .1 Examine substrates and immediately inform the Consultant in writing of defects.
- .2 Prior to commencement of work ensure that substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.4 FOUNDATION & UNDER SLAB INSULATION

- .1 Interior application: extend boards 600 mm vertically below finish grade as indicated, mechanically fastened with 4 plastic anchors per board on inside face of perimeter foundation walls.
- .2 Under slab application: extend boards as indicated. Lay boards on level compacted fill.
- .3 Refer to drawings for additional locations, including at entrance to school building.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Mineral wool insulation blankets.
- .2 Related Requirements:
 - .1 Section 09 21 16 - Gypsum Board: for sound attenuation insulation.

1.2 REFERENCES

- .1 ASTM International (ASTM)
 - .1 ASTM C665-24, Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - .2 ASTM C1320-20, Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.
 - .3 ASTM E84-2025, Standard Test Method for Surface Burning Characteristics of Building Materials
- .2 Canadian Gas Association (CGA)
 - .1 CAN/CGA-B149.1-25, Natural Gas and Propane Installation Code Handbook.
 - .2 CAN/CGA-B149.2-25, Propane Storage and Handling Code.
- .3 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-604-2022, Standard for Type A Chimneys.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures
- .2 Action Submittals:
 - .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheets.

Part 2 Products

2.1 INSULATION

- .1 Batt and blanket mineral fibre: to ASTM C665-24, CAN/ULC-S702.
 - .1 Type: 1
 - .2 Flame Spread: maximum 0, to ASTM E84-2025.
 - .3 Smoke Development: maximum 0, to ASTM E84-2025.
 - .4 Thickness: full depth of stud cavity, except as indicated.
 - .5 Acceptable manufacturers:
 - .1 "Cavityrock" cavity wall as manufactured by Rockwool Inc.
 - .2 "AFB" (Acoustical Fire Batts) manufactured by Rockwool Inc.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSULATION INSTALLATION

- .1 Install insulation to maintain continuity of thermal protection to building elements and spaces and to ASTM C1320-20.
- .2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
- .3 Do not compress insulation to fit into spaces.
- .4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC 604-2022 Type A chimneys and CAN/CGA B149.1-25 and CAN/CGA B149.2-25 Type B and L vents.
- .5 Do not enclose insulation until it has been inspected and approved by Engineer.

3.3 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Foamed-in-place insulation.
 - .2 Foamed-in-place sealant.
- .2 Related Requirements:
 - .1 Section 07 21 13 - Board Insulation
 - .2 Section 07 27 10 - Air/Vapour Barriers
 - .3 Section 08 11 00 - Steel Doors and Frames
 - .4 Section 08 41 26 - All-Glass Entrances and Storefronts
 - .5 Section 08 44 00 - Curtain Wall

1.2 REFERENCES

- .1 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S710.1:2019, Standard For Thermal Insulation – Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Material Specification
 - .2 CAN/ULC-S705.1-01-2018-REV1, Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Material – Specifications, Includes Amendments 1, 2
 - .3 CAN/ULC-705.2-2022, Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Application

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate with Section 07 27 10 Air/Vapour Barriers for adhesion testing of membrane air seal/vapour barrier (AVB) where installed under Foamed-in-place Insulation.

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Action Submittals:
 - .1 Product Data: Submit manufacturer's printed product literature, specifications and datasheet for each product indicated.
- .3 Informational Submittals:
 - .1 Compatibility: Submit letter, provided and signed by manufacturer of insulation material, indicating products used on the project are compatible with adjacent materials, and materials with which the insulation will be in contact or sealed.
 - .2 Manufacturer's Instructions: Submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.5 AMBIENT CONDITIONS

- .1 Apply foamed-in-place sealants only when substrate and ambient temperatures are within prescribed limits.
-

- .2 Ensure temperature is maintained throughout curing period.

Part 2 Products

2.1 MATERIALS

- .1 Use of insulation products manufactured with CFCs as blowing agents is prohibited.
- .2 Spray Foam Insulation: to CAN/ULC S705.1-2018-REV1, closed cell, spray applied rigid cellular polyurethane foam air barrier and thermal insulation, medium 29 kg/cu m density.
 - .1 Performance criteria:
 - .1 Fire Performance: less than 500 flame spread, less than 500 smoke developed to CAN/ULC S102.
 - .2 Water vapour permeance: 42ng/Pa-s-sq m to ASTM E96.
 - .3 Long term thermal resistance: RSI 1.95 at 50 mm thickness.
 - .2 Standard of Acceptance: BASF Walltite v3, CertainTeed CertaSpray Closed Cell Foam, Icynene MD-C-200 CDN, Johns Manville JM Corbond III, Heatlok Soya/Polaform Soya by Demilec Soya is an approved alternate.
 - .3 Locations: Around protrusions and penetrations through air seal, and other locations indicated.
- .3 Spray Foam Sealant – General Purpose: one-component, semi-rigid polyurethane sealant, to CAN/ULC-710.1:2019, 16 to 24 kg/m³, minimum RSI 0.67 per 25 mm thickness:
 - .1 Standard of Acceptance: Great Stuff Pro Gaps and Cracks Insulating Foam Sealant by Dow Chemical, or comparable product by, but not limited to, RHH Foam Systems Inc., Handi-Foam, Tiger Foam Insulation, and Hilti.
 - .2 Locations: gaps and cracks up to 75 mm in size.
- .4 Spray Foam Sealant – Low Pressure: one-component, semi-flexible polyurethane sealant, to CAN/ULC-S710.1:2019, 27 kg/m³:
 - .1 Standard of Acceptance: Great Stuff Pro Window and Door Insulating Foam Sealant by Dow Chemical, or comparable product by, but not limited to, RHH Foam Systems Inc., Handi-Foam, Tiger Foam Insulation, and Hilti.
 - .2 Locations: gaps and cracks adjacent to door, window and curtain wall framing.
- .5 Cementitious Thermal Barrier: ULC rated fire protective coating specially formulated for application over cured polyurethane foam insulation, forming a hard, durable, humidity resistant monolithic surface, minimum 350 kg/m³ dry density, minimum 23.9 kN/m² bond strength, surface burning characteristics 10 flame spread, 0 smoke developed.
 - .1 Standard of Acceptance: Grace Construction Products Monokote Type Z3306.

Part 3 Execution

3.1 PREPARATION

- .1 Clean surfaces which are to receive insulation, of dirt, dust, grease, loose material or other foreign matter which may inhibit adhesion.

- .2 Provide sufficient ventilation during and until insulation has cured, to ensure safe working conditions. Introduce fresh air and exhaust air continuously during the 24 hour period after application to maintain non-toxic, unpolluted, safe working conditions.
- .3 Temporarily brace door frames as may be required to prevent possible bowing of frames due to over expansion of the foamed-in-place insulation.
- .4 Examine substrate surfaces for conditions ready to accept Work.
- .5 Report unsatisfactory conditions in writing.
 - .1 Proceed with Work once unsatisfactory conditions are corrected.
 - .2 Start of Work implies acceptance of conditions.

3.2 PROTECTION

- .1 Provide temporary enclosures to prevent spray and noxious vapour from contaminating air beyond application area.
- .2 Protect workers in accordance with manufacturer's written instructions.
- .3 Protect adjacent surfaces and equipment from damage by over spray, fall-out, and dusting of insulation materials.
- .4 Dispose of waste foam daily and decontaminate empty drums in accordance with foam manufacturer's instructions.

3.3 INSTALLATION, GENERAL

- .1 Where spray-foam insulation or sealant is used to maintain continuity of thermal barrier, and is installed in conjunction with membrane air seal/vapour barrier around frames including metal and aluminum frames or protrusions, ensure that foamed-in-place insulation is installed on exterior side of membrane air seal/vapour barrier.
- .2 Finished surface: free of voids and imbedded objects.
- .3 Apply materials in accordance with manufacturer's written instructions.
- .4 Apply primer when required to properly prepared substrates for special conditions required by foam insulation manufacturer's requirements.

3.4 INSTALLATION AROUND PROTRUSIONS THROUGH AIR SEAL

- .1 Apply by spray method to uniform monolithic density without voids.
- .2 Install spray-foam insulation around protrusions including mechanical and electrical protrusions, electrical chases, exhaust systems, heating and cooling ducts, sole plates, top plates, wall sections, and elsewhere as required to achieve and maintain continuity of thermal barrier around such protrusions.
- .3 Conduct daily visual inspection, adhesion testing and density measurements as required by CAN/ULC S705.2-2022 and manufacturer's application guidelines.
- .4 Spray apply cementitious thermal barrier coating over foam insulation to minimum 21 mm thickness where foam insulation exposed to building interior.

3.5 INSTALLATION AROUND CURTAIN WALL AND ENTRANCE FRAMING

- .1 Install spray foam sealant around curtain wall frames, and entrance frames to maintain continuity of thermal barrier, after air/vapour barrier has been installed and sealed to framing as specified in Sections 07 27 10, 08 11 00, 08 41 26 and 08 44 00.
- .2 Ensure that spray foam sealant completely fills spaces, without voids, and that foam is continuous at corners.
- .3 Provide thermal barrier to interior spaces as indicated and required by OBC.

3.6 CLEAN-UP

- .1 Remove masking materials and overspray from adjacent areas immediately after foam surface has hardened.
- .2 Repair damaged areas in accordance with manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Rigid insulation for Masonry Cavity Wall: Section 07 21 13

1.2 SECTION INCLUDES

- .1 Materials and installation methods providing primary air vapour barrier materials and assemblies.
- .2 Air/vapour barrier materials to provide continuous seal between components of building envelope and building penetrations.

1.3 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.33-M89 Water Vapour Permeance.
 - .2 CAN/CGSB-19.13-M87, Sealing Compound, One Component, Elastomeric Chemical Curing.
 - .3 CAN/CGSB-19.24-M90, Multi-Component, Chemical Curing Sealing Compound.
- .2 NBCC 1995; Part 5 - Environmental Separation
- .3 Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification.
- .4 SCAQMD Rule#1168 South Coast Air Quality Management District.
- .5 SCAQMD Rule #1113 South Coast Air Quality Management District.
- .6 GS-11 Green Seal Environmental Standard - Paints.
- .7 GS-03 Green Seal Environmental Standard - Anti-Corrosive Paints.

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittals.
 - .1 Provide drawings of special joint conditions.
- .2 Submit manufacturer's product data sheets in accordance with Section 01 33 00 - Submittals.
- .3 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittals.

1.5 QUALITY ASSURANCE

- .1 Perform Work in accordance with Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification requirements for materials and installation.
 - .2 Perform Work in accordance with National Air Barrier Association - Professional Contractor Quality Assurance Program and requirements for materials and installation.
 - .3 Maintain one copy of documents on site.
-

1.6 QUALIFICATIONS

- .1 Applicator: Company specializing in performing work of this section with minimum 5 years documented experience with installation of air/vapour barrier systems. Completed installation must be approved by the material manufacturer.
- .2 Applicator: Company who is currently licensed by National Air Barrier Association must maintain their license throughout the duration of the project.

1.7 PRE-INSTALLATION MEETINGS

- .1 Convene one week prior to commencing Work of this section.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Avoid spillage. Immediately notify the Consultant if spillage occurs and start clean up procedures.
- .3 Clean spills and leave area as it was prior to spill.

1.9 PROJECT ENVIRONMENTAL REQUIREMENTS

- .1 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

1.10 SEQUENCING

- .1 Sequence work to permit installation of materials in conjunction with related materials and seals.

Part 2 Execution

2.1 AIR/VAPOUR BARRIER

- .1 Cold Applied Membrane: to CAN/CGSB-53-3 3, self-adhering membrane consisting of an SBS rubberized asphalt compound integrally laminated to thermoplastic film, min. 1.0mm (40mils) "Blueskin SA by Henry Baker. Refer to 2.1.6 for Thru-wall flashing membrane.
- .2 Primer: type recommended by air/vapour barrier manufacturer for type of substrate used.
- .3 Tapes for joint sealing of sheathing: type as recommended by air/vapour barrier manufacturer.
- .4 The VOC content of adhesives and sealants used in the interior of the building envelope must be less than the VOC content limits of SCAQMD Rule#1168.
 - .1 Contractor to provide cut sheets, Material Safety Data Sheets, signed attestations or other official literature from manufacturers clearly identifying product emission rates. Documentation showing amount (in litres) of each materials used should also be provided.
- .5 The VOC content of paints and coatings used in the interior of the building envelope must be less than the VOC content limits of GS-11 and GS-03 respectively. The VOC content

of interior paints and coatings not already covered by GS-11 and GS-03 must be less than the VOC content limits of SCAQMD Rule#1113.

- .1 Contractor to provide cut sheets, Material Safety Data Sheets, signed attestations or other official literature from manufacturers clearly identifying product emission rates. Documentation showing amount (in litres) of each materials used should also be provided.
- .6 Thru-Wall Flashing: cold Applied Membrane to CAN/CGSB-53-33, self-adhering membrane consisting of an SBS rubberized asphalt compound integrally laminated to a cross-laminated polyethylene film, min. 1.0mm 40mils), "yellow" in color "Blueskin TWF by Henry Bakor. Thru-wall flashing product by Soprema is an approved alternate on the proviso that it meets the specification in all aspects.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that surfaces and conditions are ready to accept the Work of this section.
- .2 Ensure all surfaces are clean, dry, sound, smooth, and continuous and comply with air barrier manufacturer's requirements.
- .3 Report any unsatisfactory conditions to the Consultant in writing.
- .4 Do not start work until deficiencies have been corrected. Commencement of work implies acceptance of conditions.

3.2 PREPARATION

- .1 Remove loose or foreign matter which might impair adhesion of materials.
- .2 Ensure all substrates are clean of oil or excess dust; all masonry joints struck flush, and open joints filled; and all concrete surfaces free of large voids, spalled areas or sharp protrusions.
- .3 Ensure all substrates are free of surface moisture prior to application of membrane and primer.
- .4 Ensure metal closures are free of sharp edges and burrs.
- .5 Prime substrate surfaces to receive air/vapour barrier in accordance with manufacturer's instructions.
- .6 Tape all joints of gypsum sheathing to air/vapour barrier manufacturers printed instructions.

3.3 INSTALLATION

- .1 Install materials in accordance with manufacturer's instructions. Caulk with sealant to ensure complete seal.
- .2 Place liquid seal onto roof vapour retarder and seal with sealant. Caulk to ensure complete air seal. Position lap seal over firm bearing.
- .3 Install seal between window and door frames and adjacent wall seal materials with sealant. Caulk to ensure complete seal. Position lap seal over firm bearing.

- .4 Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

3.4 PROTECTION OF WORK

- .1 Do not permit adjacent work to damage work of this section.
- .2 Ensure finished Work is protected from climatic conditions.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Aluminum Soffits.
- .2 Aluminum trim and accessories.

1.2 RELATED SECTIONS

- .1 Section 05 41 00 - Structural Metal Stud Framing.
- .2 Section 06 10 00 - Rough Carpentry.
- .3 Section 07 21 13 - Board Insulation.
- .4 Section 07 62 00 - Sheet Metal Flashing and Trim.
- .5 Section 07 92 00 - Joint Sealants.

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM).
 - .1 ASTM A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - .2 ASTM A1003/A1003M-15, Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.
 - .3 ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .4 ASTM D958 - Practice for Determining Temperatures of Standard ASTM Molds for Test Specimens of Plastics.
 - .5 ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
 - .6 ASTM E2768-11 – Standard Test Method for Extended Duration Surface Burning Characteristics for Building Materials (30 min Tunnel Test). Results: Zero Flame Spread, Smoke Developed Index of 5. Meets criteria for Class A fire rating.
 - .2 American Architectural Manufacturers Association (AAMA).
 - .1 AAMA 1402-09, Standard Specifications for Aluminum Siding, Soffit and Fascia.
 - .2 AAMA 2603 - Voluntary Specification, Performance requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
 - .3 AAMA 2604 - Voluntary Specification, Performance requirements and Test Procedures for High Performing Organic Coatings on Aluminum Extrusions and Panels.
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- .4 AAMA 2605-05 - Voluntary Specification, Performance requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- .3 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-51.32, Sheathing, Membrane, Breather Type.
 - .2 CAN/CGSB-93.2, Prefinished Aluminum Siding, Soffits and Fascia, for Residential Use.
 - .3 CAN/CGSB-93.3, Prefinished Galvanized and Aluminum-Zinc Alloy Steel Sheet for Residential Use.
 - .4 CAN/CGSB-93.4, Galvanized and Aluminum-Zinc Alloy Coated Steel Siding Soffits and Fascia, Prefinished, Residential.
 - .5 CGSB 93.5, Installation of Metal Residential Siding, Soffits and Fascia.
- .4 Underwriters Laboratories of Canada (ULC).
 - .1 CAN/ULC S114 – Standard method of test for determination of non-combustibility in building materials.

1.4 PERFORMANCE REQUIREMENTS

- .1 Components: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with applicable code.
- .2 Movement: Accommodate movement within system without damage to components or movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; deflection of structural support framing.
- .3 Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
- .4 Non-Combustible: to ASTM E136 and CAN/ULC S114.
- .5 Surface Burning: to ASTM E2768.
- .6 Wind Load (TAS 202 & 203): Uniform Static air and cyclic wind pressure. 100 psf design pressure. Contact manufacturer for ultimate test pressure data corresponding to framing type, dimensions, fastener type, and attachment clips. Project engineer(s) must determine Zone 4 and 5 design pressures based on project specifics.

1.5 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: Manufacturer's printed product data sheets on each product to be used, including:
 - .1 Preparation instructions and recommendations.

- .2 Storage and handling requirements and recommendations.
- .3 Installation methods and instructions.
- .3 Shop Drawings: Indicate dimensions, layout, profile, joints, expansion joints, construction details, methods of anchorage, trims and closure pieces, soffit, furring, and interface with adjacent materials.
- .4 Selection Samples: For each finish product specified, two complete sets of colour chips representing manufacturer's full range of available colours and patterns.
- .5 Verification Samples: For each finish product specified, two samples, minimum size 51 mm by 89 mm, representing actual product, color, and gloss.
- .6 Manufacturer's Certificates: Submit certificates demonstrating products meet or exceed specified requirements, including laboratory reports showing compliance with specified tests and standards.
- .7 Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic cleaning and maintenance of components.

1.6 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: Minimum 5 years' experience producing aluminum finishes of the types specified and AkzoNobel, AAMA 2604 and 2605 Certified.
- .2 Installer: Company specializing in performing Work of this section with minimum 3 years documented experience.
- .3 Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - .1 Finish areas designated by Consultant.
 - .2 Do not proceed with remaining work until workmanship, colour, and gloss are approved by Consultant.
 - .3 Refinish mock-up area as required to produce acceptable work.
- .4 Pre- Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Package and store products under cover in manufacturer's unopened packaging until ready for transport and installation.
- .2 Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- .3 Store prefinished material off ground protected from weather, to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- .4 Store preformed metal panels horizontally, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed 49 deg C.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Minimize construction waste sent to the landfill, separate and recycle materials as specified in Section 01 74 20 – Construction/Demolition Waste Management and Disposal.

1.9 PROJECT CONDITIONS

- .1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not fabricate products under environmental conditions outside manufacturer's absolute limits.

1.10 SEQUENCING

- .1 Coordinate Work with installation of windows, louvers, and adjacent components or materials.

1.11 WARRANTY

- .1 Provide limited written warranty, signed and issued in the name of the Owner covering the prefabricated soffit against cracking, peeling and gloss / colour retention within the guidelines stated by the American Architectural Manufacturers Association (AAMA).
 - .1 Woodgrains:
 - .1 AAMA 2604 -15 Year manufacturer's warranty from the date of Substantial Completion.

Part 2 Products

2.1 MANUFACTURERS

- .1 ACCEPTABLE MANUFACTURER: Mayne Inc., 27575-50th Ave. ; Langley, BC; Canada, V4W 0A2; 1-800-604-0343; Email: (info@longboardproducts.com); Web: www.longboardproducts.com.
- .2 Alternates are acceptable based on the provision that it meets or exceeds requirements indicated in this section.

2.2 MATERIALS

- .1 Extruded Aluminum 6063 T5 Soffit: Longboard Wood Grain Tongue & Groove Aluminum profile with powder coat and bonded film finish with integrated venting system.
 - .1 101.6 mm V-Groove Soffit planks (channels) in 7.3 metre lengths.
 - .2 Gloss: 30 +/- 5.
 - .3 Thickness: 1.52 mm base metal thickness.
- .2 Accessories: Prefinished aluminum in 3.6 metre lengths. Provide matching accessories and starter strips for a complete installation. Standard accessories available from Mayne Coatings Corp are as follows:
 - .1 64 mm perforated vent strip.
 - .2 64 mm V groove siding and soffit.
 - .3 J track.
 - .4 Wide Starter Strip.
 - .5 Inside Corner.
 - .6 Outside Corner.
 - .7 Finish Base & Cap (2pc set).
 - .8 Base & U Cap (2pc set).
 - .9 Base & Flat Cap (2pc set).

- .10 Powder Coated Wide Starter Strip.
- .11 Quick Screen Clip Stainless Steel.

2.3 FINISHES

- .1 Custom Colours: Colour selection will be from "Longboard Wood Grains series "Consistent" and/or "Moderate Variations". To later selection by Owner / Consultant. Provide samples as per Article 1.05 Submittals.
- .2 Pretreatment: E-CLPS Chrome Free 5 stage aluminum pretreatment system. Complies with AAMA 2603, AAMA 2604, and AAMA 2605 Superior Performance Standard and meets EPA, OSHA, Province and local environmental requirements and contains no chromates, cyanides or other heavy metals.
- .3 Akzo Nobel Interpon D3000 Series electrostatically applied Fluromax Architectural Powder Coatings are approved to AAMA 2605 Superior Performance Standard.
 - .1 Gloss Level: Standard Gloss is 30 percent, plus or minus 5 percent.
 - .2 Architectural Wood Grains.

Part 3 Execution

3.1 EXAMINATION

- .1 Do not begin installation until colours have been verified.
- .2 Conform to approved shop drawings and samples.
- .3 Verify framing members are ready to receive panel system.
- .4 Where preparation is the responsibility of another installer, notify Consultant of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- .1 Clean surfaces thoroughly before installation.
- .2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the material under the project conditions.

3.3 INSTALLATION

- .1 Install in accordance with manufacturer's installation instructions and local building Codes.
- .2 Barrier Protection: Do not install over cementitious materials, dissimilar metals or pressure treated material without adequate barrier protection.
 - .1 Install building paper or other acceptable separation membrane horizontally on soffit framing to receive prefabricated metal soffit.
 - .2 Weather lap edges and ends of separation membrane 150 mm.
 - .3 Securely staple or nail in place.
- .3 Fasten prefabricated metal soffit to structural supports; aligned, level, plumb, tight-fitting, and hairline joints.
- .4 Locate joints over supports.
- .5 Install expansion control joints where indicated on shop drawings or as per manufacturer's recommendations.

.6 Use concealed fasteners unless otherwise approved by Consultant.

.7 Attach components in manner not restricting thermal movement.

3.4 FIELD QUALITY CONTROL

.1 After installation of soffit, check entire surface for obvious flaws or defects.

.2 Replace and repair any problemed or defective areas and pay close attention to the substrate for causes of the problem.

3.5 CLEANING

.1 After application of soffits, clean as necessary to remove fingerprints and soiled areas.

.2 Upon completion of soffit application, clean entire area, removing all scrap, packaging, and unused materials related to this work.

3.6 PROTECTION

.1 Protect installed products until completion of project.

.2 Touch-up, repair or replace damaged products before Substantial Completion.

3.7 SCHEDULES

.1 Refer to canopy drawings for location and installation details of prefabricated prefinished metal soffit.

END OF SECTION

Project: **Pineview PS - RAAC**
Replace. & Access. Upgrades
Project #: **26-002**

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PREFORMED METAL CLADDING
Page 1

PART 1 – GENERAL

1.1 **Related** **Sections**

- .1 General Requirements – See applicable specification section
- .2 Safety Requirements – See applicable specification section
- .3 Rough Carpentry – Section 061000
- .4 Modified Bitumen Membrane Roofing – Section 075200
- .5 Sheet Metal Flashing – Section 076200
- .6 Joint Sealant – Section 079200
- .7 Electrical and Mechanical Requirements – See applicable specification section

1.2 **Quality** **Assurance**

- .1 **All metal cladding works (i.e. site measuring, fabrication & installation) are to be completed by a licenced sheet metal worker registered with the Ontario College of Trades (Construction Sector – Sheet Metal Worker 308-A). Prime Contractor to provide all identification and documentation as requested prior to commencing any works on site.**

1.3 **References**

- .1 ANSI B18.6.4-1981 Screws, Tapping and Metallic Drive, Inch Series, Thread Forming and Cutting.
- .2 CSA B111-1974 Wire Nails, Spikes and Staples.
- .3 CGSB 93-GP4M-78 Siding, Soffits and Fascia, Steel, Galvanized, Prefinished.

1.4 **Samples**

- .1 Submit samples in accordance with Section 010050 – General Requirements.
- .2 Submit duplicate 36" x 36" samples of siding material, of colour and profile specified.

1.5 **Shop** **Drawings**

- .1 Submit shop drawings in accordance with Section 010050 – General Requirements.
- .2 Indicate dimensions, profiles, attachment methods, schedule of wall elevations, trim and closure pieces, metal furring, and related work.

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- 1.6**
Mock-Up
- .1 Complete on-site mock-up(s) of all specified sheet metal cladding profiles and details for approval prior to proceeding with any works. Mock-up to identify: proposed profile & colour, proposed method of installation & attachment and proposed flashings, trims and accessories.
 - .2 Submit samples if approval of substitutions is requested.

PART 2 – PRODUCTS

- 2.1**
Steel
Cladding
- .1 Strip siding: to CGSB 93-GP-4M, vertical profiled.
 - .2 Finish coating: exterior pre-painted baked finish.
 - .3 Colour: **To match existing**
 - .4 Gloss; as per Manufacturer's specifications.
 - .5 Thickness: **To match existing**
 - .6 Profile: **To match existing**
 - .7 Acceptable Material: Ideal Roofing or approved equivalent.

- 2.2**
Accessories
- .1 **Exposed trim:** pre-fabricated inside corners, pre-fabricated outside corners, cap strip, drip cap, sill flashing, under-sill trim, flashings, starter strip and door /window trim of same material, colour, gloss and gauge as cladding, with fastener holes pre-punched. All exposed edges must be hemmed.
 - .2 **Closure:** closure to match profile of steel roof panels of same material, colour and gloss having a nominal core thickness: **24-gauge (0.71mm)**
 - .3 **Isolation coating:** alkali resistant bituminous paint.
 - .4 **Touch-up paint:** as recommended by pre-finished material manufacturer.

- 2.3**
Framing
Girts
- .1 Framing girts to be manufactured from the same type of material as used for cladding & shall be **20-gauge (1.00 mm)**. Framing girts to be manufactured in an "omega" profile as indicated

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2.4 **Fasteners**

- .1 **Cladding Fasteners:** to CSA B111 #14 or greater, non-corroding with hexagonal head and neoprene washer of same type of material as used for cladding. Colour and finish to match cladding. Fasteners must be specifically designed and suitable length to firmly secure new materials to substrate.
- .2 **Exposed Trim Fasteners:** same type of material as used for cladding with low profile head. Colour and finish to match cladding. Fasteners must be specifically designed and suitable length to firmly secure new materials to substrate.
- .3 **Framing Girt Fasteners:** same type of material as used for cladding with low profile head. Fasteners must be specifically designed and suitable length to firmly secure new materials to substrate.

2.5 **Sealant**

- .1 Sealants: as per Section 079200 – Joint Sealant.

PART 3 – EXECUTION

3.1 **Fabrication**

- .1 All associated trims, flashings and other items shall be as detailed, supplemented by recommendations of the S.M.A.C.N.A. Architectural Manual.
- .2 All free edges of metal flashing shall be strengthened by a fold at least 13mm wide, set out slightly and presenting a straight line and neat finish. Form flashings in 2.4m lengths, making allowance for expansion. When flashings exceed 600mm in height form flashing in 1.2m lengths.
- .3 Metal shall be formed on a bending brake, shaping trimmed and hard seaming shall be done on bench, as far as practicable, with proper sheet metal working tools. Angles of bends and folds for interlocking metal shall be made with full regard to expansion and contraction to avoid buckling or fullness in service and to avoid damaging surfaces of metal.
- .4 Dry joints are to be tight but not dented so as to permit slight adjustments of sheets and yet remain watertight.
- .5 Lock seams at all corners.
- .6 Apply isolation coating to metal surfaces to be embedded in concrete or mortar, and between dissimilar metals.

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3.2
Installation

- .1 Install cladding in accordance with CSGB 93-GP-5M, and manufacturer's written instructions.
- .2 Install and secure all Z-bar framing as required. Fasten cladding to Z-bar framing material as required. Z-bar to be secured to substrate with fasteners designed for specific application. Gauge of girts to be as required by manufacturer and spaced at 600mm OC max.
- .3 Install continuous starter strips, pre-fabricated inside and outside corners, edgings, drips, caps, flashings, sills, trims and window/door opening flashings as required.
- .4 Install all related pre-fabricated inside and outside corners, edgings, drips, caps, flashings, sills, trims and window/door opening flashings as required with carefully formed and profiled work.
- .5 Maintain joints in exterior cladding, true to line, tight fitting, hairline joints.
- .6 Attach components in manner not restricting thermal movement.
- .7 Caulk junctions with adjoining work with sealant. Do work in accordance with Section 079200-Joint Sealant.
- .8 Exposed raw/cut edges along the new cladding panels are not acceptable. All raw/cut edges to be fully concealed by overlapping factory finished panel, trim, flashing, pre-fabricated detail, etc.
- .9 Cutting of cladding panels must be completed in a manner that does not damage the panel or paint finish in any location.

-END OF SECTION-

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PART 1 – SCOPE OF WORK

- | | |
|--|---|
| <u>1.1</u>
<u>Related</u>
<u>Sections</u> | <ul style="list-style-type: none">.1 General Requirements – See applicable specification section.2 Safety Requirements – See applicable specification section.3 Rough Carpentry – Section 061000.4 Preformed Metal Cladding – Section 074650.5 Sheet Metal Flashings – Section 076200.6 Plumbing – Section 224200.7 Electrical & Mechanical Requirements – See applicable specification section |
| <u>1.2</u>
<u>General</u> | <ul style="list-style-type: none">.1 Provide the necessary labour and materials to complete the removal of the existing roofing system, sheet metal flashings, wood blocking, Insulation, vapour barrier, deck sheathing, etc. down to the structural roof deck..2 Provide the necessary labour and materials to allow for all modifications to the electrical services, mechanical equipment, and natural gas piping system required to complete the project, as per applicable mechanical & electrical specification section |
| <u>1.3</u>
<u>Roof</u>
<u>Assembly</u> | <ul style="list-style-type: none">.1 Supply all labour and materials necessary to complete the new Modified Bitumen Membrane roof system, as specified and detailed within the roof section as indicated on the drawings. |

New Typical Roof Assembly for Roof Areas # “A, B-1 & B-2” shall be:

- **New 2-Ply Modified Bitumen Membrane Flashings**
- **New 2-Ply Modified Bitumen Membrane System**
- **New 6mm (1/4”) Asphaltic Protection Board**
- **New 2% Tapered Insulation System**
- **New 50mm (2”) Secondary Thermal Insulation**
- **New 75mm (3”) Base Thermal Insulation**
- **New Vapour Barrier**
- **New 16mm (5/8”) Deck Sheathing**
- **New Steel Deck (as per Structural)**

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1.4
Roof
Assembly
Flashings

- .1 Supply all labour and materials necessary to complete the new Modified Bitumen Membrane Roof Flashings, as specified and detailed herein and as indicated on the detail drawings.

1.5
Precautions

- .1 Roofing shall not be carried out when materials are damp and base sheet shall not be applied when ambient temperature is less than minus ten (-10) degrees Celsius. (Postpone roofing work when inclement weather appears imminent).
- .2 Fasteners/Adhesives for each component of the roof assembly (deck sheathing, insulation, sloped insulation, overlay board, roofing membranes): as recommended by roofing system manufacturer to suit structural roof deck as applicable, and as required to meet CSA A123.21 wind uplift criteria. Prime Contractor to provide all wind uplift information as per the manufacturer's specifications and project specific standards/requirements.
- .3 **Prime Contractor may not employ the use of ride-on type roofing equipment (i.e. Labour Saver, Dingo, Bobcat, Garlock, Skid-Steer or similar) in any location throughout the project. Do not overload the roof decks with materials and/or equipment in any location. Prime Contractor to assume all risks associated with damage to existing roofing and structure as a result of materials/equipment storage, usage and installation.**
- .5 Apply each part of roofing system only when surfaces are clean and dry.
- .6 Conduct, operations to leave deck exposed for minimum period of time. Protect, as required, to prevent water infiltration or environmental damage to building interior. At no time shall the deck be left exposed overnight.
- .7 Insulation shall not be left exposed to the elements no shall more be laid\ than can be completely covered in the same day.
- .8 Provide temporary membrane to render all insulation watertight if for some unforeseen reason work cannot be completed as specified. Remove temporary membrane completely prior to any further roofing operations.
- .9 Where work must continue over finished roofing membrane, protect surface with plywood sheets.

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1.5 Cont'd

- .10 Strictly adhere to all safety guidelines for the torching of Modified Bituminous Membrane.
- .11 Any sharp projections, that in the opinion of the Consultant may penetrate the vapour barrier, shall be ground smooth and flush.
- .12 All aspects of the re-roofing operation shall follow in close sequence. No part of the operation shall be so far ahead of the succeeding part that the latter cannot be finished that working day.

1.6
Warranty

- .1 Prior to award of the project, Prime Contractor must provide a copy of their certification in good standing with their chosen material manufacturer. Prime Contractor must also provide in writing, their ability to issue the specified warranty.
- .2 All roof system components / materials must be sourced from one (1) manufacturer.
- .3 Warranties as noted below must be provided directly by material manufacturer. Material supplier issued warranties are not acceptable and will not be considered.
- .4 Remedy all defects in the Modified Bituminous Membrane Roofing and Membrane Flashings installed hereunder which appear within a period of **Five (5) Years** from date of substantial completion. In addition, submit Membrane Manufacturer's **15-Year Full System Warranty (No Dollar Limit)** upon completion of project. Standard of Acceptance: **15-Year Platinum Warranty by Soprema or approved equivalent**
- .5 Make all necessary repairs and replacements within **48 hours** of receipt of written notification. Provide a written warranty confirming above, issued on the corporate letterhead, signed and sealed by an authorized signing officer.
- .6 Nothing contained in this article shall be construed as in any way restricting or limiting the liability in common law and statutory liability of the Prime Contractor.

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PART 2 – MATERIALS

2.1

Deck Sheathing

- .1 **Glass Mat Gypsum Roof Board:** Pre-primed with fibreglass mats front & back mechanically bonded to a high-density gypsum core. Boards to be 1.2 m x 2.4 m (4' x 8'), thickness 16 mm (5/8") with pre-primed surface. Standard of acceptance: **Dens Deck Prime Roof Board or approved equivalent.**

2.2

Adhesive

- .1 **Adhesive:** low-rise, 2-component, polyurethane adhesive. Used for securing roof board to structural deck, insulation to vapour retarder, protection board to insulation. Standard of acceptance: **Duotack by Soprema or approved equivalent.** Strictly follow minimum temperature application as per the manufacturer's guidelines. **Note: All adhesive must be applied by a manufacturer's approved applicator.**

2.3

Bitumen & Primers

- .1 **Self-Adhesive Membrane Primer:** composed of SBS synthetic rubbers, adhesive enhancing resins and volatile solvents designed for use with self-adhesive waterproofing membranes on most substrates. Standard of Acceptance: **Elastocol Stick by Soprema or approved equivalent.**
- .2 **Black Bituminous Primer:** to be composed of asphalt modified bitumen with thermoplastic polymers and volatile solvents. Standard of Acceptance: **Elastocol 500 by Soprema or approved equivalent.**
- .3 **Roofing Cement:** with water displacing characteristics, to ensure an effective bond to both wet and dry surfaces. The ability to adhere during inclement weather conditions. Composed of selected asphalts, mineral fillers combined with refined solvent, and special chemical ingredients to create a water displacement quality. Standard of Acceptance: **Karnak Amphibikote 155 (wet and dry) or approved equivalent**

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2.4
Vapour & Air
Barrier
Membranes

- .1 **Air Barrier:** self-adhesive membrane composed of SBS modified bitumen and a tri-laminated woven polyethylene facer. Underface covered with a silicone release paper or film. Top face is covered by a thin poly-film. Standard of Acceptance: **Soprasedal Stick 1100T by Soprema or approved equivalent.**
- .2 **Underneath Parapets, Curbs and Walls:** composed of SBS modified bitumen reinforced with composite reinforcement. The surface is sanded. The underface, self-adhesive, is covered with a release protection film. Standard of Acceptance: **Sopralene Stick HR 20 by Soprema or approved equivalent.**
- .3 **Roof Field:** membrane composed of a non-woven polyester reinforcement and SBS modified bitumen. Membrane to be a minimum of 3.5mm thick. Standard of Acceptance: **Sopralene 180 SP 3.5 by Soprema or approved equivalent**

2.5
Batt/ Blanket
Insulation

- .1 **Batt/Blanket Insulation:** semi-rigid stone wool batt insulation for exterior wood and steel stud applications. To be non-combustible and fire resistant. Standard of Acceptance: **Comfortbatt by Rockwool or approved equivalent**

2.6
Thermal
Insulation

- .1 **Thermal Insulation: (thicknesses as indicated)** closed cell polyisocyanurate foam bonded on top and bottom sides to an organic/inorganic facer. Board size not to exceed 1200mm x 1200mm. Insulation to meet CAN/CGSB 51.26-M and CAN/ULC-S704. Standard of Acceptance: **Sopra-Iso by Soprema or approved equivalent**

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2.7
Tapered
Insulation

- .1 Standard of Acceptance: **Soprema Tapered Polyisocyanurate Insulation or approved equivalent**
- .2 Tapered Polyisocyanurate (**2% as per applicable tapered insulation roof plan(s)**): tapered insulation system to be fabricated from Polyisocyanurate only. Modules shall be factory cut to correct slopes and clearly marked, similar to provided applicable roof plan(s). All valleys, corners, angles, crickets, details, etc. must be factory mitred. Slope(s) to meet specification requirements and Consultant's approval. Slopes to be 4-way directional and a minimum 38mm (1.5") thickness, commencing at each roof drain/sump location as described. Shop drawings indicating: layout, thicknesses, type of material and average R-Value(s) to be submitted for approval prior to material ordering / fabrication.
- .3 Tapered insulation system must cover the entire field surface area of each contract roof section similar to applicable tapered insulation roof plan. Tapered insulation package must be designed with a continuous upwards slope beginning at each roof drain/sump location and extend to the contract roof area perimeters. Tapered insulation package may not contain any: flat areas, breaks or interruptions. Reduction or removal of specified base or secondary thermal insulation layer(s) will not be accepted. Tapered insulation system must commence above the thermal insulation layer(s) (as indicated - "typical new roof assemblies") within all locations. Tapered insulation system is independent of thermal insulation layer(s) and may not be incorporated into or form part of the thermal insulation layer(s).
 - .1 Submit the manufacturer's latest specifications including compliance data. **Only manufacturer's data sheets will be acceptable.**
 - .2 **Crickets:** Modules shall be factory cut/mitred to correct slopes and clearly marked. Cricket leading edges to terminate at 0.
 - .3 **Sumps:** Modules shall be factory cut/mitred to correct slopes and clearly marked. All drains must be sumped a maximum of 1200mm x 1200mm (4' x 4'), with a minimum 2% slope. All sumps to be a minimum of 13mm (0.5") and maximum of 38mm (1.5") thick.
 - .4 Insulation slopes and thickness shall be as indicated on the detailed drawings and roof plan and shall be a distinct separate layer with joints staggered over the thermal insulation layer(s). Ensure sump drops in elevation minimum 2%. Chamfer sump edges to receive protection board.

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2.8
Protection
Board

- .1 6mm (1/4") thick asphaltic roofing board composed of a mineral fortified asphaltic core between 2 asphaltic saturated fibreglass liners. Board size to be 1220mm x 1520mm. Standard of Acceptance: **Sopraboard by Soprema or approved equivalent.**

2.9
Modified
Bitumen
Membrane

- .1 Two (2)-ply system made from prefabricated modified bitumen membranes containing minimum 15% of elastomer Styrene Butadiene Styrene (SBS) and reinforced with non-flammable, fireproof and stress resistant insert of glass fibre or polyester.
- .1 **Membrane Base Ply:** base sheet membrane composed of SBS modified bitumen and non-woven polyester reinforcement. Both sides are covered with thermofusible plastic film. Standard of Acceptance: **Sopralene Flam 180 by Soprema or approved equivalent**
- .2 **Membrane Cap Ply:** cap sheet membrane composed of SBS modified bitumen and non-woven polyester reinforcement. Surface protected by coloured granules and underface covered with thermofusible plastic film. Standard of Acceptance: **Sopralene Flam 250 GR by Soprema or approved equivalent**
- .3 **Membrane Base Flashings:** base sheet membrane composed of SBS modified bitumen and glass mat reinforcement. Surface covered with thermofusible plastic film and self-adhesive underface covered with a silicone release film. Standard of Acceptance: **Sopraflash Flam Stick by Soprema or approved equivalent.**
- .4 **Membrane Base Flashings (over existing compatible membrane surfaces):** base sheet membrane composed of SBS modified bitumen and non-woven polyester reinforcement. Both sides are covered with thermofusible plastic film. Standard of Acceptance: **Sopralene Flam 180 by Soprema or approved equivalent**
- .5 **Membrane Cap Flashings:** cap sheet membrane composed of SBS modified bitumen and non-woven polyester reinforcement. Surface protected by coloured granules and underface covered with thermofusible plastic film. Standard of Acceptance: **Sopralene Flam 250 GR by Soprema or approved equivalent.**

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2.9 Cont'd

- .6 **Reinforcing Membrane:** base sheet membrane composed of SBS modified bitumen and a non-woven polyester reinforcement. Both sides are covered with a thermofusible plastic film. Standard of Acceptance: **Sopralene Flam 180 by Soprema or approved equivalent**
- .7 **Sacrificial/ Traffic Membrane:** cap sheet membrane composed of SBS modified bitumen and non-woven polyester reinforcement. Surface protected by coloured granules and underface covered with thermofusible plastic film. Standard of Acceptance: **Sopralene Flam 250 GR by Soprema or approved equivalent**
- .2 Low temperature Requirements
Grade 2 material to pass low temperature requirements at -30°C to CGSB 37-GP-56M.
- .3 Test Results
Test results from a certified independent laboratory showing conformance to above requirements shall be submitted with tender documents or within 48 hours of tender closing, **if requested.**
- .4 Standard of Acceptance
S.B.S. Modified Bitumen Membranes as manufactured by the following: Soprema, IKO & Johns Manville only

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2.10
Roof
System
Accessories

1. **Roofing Nails:** to CSA B111, Table 12, of electrogalvanized steel, sufficient length to penetrate wood substrate at least 25mm
Nails to have a minimum head diameter or 25mm. Standard of Acceptance: **Electrogalvanized Bulk Roofing Nails by Canada Fine Parts & Supplies or equivalent**
2. **Round Top Cap Nails:** In compliance with CSA B-III1979 standard, table 12, nails shall be made of galvanized steel, long enough to penetrate the wood blocking by a minimum 25 mm (1") depth on flashings and parapet walls. **45 mm (1-3/4") Electrogalvanized Bulk Metal Cap Hand Nails by Canada Fine Parts & Supplies or approved equivalent**
3. **Deck Sheathing/ Base Flashing Fasteners:** Corrosion resistant # 12 screws and hexagonal steel plates. Standard of Acceptance: **Dekfast Pre-Assembled Screws & Plates or equivalent**

NOTE (Base Flashing Fasteners): In locations where the substrate causes interference with the above noted fasteners, Contractor is responsible to supply and install the appropriate length and diameter of fastener to properly support and secure the stress plate and underlying membrane.
4. **Plumbing Vent Flashings:** 1-piece aluminum construction with flashing sleeve and integral flange, matching aluminum hood and perforated collar, pre-molded urethane insulation liner and EPDM base seal. Standard of Acceptance: **SJ-31 Vandal Proof Stack Jack Flashing by Thaler Roofing Specialties only. Extend vent pipe as required. Extend vent pipe from below deck if required to match height of new flashing**
5. **Mechanical Stack Flashing:** Pre-fabricated galvanized steel tall cone flashing with integrated flange c/w metal storm collar, height to suit detail (minimum 14" tall), all joints fully solder welded.
6. **Mechanical / Electrical Outlet Flashing:** Pre-fabricated 1-piece aluminum construction with integral flange, factory insulated and rigid PVC hood seal. Standard of Acceptance: **Flash-Tite Wire Outlet Post by Lexcor or approved equivalent.**
7. **Liquid Membrane Flashing:** one-component polyurethane and bitumen liquid membrane, and a flexible 100g/m² woven polyester membrane. Standard of Acceptance: **Alsan Flashing & 6" Reinforcement Mesh by Soprema or approved equivalent**

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- .8 **Misc. Accessory Flashing:** precast blocks made of polyester resin
Standard of Acceptance: **Sopramastic Blocks by Soprema or approved equivalent.**
- .9 **Accessory Flashing Filler:** is a polyether-based resin, single-component, moisture cure elastomer sealing mastic. Odourless and to have low VOC content. Standard of Acceptance: **Sopramastic PF by Soprema or approved equivalent**
- .10 **Accessory Adhesive:** polyether-based resin, single-component, moisture cure elastomer sealing mastic and adhesive with low VOC content.
Standard of Acceptance: **Sopramastic SP2 by Soprema or approved equivalent**
- .11 **Mastic:** solvent-based mastic containing SBS modified bitumen, fibres and mineral fillers. **Sopramastic by Soprema or approved equivalent**
- .12 **Loose Granules:** composition and colour to match granule surface of roofing membranes. Granules to be embedded into heated asphalt surfaces at joints between rolls or at any other locations where the bitumen bleed-out exceeds the manufacturer's recommendations. Standard of Acceptance: **Granules by Soprema or approved equivalent.**
- .13 **Pre-Cast Concrete Paver:** to CSA A231.1, exposed aggregate surface, 600mm x 600mm (24" x 24") size 50mm (2") thick. Colour and finish to be approved by Owner.
- .14 **Bird Screen (Gooseneck Vents):** 20mm x 20mm galvanized wire mesh.
- .15 **Protection Mats:** 19 mm x 1.22m x 1.8 m rubber matting manufactured from recycled materials. Standard of acceptance: **Magnum Mat by North West Rubber or approved equivalent.**
- .16 **Flame Guard Tape (**Only Where Required):** composed of SBS modified bitumen and a glass mat reinforcement with a sanded surface and self-adhesive underface with a silicone release film. A minimum width of 150 mm for installation at protection boards and vertical transitions.
Standard of Acceptance: **Sopraguard Tape by Soprema or approved equivalent.**

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2.10 Cont'd

- .17 **Cement Board:** formed in continuous process of aggregated portland cement slurry with polymer-coated, glass-fiber mesh completely encompassing edges, back and front surfaces. The edges are formed smooth with poly-propylene fabric-wrapped edge. Ends are square cut. Boards to be 1.2 m x 2.4 m (4' x 8'), thickness to be 16 mm (5/8"). Standard of Acceptance: **Durock Cement Board with Edgeguard by CGC or approved equivalent**
- .18 **Cement Board Fasteners:** Corrosion resistant fasteners specifically designed for application and securement to wood substrate. Fastener to be suitable length to securely fasten cement board in-place. Standard of Acceptance: **Durock Cement Board Fasteners by CGC or approved equivalent**
- .19 **Fibreglass Tape:** exterior tape designed to reinforce joints and corners of cement board panels. Tape is 4" wide & self-adhesive. Made of alkali-resistant glass-fiber mesh. Standard of Acceptance: **Durock Exterior Fibreglass Tape by CGC or approved equivalent**
- .20 **Free Standing Supports:** engineered prefabricated support made of high-density polypropylene plastics with UV Protection. HDG structural steel frame, rollers and hardware. Support to be appropriately sized to support item (i.e. gas, electrical, refrigeration). Standard of Acceptance: **PP-10 w/ Roller, PP-10 with Chanel, RB-18 or other by Portable Pipe Hangers only. Contractor may NOT substitute PP-10 for SS8-C or SS8-R pipe supports.**
- .21 **High Temperature Gasket/Sealant** – single component, room temperature vulcanizing RTV gasketing compound to provide “formed-in-place” gaskets for mechanical assemblies. Product to resist aging, weathering and thermal cycling without hardening, shrinking or cracking. (up to 750°F intermittent). Standard of Acceptance: **Optimum Red by Permatex or approved equivalent**
- .22 **Steel Channel & Clamps:** 1-5/8" x 1-5/8", 12-gauge pre-galvanized steel channel with pre-punched holes. Pre-galvanized steel clamps to suit channel and designed to secure component as required (i.e. gas line). Standard of Acceptance: **P1000HS Unistrut by Atkore or approved equivalent.**

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- .23 **Expansion Joint:** monolithic expansion joint made of EPDM-based synthetic rubber consisting of two (2) flanges coated on the surface and underface with a woven oxidized and stabilized polyacrylonitrile, with an expandable core. Expansion joint to be custom manufactured to suit all site conditions, including but not limited to: 90-degree, angled, cross, T-shaped and curved transitions, as well as continuously in other directions. Expansion joint to be manufactured with a minimum expansion/contraction as noted. Contractor responsible to complete accurate field measurements for the fabrication of this product to meet all project requirements. Standard of Acceptance: **Soprajoint Plus 75 by Soprema or approved equivalent.**
- .24 **Expansion Joint Fasteners:** Hardened carbon steel # 14 Phillips head fasteners with anticorrosion coating. 2" membrane stress plates manufactured from heavy gauge galvalume with special barbs and ribs. Standard of Acceptance: **Soprafix Pre-Assembled Screws & Plates by Soprema**

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PART 3 – APPLICATION

3.1 **Surface** **Inspection &** **Preparation**

- .1 After removal of the existing roof system assemblies and before commencing the work of this section, conduct an inspection of the entire substrate with the Consultant and the Roofing Contractor to approve the condition of the substrate. Ensure that the deck and all parts of the structure that are to be covered with roofing membrane possess a smooth surface with an even finish, free of excessive moisture, ridges, hollows and sharp corners. **Obtain letter from roof material manufacturer's accepting substrate.** Before commencing works, ensure that all surfaces are smooth, dry, clean and free of ice and debris. The deck must be free of contamination by materials which could affect the adhesion of the roofing or the physical integrity of the membrane itself. No salt or calcium shall be used to remove ice or snow
- .2 Ensure that the work has been properly completed, that there is a proper slope as indicated, with minimal ponding that may occur.
- .3 Commencement of roofing installation shall be construed as acceptance of the substrate, and thereafter the Contractor shall be fully responsible for satisfactory work as required herei

3.2 **Installation**

- .1 Do not install materials under conditions of rain, snow or fog.
- .2 Install roofing elements on clean and dry surfaces, in accordance with the manufacturer's requirements and recommendations.
- .3 Perform work on a continuous basis as surface and weather conditions allow.
- .4 Protect adjoining surfaces against any damage that could result from roofing installation.

3.3 **Equipment**

- .1 Maintain all equipment and tools in good working order.
- .2 Use torch types recommended by the membrane manufacturer.

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3.4
Protection

- .1 **Cover walls and adjacent work where materials are hoisted or used.**
- .2 Use warning signs and barriers. Maintain in good order until completion of work.
- .3 Clean off drips and smears of bituminous material.
- .4 Dispose of rainwater off roof and away from face of building until roof drains or hoppers installed and connected.
- .5 Do not permit traffic across finished roof area unless protected by catwalks, prevent traffic over above roof level. Comply with precautions deemed necessary by the Consultant. Repair damage caused by non-compliance with Consultants requirements.
- .6 Where work must continue over finished roofing membrane, protect the surface with minimum 1/2" thick plywood sheets.
- .7 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed and incomplete work.
- .8 Install water cut-offs at the end of a day's work, remove same prior to continuing roof application.

3.5
Primer
Application

- .1 Treat all surfaces to be roofed with Primer to improve adhesion. Apply by brush or roller at a rate of 350 g/m². Ensure all surfaces are thoroughly covered and primer is allowed to properly flash-off prior to any membrane application.
- .2 Note that the drying time of the primer is related to the ambient temperature and may vary from a few hours to a whole day. Do not proceed until the primer is dry.
- .3 Apply to all metal surfaces (aluminum, copper, etc.,) prior to any membrane installation.
- .4 Apply primer on all substrates that are to receive self-adhering, torch applied & asphalt applied membranes.
- .5 All primer to be installed as per manufacturer's Guidelines and recommendations.

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3.5 Cont'd

- .6 **Surfaces of gypsum sheathing must be fully coated with black bituminous primer (Elastocol 500) to a full, even and consistent finish prior to any membrane applications (voids or uncoated areas are not acceptable). Contractor must follow manufacturer recommended installation procedures and quantities.**

3.6
Deck
Sheathing
Installation

.1 Steel Deck Roof:

- .1 Inspect the underside of the deck to ensure fasteners will not be visible, damage the structure or interior surfaces, affect electrical and mechanical services. Fasteners to penetrate top flute of the deck maximum 20 mm.
- .2 Advise Consultant of any unusual circumstances affecting the work. Be responsible and correct all damage caused by work to match existing materials and finish.
- .3 **Mechanically fasten each board to the steel deck as required by roofing system manufacturer to meet all current wind uplift criteria.**
- .4 Attach 16mm (5/8") gypsum sheathing over steel deck as indicated herein. Install gypsum sheathing boards with long side perpendicular to flutes of deck. Stagger joints in boards. Terminate ends of boards on top of the flutes.
- .5 Secure to top flute of steel deck with screws spaced in pattern to meet manufacturer wind uplift criteria. Use screw-type anti-backout corrosion resistant fasteners with metal plates as generally approved or required by the gypsum manufacturer.
- .6 Prime metal plates that will be covered with bitumen roofing. Ensure primer is tack-free before proceeding.

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3.7
Vapour
Barrier
Installation

- .1 Prior to installation of field vapour barriers, install self-adhering vapour barrier at all parapets, walls, curbs, and other vertical surfaces, as detailed on the drawings. Set the vapour barrier removing the release paper and applying pressure to the entire surface with a steel roller. Apply vapour barrier with 75mm side laps. Extend vapour barrier 150mm onto the roof deck.
- .2 Install **1-ply of Roof Field Vapour Barrier** fully torch applied over surface of deck sheathing.
- .3 Install batt insulation at openings in deck and carefully apply temporary covers at openings to prevent bleeding of bitumen into building.
- .4 Starting at low point and laying across roof slope fully adhere vapour barrier to surface of sheathing using proper shingling methods. Lap sides 75 mm and ends 150 mm.
- .5 Apply the vapour retarder following the manufacturer's guidelines. Ensure application is free of air pockets, wrinkles, fishmouths, or tears. Check all seams and repair areas where adhesion is lacking and repair them with approved methods.
- .6 Apply a single ply vapour barrier extending up and onto the parapet coping as detailed.

3.8
Thermal &
Tapered
Insulation
Installation

- .1 Install insulation to meet thickness as indicated herein and indicated on the drawings (thicknesses as indicated).
- .2 At drain location(s), install 2% sloped insulation sump in a single layer. Finish insulation sump flush with top of surrounding insulation, size to be as indicated herein and on drawings.
- .3 Install all insulation layers (base, secondary, fillers, tapered, etc.) with 2-part urethane adhesive as required by roofing system manufacturer to meet all current wind uplift criteria. Fit boards tightly together. All gaps between boards shall be filled with insulation. Stagger all joints in boards by a minimum of 300mm (12"). Stagger all joints from each other and from the layer below.
- .4 All insulation panels to be neatly cut at projections and points of termination. Replace all broken, damaged or misfit boards as work progresses.

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3.8 Cont'd

- .5 Where necessary, back-cut insulation to allow it to conform and stay bonded to irregular surfaces without bridging. Subsequent to placement, walk insulation into place to ensure positive bonding is achieved.

3.9 **Protection** **Board** **Installation**

- .1 Install 6mm (1/4") protection board by embedding into beads of 2-part urethane adhesive over the surface of the polyisocyanurate foam insulation. Adhere overlay board to insulation with adhesive at the rate and pattern specified as for insulation (above).
- .2 Place boards in parallel rows with end joints staggered. Lay out in rows in the same direction as the polyisocyanurate foam.
- .3 Do not install more insulation than can be completely roofed in the same day.

3.10 **Roof** **Membrane** **Installation**

- .1 **Base Ply Membrane:** Allow membrane rolls to relax before installation. Torch apply base ply membrane over the Protection board, overlap rolls 75 mm on sides and 150 mm on ends and in shingle-fashion up from bottom of slope. Ensure application is free of air pockets, wrinkles, fishmouths, or tears. Torch seal all seams. Check all seams and repair using a torch.
- .2 **Cap Ply Membrane:** Torch adhere cap ply membrane to base sheet, using proper shingling methods. Stagger seams in cap sheet a minimum 300 mm with those of the base sheet. Lap sides 75 mm and ends 150 mm. Degranulate surface granules where cap sheet is to be lapped by cap flashings or other overlying membrane. Ensure application is free of air pockets, wrinkles, fishmouths, or tears. Check all seams and repair areas where adhesion is lacking, and repair them, using a torch.
- .3 **Base Ply Flashings:** All membrane flashings are to be 2-ply application. Self-adhere all base ply flashings, ensure all deficiencies have been corrected within the membrane below prior to installation of new base ply flashings. Stagger joints at least 100 mm with those of the base ply. Use maximum 1 m lengths of membrane. Check all seams in base ply after application and repair areas where adhesion is lacking, using a torch.

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3.10 Cont'd

- .4 **Base Ply Flashings (over existing compatible membrane surface):** All membrane flashings are to be 2-ply application. Clean, prepare and fully degranulate existing membrane surfaces. Fully torch apply all base ply flashings, ensure all deficiencies have been corrected within the membrane below prior to installation of new base ply flashings. Stagger joints at least 100 mm with those of the base ply. Use maximum 1 m lengths of membrane. Check all seams in base ply after application and repair areas where adhesion is lacking, using a torch.
- .5 **Base Flashing Fasteners:** Upon completion of base ply flashing membrane applications, install a minimum of two (2) equally spaced rows of pre-assembled fasteners & plates, spaced at 450mm (18") OC as per sketch example (SK1). Locations include but are not limited to: parapets, penetrations, curbs, control joints, expansion joints, raised walls, roof separators, etc. At locations where detail exceeds 450mm (18") in height, additional rows of fasteners are to be installed at every 450mm (18") interval from second fastener row to the top of detail. All fastener and plate locations to be fully coated with black bituminous primer.
- .6 **Reinforcing Membrane:** Upon completion of base ply flashing membrane and base flashing fastener applications, install a torch applied membrane reinforcing ply at all 90-degree intersections. Install as specified for base ply membrane (above). Locations include but are not limited to: parapets, penetrations, curbs, control joints, expansion joints, raised walls, roof separators, etc. Membrane reinforcing ply to extend onto roof surface a minimum of 150mm (6") and carry up the vertical surface to the upper leading edge (maximum of 18"). Base flashing fasteners in excess of the first two (2) rows are to receive a minimum 200mm x 200mm (8" x 8") cover patch of the same material. See sketch example (SK1)
- .7 **Cap Ply Flashings:** After base ply flashings are complete, cap ply flashings shall be laid in strips maximum 1 m wide and torch applied. Overlap 75 mm on sides and 150 mm onto flat roof area. Use chalk line to measure and neatly embed granules (where applicable) at overlay onto cap sheet.
- .8 Stagger joints minimum 100 mm from joints in cap sheet, and minimum 300 mm from joints in base sheet flashings. Degranulate as required where other membrane work is to overlay granulated membrane surfaces.

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3.10 Cont'd

- .9 **NOTE: Membrane Applications Over Existing Compatible Membrane Surfaces:** New membrane applications over existing compatible membrane surfaces to be fully torch applied – both layers (180 Flam & 250 GR). Ensure existing substrates are fully cleaned, prepared and degranulated (where applicable) as per manufacturer requirements.

3.11 **Vent** **Flashings**

- .1 Install spun aluminum vent stack covers at all existing vent pipes. Extend existing vent pipes as required to a minimum height of 400mm above the completed membrane surface. Extension to be same material as existing vent pipe. Provide sufficient allowance for pipe expansion or contraction.
- .2 Prime aluminum flange, center over existing vent stack and set into torch softened base sheet. Flash with one (1) ply of reinforcing membrane, to extend a minimum of 200mm beyond flange. Complete installation with the application of the cap sheet membrane.

3.12 **Roof** **Drains**

- .1 Co-ordinate the roof drain installation with Plumbing/Mechanical works.
- .2 Ensure the integrity of the vapour barrier is maintained, where applicable.
- .3 Install base sheet, 1 ply of reinforcing membrane (180 gram/m², torch applied) 1.0m x 1.0m centered over the drain and then complete the cap sheet application over the first two plies. Extend the cap sheet under the clamping ring.

- .4 Trim roofing membrane and set clamping ring.

3.13 **Sacrificial** **Membrane**

- .1 Install sacrificial membrane at all locations as indicated and or required. All locations to be fully-adhered via torch application.
- .2 Sacrificial membrane to be extended 75 mm (3") beyond protection matting in all directions

3.14 **Free-Standing** **Mechanical** **Supports**

- .1 Install free standing gas pipe supports where indicated on the drawings. Spacing will vary depending on pipe size. For spacing requirements see Mechanical specifications.
- .2 Install sacrificial membrane, fully-adhered via torch application, at pipe support location. Place support on 19 mm protection mat/pad and adjust roller height to suit site condition. Install steel clamp to secure pipe to support.

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3.15
Protection
Mats

- .1 19mm rubber protection mats to be installed at all locations as indicated and or required.
- .2 Protection mats to be installed in full size pieces (1.22m x 1.8m) and as per manufacturer's instructions. Leave a 25 mm (1") gap between pieces for expansion.
- .3 Protection mats to be fully adhered in all locations with manufacturer approved adhesive.

3.16
Pavers

- .1 Install pavers as detailed and where indicated on the drawings.
- .2 Install protective membrane, fully-adhered via torch application, at paver/protection mat locations. Place paver on 19 mm rubber protection mat and ensure pavers are level after installation.

3.17
Roof Top
Mechanical
Units

- .1 Disconnect existing mechanical units and remove from structural support (i.e. curb, frame, stand, legs, posts or other) by means of crane. Store units in an appropriate manner
- .2 **Build/install new roof curb detail, where indicated on project drawing(s). Top of all curbs to be a minimum of 400mm above finished roof surface, as detailed.**
- .3 To extend ductwork (where applicable), remove last piece of ductwork and replace with new piece. Fabricate new piece to proper shape and dimensions to suite new site conditions. See Mechanical specifications
- .4 Reinstall unit on curb and reconnect.
- .5 Extend all gas and electrical services as required. See Mechanical specifications.

3.18
Sheet
Metal
Flashings

- .1 Metal flashings are specified in Section 076200. Co-ordinate this work with that section.

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3.19
Liquid
Membrane

- .1 Prepare surfaces as recommended by manufacturer; surfaces must be clean, dry, and free of dirt, dust, and particles.
- .2 Apply a base coat of liquid membrane onto surfaces, 150mm from joints, angles, or openings.
- .3 Install reinforcing membrane on service conduit and onto vertical surface; notch reinforcing membrane to allow for better tie-in detail on vertical surface. Apply liquid membrane flashing membrane over reinforcing membrane.
- .4 Install reinforcing membrane on vertical surface round service conduit and over previously installed reinforcing membrane. Apply liquid membrane flashing over second reinforcing membrane.
- .5 Apply finish coat of liquid membrane over dry, previously applied liquid membrane.
- .6 Apply liquid membrane flashing as recommended by the manufacturer, and following written instructions

3.20
Completion
of Days Work

- .1 Install a water tie-off at the edge of completed roofing work at the end of the day, to prevent water entry. Remove this completely at the start of the next days work. Inspect all exposed membrane to assure that it is left in a watertight condition overnight. Ensure that drainage is provided to prevent buildup of water on partially completed works.
- .2 Provide a fire watch on the site, after torching work has been completed for the day, for at least two (2) hours at the end of each day. Walk the entire day's production area to check for smoke and or hot spots using a hand-held infrared thermometer.
- .3 Inspect all laps of the membrane application to ensure they are properly bonded. Repair any deficiencies prior to leaving the site for the day.
- .4 Base sheet applications should not be left exposed overnight unless all seams are torch welded prior to leaving the work site.

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3.21
Cleaning

- .1 Upon completion of the work of this Section remove from the premises all surplus material, dirt and debris caused by the work of this Section and leave the installation clean.
- .2 Clean any drips, spills and surplus material from adjacent surfaces and make good any damage caused by the work of this Section.

3.22
General

- .1 Patching the cap sheet membrane shall be carried out utilising patches with a minimum size of 450mm x 100mm.
- .2 Minimum length of cap sheet on flat run of roof shall not be less than 1000 mm.
- .3 Wrinkled or deformed ends of cap sheets rolls will not be tolerated and therefore, must be discarded prior to application.
- .4 Following completion of new roofing, torch soften and apply a liberal application of approved bulk type mineral granules to cap sheet membrane edges where asphalt has extruded or flowed beyond clean lines and to all surface damage.
- .5 Splices in delivered rolls of membrane are to be removed. Cut back the roll 450mm on both sides of the splices and remove prior to installation

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SPECIAL CONDITIONS

SCOPE

1. Roof Areas “A, B-1, B-2” are to be replaced as part of this project. Refer to Pineview PS drawings, dated March 2026. Refer to Key Plan KP-1 and Roof Plans RP-1 & RP-2
2. **Roofing Document Package:** Roof plans RP-1 to RP-3 indicate existing conditions & existing roof penetration locations only throughout contract roof areas. Detail call-outs throughout roof plans RP-1 to RP-3 and associated roofing details (A1 to A15) are examples of new required detailing (architectural, electrical, mechanical, structural, etc.) throughout the contract roof areas and do not necessarily indicate exact location(s). Tapered insulation roof plan RP-4 indicates existing & new roof drain locations throughout contract roof areas. Prime Contractor must carefully co-ordinate all roofing works throughout the project with architectural, electrical, mechanical & structural disciplines / trades & contract documents for the successful completion of the project
3. **Tapered Insulation:** Included tapered insulation drawing RP-4 is diagrammatical only and indicates the general / approximate location of all new & existing roof drain locations, as well as approximate location of new control joint locations. Actual tapered insulation design, layout, thicknesses, etc. may differ due to site conditions, new drain installation location(s) and new control joint locations. Prime Contractor must endeavour to complete all roof drain installations throughout the contract roof area(s) immediately upon structural roof deck replacement. Prime Contractor is responsible to provide detailed measurements (“X” & “Y” axis) of each roof drain location to chosen tapered insulation manufacturer for the purpose of tapered insulation design and manufacturing. Contractor must provide detailed shop drawings to project consultant for review & approval prior to production of tapered insulation system. Shop drawings must indicate system design, including but not limited to: layout, slopes thicknesses, sumps, crickets, etc. Extra costs for revised tapered insulation design, layout and installation to suit actual site conditions will not be considered.

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4. **Roofing Daily Temporary Termination Points:** All daily termination points of new vapour barrier / new roof system along tie-in to existing vapour barrier / existing roof system must be fully sealed and must remain fully watertight for the duration within each location.
5. **Roof Tie-In Locations (Expansion Joint Locations):** At tie-in locations to existing roof system, neatly cut and remove existing insulation and sub-components as required to complete all detailing – minimum of 450mm (18"). Fully degranulate all existing membrane surfaces as required to ensure adequate tie-in and seals. Ensure vapour barrier continuity is maintained and ensure adequate overlapping and seals of new to existing vapour barrier – minimum 150mm (6") overlap. Upon completion of construction works, reinstate all insulation and sub-components to match original. Fill any voids or gaps with spray foam or batt insulation. Replace all components with new to match within all required location(s). Provide overlapping compatible membrane seals – minimum of 300mm (12").
6. Noted test cut evaluations are for information/reference purposes only. Prime Contractor to complete tests cuts at each contract roof section to determine actual site conditions. This is to be completed at the Prime Contractor's own expense. Proposed extras for discrepancies between provided test cut information and actual site conditions will not be considered. Upon commencement of project, Prime Contractor assumes full responsibility for existing roof system site conditions, which includes but is not limited to: existing roof assembly, level of saturation, weight, embrittlement, quantity of dust, etc.
7. Replace existing roof system with new System – Soprema, IKO & Johns Manville roof system only, as identified herein. Confirm structural deck in applicable roof area.
8. Remove and discard all "not-in-use" roof details as determined by the UCDSB Project Manager and as per the contract documents. Confirm all "not-in-use details with UCDSB Project Manager prior to removal.

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9. Prime Contractor must remove all existing screw fasteners with a drill where existing. No damage to the existing fasteners or deck will be tolerated.
 10. Install new perimeter construction detailing (i.e. parapets, control/expansion joints, walls, etc.) – refer to typical detailing. Prime Contractor shall be responsible to construct all new perimeter detailing as per the contract documents to achieve all requirements as described. Prime Contractor must review and confirm all site conditions prior to pre-constructing any new perimeter detailing
 11. **Base Membrane Flashing Fasteners & Reinforcing Membrane:** Prior to the installation of any granulated cap membrane, **Prime Contractor must ensure the installation of the base flashing fasteners and reinforcing membrane is completed within all locations as described herein.** Consultant must be provided a minimum of 48hrs. advanced notice from the Prime Contractor to arrange a site review to confirm the applications. Prime Contractor may not proceed with any granulated cap membrane applications without the approval to proceed from the project consultant. Failure to comply with this directive will result in the removal and replacement of all required membrane layers as instructed. All required remedial works will be at the Prime Contractor's own expense.
 12. All roof top mechanical units and curbs (regardless of operation) are to be completed to a minimum height of 400 mm above the finished roof surface.
 13. Prime Contractor shall supply and install the required mechanical flashings where required at all mechanical pipe details (i.e. tall cones, plumbing vent flashings, etc.). All joints must be soldered within the mechanical galvanized metal flashing detail, with applied shrouds / storm collars where required
 14. At ALL roof access locations (i.e. hatches, ladders, stairs, doorways) install a landing pad as per applicable detail

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15. **Expansion Joint:** New pre-manufactured expansion joint to be installed along all expansion locations as detailed and indicated. Expansion joint to be custom manufactured to suit all site conditions, including but not limited to: 90-degrees, angled, cross, T-shaped and curved transitions, as well as continuously in other directions. Expansion joint to be manufactured with a minimum expansion/contraction as noted herein. Contractor responsible to complete accurate field measurements for the fabrication of this product to meet all project requirements. Contractor to contact material manufacturer for assistance with measuring, ordering and installation of the expansion joint. Expansion joint to be installed as per all manufacturer installation instructions and directives to ensure warranty compliance.
16. **Testing:** any hazardous material testing requested by the Prime Contractor over and above what is documented in the provided DSR report is to be completed at the sole expense of the Prime Contractor. If any requested testing yields a positive result, the UCDSB will cover the Prime Contractor's expenses for said tests. The UCDSB will arrange for any testing requested by the Prime Contractor.
17. **Drain Flushing:** All existing and new roof drain locations within the contract roof areas and any additional roof area(s) used for mobilization, storage, staging, etc. are to be flushed and checked for positive drainage upon completion of roofing works. Prime Contractor to retain the services of a qualified sub-contractor specializing in this type of work. All required water for the flushing works is to be provided by the sub-contractor. The use of water from the work site is prohibited. Upon completion, sub-contractor to provide a detailed report, indicating all drains locations are flowing at maximum capacity and no blockages of any type remain. The Prime Contractor shall be fully responsible for the acts, performance and omissions of its sub-contractor and their employees or agent

-END OF SECTION-

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PART 1 – SCOPE OF WORK

- | | |
|---|--|
| <u>1.1</u>
<u>Related</u>
<u>Sections</u> | <p>.1 General Requirements – See applicable specification section</p> <p>.2 Safety Requirements – See applicable specification section</p> <p>.3 Rough Carpentry – Section 061000</p> <p>.4 Preformed Metal Cladding – Section 074650</p> <p>.5 Modified Bitumen Membrane Roofing – Section 075200</p> <p>.6 Joint Sealants – Section 079200</p> <p>.7 Electrical & Mechanical Requirements – See applicable specification section</p> |
| <u>1.2</u>
<u>Quality</u>
<u>Assurance</u> | <p>.1 All sheet metal flashing works (i.e. site measuring, fabrication & installation) are to be completed by a licenced sheet metal worker registered with the Ontario College of Trades (Construction Sector – Sheet Metal Worker 308-A). Prime Contractor to provide all identification and documentation as requested prior to commencing any works on site.</p> |
| <u>1.3</u>
<u>General</u> | <p>.1 Install all sheet metal caps, counter flashings, siding and all other metal flashings required to complete roofing installation.</p> <p>.2 Form to profiles as detailed upon the drawings, or as required to suite site conditions.</p> |
| <u>1.4</u>
<u>Mock-Up</u> | <p>.1 Complete on-site mock-up(s) of all specified sheet metal flashing profiles for approval prior to proceeding with any works. Mock-up to identify: proposed colour & proposed method of shaping, forming, jointing and fastening.</p> <p>.2 Submit samples if approval of substitutions is requested.</p> |
| <u>1.5</u>
<u>Workmanship</u> | <p>.1 Sheet metal flashing work shall be carried out in accordance with the best standard practices; with joints locked, cleated, caulked as required and exposed edges hemmed. Ample allowance shall be made in all work for expansion and contraction.</p> <p>.2 Mitred corners shall be straight and true to profiles shown on drawings, with flat surfaces free of distortion and free of face nailing.</p> |
| <u>1.6</u>
<u>References</u> | <p>.1 Standard practices, unless otherwise noted herein, shall be deemed to constitute recommended procedures published in the S.M.A.C.N.A. Architectural Manual.</p> |

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1.7
Warranty

- .1 Remedy all defects in the Sheet Metal Flashings installed hereunder, which appear within a period of **Five (5) years** from the date of substantial performance.
- .2 Make all necessary repairs and replacement within 48 hours of receipt of written notification.
- .3 Provide a written warranty confirming the above, issued on the corporate letterhead, and sealed by an authorized company official.
- .4 Nothing contained in the Article shall be construed as in any way restricting or limiting the liability in Common Law and statutory liability of the Prime Contractor.

PART 2 – PRODUCTS

2.1
Metal
Flashings

- .1 Metal flashing shall be **26 gauge (0.55mm)** commercial galvanized to STM A653/A653M. Coating designation G90, PPD. Standard of Acceptance: **Perspectra Plus Series – Weather XL**. Colour selected by Consultant/Board from manufacturer's standard range.
- .2 Where metal flashing is in contact with dissimilar metal, use separation sheet or backpaint to suitable thickness (as approved by Consultant) to prevent galvanic corrosion.

2.2
Caulking

- .1 Sealing compound: one component polyurethane base caulking compound to CGSB 19.13-M. Standard of Acceptance: **Tremco Dymonic, Sonneborn NP1 or approved equivalent**. Sealing compound to be installed in accordance with manufacturer's recommendations.

2.3
Starter
Clip

- .1 Starter strips to be manufactured from the same type of material used for cap and counter flashings and shall be **24-gauge (0.71mm)**.

2.4
Framing
Girts

- .1 Framing girts to be manufactured from the same type of material used for cap and counter flashings & shall be **22-gauge (0.85mm)**.

2.5
Fastening
Cleats

- .1 Fastening cleats to be manufactured from the same type of material used for cap and counter flashings and shall be **24 gauge (0.71mm)**. Space at 600mm o/c.

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2.6
Fastening
Bars

- .1 Fastening bars to be manufactured from the same type of material used for cap and counter flashings & shall be **18-gauge (1.21mm)** & pre-drilled at 400mm o/c.

2.7
Fasteners

- .1 **Exposed Fasteners:** to CSA B111 #14 or greater, non-corroding with hexagonal head and neoprene washer of same material type as used for sheet metal flashing. Colour and finish to match sheet metal flashing. Fastener must be specifically designed and suitable length to firmly secure new materials to substrate.
- .2 **Concealed Fasteners:** to CSA B111 #10 or greater, non-corroding of same material type as used for sheet metal flashing. Pan / flat head screw of length and thickness suitable to firmly secure new materials to substrate.
- .3 **Framing Girt Fasteners:** Corrosion resistant # 14 screw with recessed truss head of same material type as used for framing girts. Fastener must be specifically designed and suitable length to firmly secure new materials to substrate.

2.8
Accessories

- .1 **Isolation coating:** alkali resistant bituminous paint.
- .2 **Touch-up paint:** as recommended by pre-finished material manufacturer

PART 3 – EXECUTION

3.1
General

- .1 Metal flashing shall be as detailed, supplemented by recommendations of the S.M.A.C.N.A. Architectural Manual.
- .2 All raw edges of metal flashing shall be strengthened by a fold at least 13mm wide, set out slightly and presenting a straight line and neat finish. Form flashings in 2.4m lengths, making allowance for expansion. When flashings exceed 600mm in height form flashing in 1.2m lengths.
- .3 Metal shall be formed on a bending brake, shaping trimmed and hard seaming shall be done on bench, as far as practicable, with proper sheet metal working tools. Angles of bends and folds for interlocking metal shall be made with full regard to expansion and contraction to avoid buckling or fullness in service and to avoid damaging surfaces of metal.
- .4 Dry joints are to tight but not dented so as to permit slight adjustments of sheets and yet remain watertight.

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3.1 Cont'd

- .5 Lock seams at all corners.
- .6 Do not install fasteners through cant strips.
- .7 Apply isolation coating to metal surfaces to be embedded in concrete or mortar, and between dissimilar metals.

3.2
Anchors &
Fasteners

- .1 Space exposed fasteners evenly and in an organized pattern, keep number to a minimum. Where exposed to view, use metal fasteners of same material, colour, texture and finish as the metal on which they occur.
Obtain approval before installing any exposed fasteners.

3.3
Cap
Flashing

- .1 Supply and install continuous metal starter strips, secure at 600mm O.C. maximum of 50mm above drip edge, with fastener of sufficient length to penetrate a minimum of 25mm into substrate.
- .2 Supply and install metal cleats at specified spacing. Use fasteners of sufficient length to penetrate a minimum of 25mm into substrate.
- .3 Use concealed fastenings except where approved by Consultant.
- .4 Secure sections of metal ***in S-lock joints on all faces*** and allow for sufficient expansion and contraction between each piece. Ensure drip edges are inserted into the drip of the adjacent section.
- .5 Form cap flashings to profiles as shown on the detail drawings. Ensure positive drainage to the interior (roof surface) areas.
- .6 Where height of metal fascia exceeds 150mm, provide stiffening breaks every 150mm maximum. Breaks to be located at equal distance from the top and bottom of the fascia, and from each other.

3.4
Fastening
Bars

- .1 Install metal fastening bars where detailed, secured at 300mm o/c with self-tapping flat head screws. Fastener length to be 19mm. **Fasteners to be approved by Consultant.**

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3.5
Reglets

- .1 Reglets that are not of sufficient height are not to be reused. New reglets are to be cut a minimum of 400mm above finished roof surface and are to be a minimum of 19mm wide and 25mm deep. **Reglets to be cut prior to the application of the membrane flashings.**
- .2 For existing reglets greater than 400mm above finished membrane, clean out and secure new metal flashing and caulk. (minimum height shall be 450mm or as detailed).
- .3 Prime reglet prior to the application of the membrane flashings.
- .4 Turn top edge of metal flashing into walls, secure with lead wedge or friction fit pins into reglet and caulk joint at wall.
- .5 Secure sections of metal ***in S-lock joints on all faces*** and allow for sufficient expansion and contraction between each piece. Ensure drip edges are inserted into the drip of the adjacent section.

3.6
Caulking

- .1 Install caulking in accordance with manufacturer's latest recommendations and guidelines.
- .2 Provide foam backer rod for joints greater than 19mm wide and 25mm deep, prior to installing caulking compound.
- .3 Tool finish to satisfaction of Consultant.

3.7
Clean-up

- .1 Finished sheet metal flashing work shall be clean and left in neat, workmanlike condition. Adjoining materials shall be properly cleaned of all soil caused by this trade, debris/soil shall be removed from site to the satisfaction of the Consultant.

-END OF SECTION-

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 22 00 – Unit Masonry.
- .2 Section 07 92 00 – Joint Sealants.
- .3 Section 09 21 16 – Gypsum Board Assemblies.
- .4 Section 09 22 16 – Non-Structural Metal Framing.
- .5 Division 22 – Plumbing.
- .6 Division 23 – Heating, Ventilating and Air Conditioning.
- .7 Division 26 – Electrical.

1.2 REFERENCE STANDARDS

- .1 American Society of Testing and Materials (ASTM International).
 - .1 ASTM E2174-24, Standard Practice for On-site Inspection of Installed Firestops.
 - .2 ASTM E2393-24, Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
 - .3 ASTM G21-15(2021)e1, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
 - .4 ASTM E 2307-25, "Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus"
 - .2 Green Globes Canada.
 - .1 Green Globes for New Construction. Technical Manual 2015.
 - .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Safety Data Sheets (SDS).
 - .4 National Research Council Canada (NRC).
 - .1 National Building Code of Canada 2015 (NBCC).
 - .2 NRCC-49677. June 2007. Best Practice Guide on Firestops and Fire Blocks and their Impact on Sound Transmission.
 - .5 Underwriters Laboratories of Canada (ULC).
 - .1 CAN/ULC-S101-14-EN, Standard Methods of Fire Endurance Tests of Building Construction and Materials.
 - .2 CAN/ULC-S102:2018, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .3 CAN/ULC-S115:2018, Standard Method of Fire Tests of Firestop Systems.
 - .1 Underwriters Laboratories of Canada (ULC) of Scarborough runs CAN/ULC-S115:2018 under their designation of ULC-S115:2018 and publishes the results in their "FIRE RESISTANCE RATINGS DIRECTORY" that is updated annually.
 - .5 International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.
-

1.3 DEFINITIONS

- .1 Firestop Material: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in, or construction joints between fire rated wall and floor assemblies.
- .2 Single Component Firestop System: Firestop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create firestop system.
- .3 Multiple Component Firestop System: Exact group of firestop materials that are identified within Listed Systems Design to create on site firestop system.
- .4 Membrane penetration: Any penetration of a fire rated barrier that breaches one side but does not pass completely through to the other side, including recessed electrical devices.
- .5 System: The combination of specific materials and/or devices, including the penetrating items required to complete the Firestop, as tested by an independent third-party test facility.
- .6 Barrier / assembly: A wall, floor, ceiling or roof assembly or other partition with a fire-smoke rating of 0,1, 2, 3 or up to 4 hours.
- .7 Fire resistive joint: Any joint or opening, whether static or dynamic, within or between adjacent sections of fire rated interior or exterior walls, floors, ceilings or roof decks.
- .8 Fireblocking: Building materials installed to resist the free passage of flame, smoke and noxious gases to other areas of the building through concealed spaces.
- .9 Intumescent: Materials that expand with that to seal around objects threatened by fire.
- .10 F-rating: The time a firestop, penetrating item, building, material, firestop material, can withstand direct flame without a burn through as tested to CAN/ULC-S115.
- .11 T-Rating: The amount of time a through-penetration firestop limits the temperature rise on the cold side-outside the test furnace as tested to CAN/ULC-S115.
- .12 Tightly Fitted; (ref: NBC Division B Part 3.1.9.1(1) and 9.10.9.6(1)): Penetrating items that are cast in place in buildings of non-combustible construction or have 0 annular space in buildings of combustible construction.
 - .1 Words tightly fitted should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit only the most current literature that has been updated by the manufacturer on a regular basis. Submit only literature that includes a date less than 24 months old.
 - .3 Submit manufacturer's printed product data sheets. Submit complete product data sheet for each individual component. Provide a comprehensive list and indicate the following properties for each component:
 - .1 Product name and product number.
 - .2 Product characteristics and performance criteria.

- .3 Physical size, finish and limitations.
 - .4 Technical data on out-gassing, off-gassing and age testing.
 - .5 Curing time.
 - .6 Chemical compatibility to other construction materials.
 - .7 Shelf life. Include expiry date.
 - .8 Life expectancy.
 - .9 Temperature range for installation.
 - .10 Humidity range for installation.
 - .4 Submit copies of WHMIS SDS - Safety Data Sheets.
 - .5 Submit Product Data in accordance with Green Globes Material Declaration form as contained in the GG Technical Manual.
- .3 Manufacturer's engineering judgment identification number and drawing details when no ULC or cUL system is available for an application. Engineering judgment to include both project name and Contractor's name who will install firestop system as described in drawing.
- .4 Shop Drawings:
 - .1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.
 - .2 Construction details should accurately reflect actual job conditions.
 - .3 Submit design system listings.
 - .1 Indicate proposed material, including technical data, reinforcement, anchorage, fastenings and method of installation. Construction details to accurately reflect actual job conditions.
 - .2 Provide CAN/ULC-S115 design system listings on each system for each application for each area as indicated.
 - .3 When more than one product is specified for the firestop design listing system or more than one backing/damming material is indicated, identify the item that will be used on this project.
- .5 Samples:
 - .1 Submit duplicate samples showing actual firestop material proposed for project in un-opened containers.
 - .2 Include all anchors / fasteners and damming material. Select samples from the same batches and production runs of products that will be used on-site. Identify each product indicating the shelf life and expiry date.
- .6 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
 - .1 Test reports: In accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.
 - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied firestopping with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .1 Submit certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC's) and are non-toxic to building occupants.

- .3 Manufacturer s Instructions: Submit manufacturer s installation instructions and special handling criteria, installation sequence, cleaning procedures and
- .4 Manufacturer s Field Reports: Submit to manufacturer s written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.5 RECORD DOCUMENTATION

- .1 Submit as-built records in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Maintain a daily log of all activities on site during construction. Provide a copy of all daily logs at completion of firestopping work.
- .3 Provide a copy of as-built drawings, project manual, schedules and firestop details.
- .4 Mark up the drawings, schedules and details weekly, showing all alterations, changes and confirmation of each design listing in relationship to the project schedules.
- .5 Provide completed firestopping schedules for floors, walls and ceilings.
- .6 Indicate all service penetrations or joints through each reference wall, floor and ceiling in the schedules. Record all information. Indicate all required descriptions for each column based on the actual on-site condition. Submit schedules to PMT at the end of the project for maintenance use.

1.6 OPERATION AND MAINTENANCE MATERIALS

- .1 Submit Operation and Maintenance products and records and incorporate the following materials:
 - .1 Safety Data Sheets (SDS).
 - .2 Product literature of each product used on this project.
 - .3 Approved design listings and Engineer Judgments.
 - .4 Matrix schedule indicating all design listings and Engineer Judgments and matching them to the penetration or joint type. Included in this schedule to be a quantity of each design listing / EJ on each floor.

1.7 ENGINEERING JUDGMENTS (EJ)

- .1 Where there are no specific tested design system listings available from the manufacturer for a firestop configuration, review systems from all other manufacturers to attempt to obtain a design system listing.
- .2 Include in each EJ, a drawing of the proposed system, a description of the system, project name and room name including the room number that the EJ is located in. Include copies of all referenced design listings and signed and dated by the manufacturer's fire protection engineer. Once the EJ has been reviewed, submit the EJ to the Authority Having Jurisdiction for final approval.
- .3 EJ to be issued only by firestop manufacturer's qualified technical personnel or in concert with the manufacturer, by a knowledgeable registered Professional Engineer, or fire protection engineer, or an independent testing agency that provides listing services for firestop systems.
- .4 EJ to be based upon interpolations of previously tested firestop systems that are either sufficiently similar in nature or clearly bracket the conditions upon which the Engineering Judgment is to be given. Additional knowledge and technical interpretations based upon accepted engineering principles, fire science and fire testing guidelines (e.g. ASTM E2032) may also be used as further support data.

- .5 EJ to be based upon full knowledge of the elements of the construction to be protected and understanding of the probable behaviour of that construction and the recommended firestop system protecting it were they to be subjected to the appropriate firestop standard fire test method for the required fire rating duration.
- .6 EJ to be limited to the specific conditions and configurations upon which the Engineering Judgment was rendered and should be based upon reasonable performance expectations for the recommended firestop system under those conditions.
- .7 EJ to be accepted only for a single specific job and location and should not be transferred to any other job or location without thorough and appropriate review of all aspects of the next job or location's circumstances.

1.8 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Qualifications: Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary training to install manufacture's products per specified requirements. A supplier's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
 - .2 Installer: Company specializing in firestopping installations approved by manufacturer with not less than 5 years documented experience.
 - .3 Procurement Responsibility: The procurement of through-penetration firestop systems and fire-resistive joint systems on this project to be from a single sole source firestop specialty manufacturer.
 - .4 The work is to be installed by a Contractor with at least one of the following qualifications:
 - .1 FM 4991 approved Contractor.
 - .2 ULC approved Contractor.
 - .3 Hilti accredited firestop specialty Contractor.
- .2 Pre-Installation Meetings: Convene pre-installation meeting one week before beginning work of this Section, with Owner, Consultant, and manufacturer's representative in accordance with Section 01 32 16 - Construction Progress Schedule - Bar (GANTT) Chart to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer s installation instructions and warranty requirements.
- .3 Site Meetings: As part of Manufacturer s Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
 - .1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.
- .2 Storage and Protection:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
- .3 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 19 – Construction Waste Management and Disposal.

1.10 PROJECT CONDITIONS

- .1 Do not use materials that contain flammable solvents.
- .2 Scheduling:
 - .1 Schedule installation of firestopping materials after completion of penetrating item installation but before covering or concealing of openings.
 - .2 Schedule installation of preformed joint materials to be installed with the metal framing.
- .3 Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- .4 Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.
- .5 During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

- .1 Materials, products, and verification to be in accordance with Section 01 47 15 – General Sustainability Requirements.

2.2 PERFORMANCE REQUIREMENTS

- .1 Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
- .2 Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- .3 Provide a round fire-rated cable management device whenever cables penetrate fire-rated walls, where frequent cable changes and additions may occur. The fire-rated cable management device to consist of a corrugated steel tube with zinc coating, contain an inner plastic housing, intumescent material rings, and inner fabric smoke seal membrane. The length of the sleeve to be 305 mm. The fire-rated cable management device to contain integrated intumescent firestop wrap strip materials enough to maintain the hourly

rating of the barrier being penetrated. The fire-rated cable management device to contain a smoke seal fabric membrane or intumescent firestop plugs enough to achieve the L-Rating requirements of the barrier type. Install device per the manufacturer's published installation instructions.

- .4 Penetrations in Fire Resistance Rated Walls: Provide firestopping with ratings determined in accordance with CAN/ULC-S115 as indicated below:

Fire Resistance Rating of Separation	Required ULC or cUL "F" Rating of Firestopping Assembly
30 minutes	20 minutes
45 minutes	45 minutes
1 hour	45 minutes
1.5 hours	1 hour
2 hours	1.5 hours

- .5 For combustible pipe penetrations through a Fire Separation provide a firestop system with a "F" Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.
- .6 Penetrations in Horizontal Assemblies: Provide firestopping with ratings determined in accordance with CAN/ULC-S115. For penetrations through a Fire Wall or horizontal Fire Separation provide a firestop system with a "FT" Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.
- .1 W-Rating: Class 1 rating in accordance with water leakage test per CAN/ULC-S115.
- .7 Provide a firestop system with an assembly rating as determined by CAN/ULC-S115 which is equal to the time rating of construction joint assembly.
- .8 Penetrations in smoke barriers: Provide firestopping with ratings determined in accordance with CAN/ULC-S115.
- .1 L-Rating: Not exceeding 5.0 cfm / square feet of penetration opening at both ambient and elevated temperatures.
- .9 Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of 0 as determined by ASTM G21.
- .10 Spray-applied fire-resistive material at columns and beams: Refer to Section 07 21 29 – Sprayed Insulation.

2.3 ACCEPTABLE MANUFACTURERS

- .1 Subject to compliance with through penetration firestop systems and joint systems listed in the ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory, provide products of the following manufacturers as identified below:
- .1 Basis of Design: Hilti (Canada) Corporation, Mississauga, Ontario.
- .2 Substitution requests will be considered in accordance with requirements of Section 01 25 00 – Substitution Procedures.

2.4 MATERIALS

- .1 Use only firestop products that have been ULC or cUL tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- .2 Accessories: Provide components for each firestopping and smoke seal systems that are needed to install fill materials. Use only components specified by firestopping material manufacturer and approved by the qualified testing agency. Accessories include, but are not limited to, the following items:
 - .1 Permanent forming, damming, and backing material.
 - .2 Temporary forming material.
- .3 Acceptable Hilti pre-formed firestop devices for use with non-combustible and combustible pipes (closed and open systems), conduit and cable bundles penetrating gypsum walls:
 - .1 Tub Box Kit (CP 681) for use with tub installations.
 - .2 Hilti Cast-In Place Firestop Device (CP 680-PX) for use with XFR pipe
 - .3 Hilti Cast-In Place Firestop Device (CP 680-M) for use with noncombustible penetrants.
 - .4 Speed Sleeve (CP 653) for use with cable penetrations.
 - .5 Firestop Drop-In Device (CFS-DID) for use with non-combustible and combustible penetrants.
 - .6 Hilti Cast-in Firestop sleeve (CFS-CID MD P) and (CFS-CID MD M) for use with combustible and noncombustible pipes through metal deck.
 - .7 Firestop Block (CFS-BL).
- .4 Acceptable Hilti sealants or caulking materials for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit, electrical metallic tubing (EMT), and sheet metal ducts:
 - .1 Intumescent Firestop Sealant (FS-ONE MAX).
 - .2 Fire Foam (CP 620)/CP 660.
 - .3 Flexible Firestop Sealant (CP 606).
 - .4 Firestop Silicone Sealant Gun Grade (CFS-S SIL GG).
 - .5 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)
- .5 Acceptable Hilti sealants, sprays, or pre-formed materials for use with fire-rated construction joints and other gaps:
 - .1 Top Track Seal (CFS-TTS).
 - .2 Top Track Seal for Metal deck (CFS-TTS MD).
 - .3 Firestop Joint Spray (CFS-SP WB).
 - .4 Firestop Silicone Joint Spray (CFS-SP SIL).
 - .5 Flexible Firestop Sealant (CP 606).
 - .6 Firestop Silicone Sealant Gun Grade (CFS-S SIL GG).
 - .7 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)
 - .8 Bottom of Wall sealant (CP 605).
- .6 Acceptable Hilti pre-formed mineral wool designed to fit flutes of metal profile deck; as a backer for spray material:
 - .1 Speed Plugs (CP 777).
 - .2 Speed Strips (CP 767).
- .7 Acceptable Hilti non-curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles:
 - .1 Firestop Putty Stick (CP 618).
 - .2 Firestop Plug (CFS-PL).

- .8 Acceptable Hilti Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems) tested to 50 Pa. pressure differentials, the following products are acceptable:
 - .1 Hilti Firestop Collar (CP 643N).
 - .2 Hilti Wrap Strips (CP 648E/648S).
- .9 Acceptable Hilti wall opening protective materials for use with cUL. / ULC listed metallic and specified non-metallic outlet boxes:
 - .1 Firestop Putty Pad (CP 617).
 - .2 Firestop Box Insert.
- .10 Acceptable Hilti sealants or caulking materials used for openings between structurally separate sections of wall and floors:
 - .1 Firestop Joint Spray (CFS-SP WB).
 - .2 Flexible Firestop Sealant (CP 606).
 - .3 Firestop Silicone Sealant Gun Grade (CFS-S SIL GG).
 - .4 Firestop Silicone Sealant Self Leveling (CFS-S SIL SL).
- .11 Acceptable Hilti product for single or cable bundles up to 25 mm diameter penetrating gypsum, masonry, concrete walls or wood floor assemblies: CFS-D Firestop Cable Disk.
- .12 Acceptable Hilti used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
 - .1 Hilti Firestop Block (CFS-BL).
 - .2 Hilti Composite Sheet (CFS-COS).
 - .3 Hilti Firestop Mortar (CP 637).
 - .4 Hilti Fire Foam (CP 620)/660.
 - .5 Hilti Firestop Board (CP 675T).
- .13 Acceptable Hilti Pre-formed materials or Sealants for use as part of a perimeter fire barrier system between fire-resistance-rated floors and exterior wall assemblies, the following products are acceptable:
 - .1 Hilti Preformed Firestop System (CFS-EOS QuickSeal).
 - .2 Hilti Firestop Joint Spray (CFS-SP WB).
 - .3 Hilti Firestop Silicone Joint Spray (CFS-SP SIL).
 - .4 Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG).
 - .5 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL).
- .14 Acceptable Hilti product for joints and penetrations in non-rated fire separations:
 - .1 CP 506 Smoke and Acoustic sealant.
 - .2 CP 572 Smoke and Acoustic Spray.
- .15 Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:
 - .1 Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG).
 - .2 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL).
 - .3 Hilti Flexible Firestop Sealant (CP 606).
 - .4 Hilti Intumescent Firestop Sealant (FS-ONE MAX).
- .16 Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:
 - .1 Hilti Intumescent Firestop Sealant (FS-ONE MAX).

- .2 Hilti Fire Foam (CP 620)/660.
 - .3 Hilti Flexible Firestop Sealant (CP 606).
 - .4 Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG).
 - .5 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL).
- .17 Materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
- .1 Hilti Firestop Block (CFS-BL).
 - .2 Hilti Composite Sheet (CFS-COS).
 - .3 Hilti Firestop Mortar (CP 637).
 - .4 Hilti Fire Foam (CP 620)/660.
 - .5 Hilti Firestop Board (CP 675T).
- .18 Non-curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
- .1 Hilti Firestop Block (CFS-BL).
 - .2 Hilti Firestop Board (CP 675T).
- .19 Re-penetrable, round cable management devices for use with new or existing cable bundles penetrating gypsum or masonry walls, the following products are acceptable:
- .1 Hilti Speed Sleeve (CP 653) with integrated smoke seal fabric membrane.
 - .2 Hilti Firestop Cable Collar (CFS-CC).
 - .3 Hilti Firestop Sleeve (CFS-SL SK).
 - .4 Hilti Retrofit Sleeve (CFS-SL RK) for use with existing cable bundles.
 - .5 Hilti Gangplate (CFS-SL GP) for use with multiple cable management devices.
 - .6 Hilti Gangplate Cap (CFS-SL GP CAP) for use at blank openings in gangplate for future penetrations.

2.5 SPECIAL FIRESTOPPING CONDITIONS / TREATMENTS

- .1 The following table identifies special site conditions that typically requires Engineering Judgements (EJs). Refer to Drawings where specific locations for Firestopping Treatments (FT) are identified. Consultant will obtain EJs for submission to Authorities Having Jurisdiction. Specific installation instructions will be available upon receipt of the EJs.

Firestopping Treatment No.	Rating	Location	Description of Firestopping Treatment
FT1	0, 1 Hour	Top of block wall at underside of deck, with steel beams or open	<ul style="list-style-type: none"> Maximum gap between top of block wall and underside of deck 75 mm.

		web steel joists penetrating wall assembly. Minimum width of block 140 mm. Maximum depth of joint 75 mm.	<ul style="list-style-type: none"> • Insert into bar joist / beam openings, compressed mineral wool at 50 percent (minimum density 4 PCF), flush with wall surfaces. • Insert at top of wall gap, mineral wool safing insulation (minimum density 4 PCF), compressed at 50 percent, flush with wall surfaces. • Cover all insulation surfaces with 3 mm thick, Hilti CFS-SP WB Firestop Joint spray and overlap minimum 12 mm onto adjacent surfaces, both sides of wall assembly.
FT2	0, 1 Hour	Top of block wall adjacent to steel beam, parallel or perpendicular to deck flutes. Maximum depth of joint 102 mm.	<ul style="list-style-type: none"> • Provide minimum 100 mm thick mineral wool safing insulation (minimum density 4 PCF), compressed to 50 percent. Install flush with bottom surface of beam, between beam and block wall. • Provide minimum 150 mm thick mineral wool safing insulation (minimum density 4 PCF), compressed to 50 percent. Insert into joint between top of block wall and underside deck, flush with wall surfaces. • Where beams are perpendicular to deck flutes, provide minimum 100 mm thick mineral wool safing insulation (minimum density 4 PCF), compressed to 50 percent. Insert flush with edge of beam, between top of beam and underside of deck. • Cover exposed side of insulation surfaces with 3 mm thick, Hilti CFS-SP WB Firestop Joint spray and overlap minimum 12 mm onto adjacent surfaces.

FT3	1 and 2 Hours	Steel beams or open web steel joists penetrating wall assembly, through top of block masonry wall, minimum block thickness 140 mm. Maximum depth of joint 82 mm.	<ul style="list-style-type: none"> • Provide minimum 100 mm thick mineral wool safing insulation (minimum density 4 PCF), compressed to 50 percent. Insert into joint and bar joist / steel beam openings, between top of block wall and underside of deck, flush with wall surfaces. • Cover all insulation surfaces with 3 mm thick, Hilti CFS-SP WB Firestop Joint spray and overlap minimum 12 mm onto block wall, structural steel
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			members, and deck, both sides of assembly.
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Part 3 Execution

3.1 MANUFACTURERS INSTRUCTIONS

- .1 Compliance: Comply with manufacturer s written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.

3.2 EXAMINATION

- .1 Verify substrate conditions are acceptable for product installation in accordance with manufacturer's instructions and approved design system listings for each condition.
- .2 Verify that all joints, service penetrating elements and supporting devices / hangers have been properly installed as indicated on approved design listings. All temporary lines and markings have been removed to meet the approved design system listings for each condition has been identified.
- .3 Verify that the proposed firestopping system is composed of components that are compatible with each other, the substrates forming the openings, and the items, if any, penetrating the firestopping under conditions of application and service, as demonstrated by firestopping manufacturer based on testing and field experience.
- .4 Ensure no additional items have been installed through opening that does not appear on the approved design listing.
- .5 Ensure areas that are to be firestopped are accessible for proper installation and inspection.
- .6 Report in writing to the Consultant any defective surfaces or conditions affecting the firestop system installation, immediately and before commencing any installations.
- .7 Proceed only when defected surfaces or conditions have been corrected. Beginning of installation means acceptance of site conditions.

3.3 PREPARATION

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
 - .1 Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with firestopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.
- .5 Do not proceed until unsatisfactory conditions have been corrected.
- .6 Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

3.4 COORDINATION

- .1 Coordinate construction of openings, penetrations and construction joints to ensure that the firestop systems are installed according to specified requirements.

- .2 Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems. Coordinate construction and sizing of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- .3 Coordinate firestopping with other trades so that obstructions are not placed in the way before the installation of the firestop systems.
- .4 Do not cover up through-penetration firestop and joint system installations that will become concealed behind other construction until each installation has been examined by the building inspector.

3.5 INSTALLATION

- .1 Regulatory Requirements: Install firestop materials in accordance with ULC Fire Resistance Directory or UL Products Certified for Canada (cUL) Directory or Omega Point Laboratories Directory.
- .2 Install firestopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.
- .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.
- .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 neat finish.
- .6 Remove excess compound promptly as work progresses and upon completion.

3.6 SEQUENCES OF OPERATION

- .1 Proceed with installation only when submittals have been reviewed by Consultant.
- .2 Install floor firestopping before interior partition erections.
- .3 Deck bonding: firestopping to precede spray applied fireproofing to ensure required bonding.
- .4 Mechanical pipe insulation: certified firestop system component.
 - .1 Ensure pipe insulation installation precedes firestopping.

3.7 REPAIRS AND MODIFICATIONS

- .1 Identify damaged or re-entered seals requiring repair or modification.
- .2 Remove loose or damaged materials. Where penetrating items are to be added, remove enough material to insert new elements. Cause no damage to the balance of the seal.
- .3 Ensure that surfaces to be sealed are clean and dry. Install materials in accordance with specified installation requirements herein. Use only materials approved by manufacturer as suitable for repair of original seal. Do not mix different manufacturer's products.
- .4 Repair all damage resulting from firestop destructive testing.

3.8 FIELD QUALITY CONTROL

- .1 Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- .2 Keep areas of work accessible until inspection by applicable Code authorities.

- .3 Inspection of through-penetration firestopping to be performed in accordance with ASTM E2174-24 and ASTM E2393-24.
- .4 Perform under this Section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.
- .5 Manufacturer's Field Services: The manufacturer's representative to be present during the first installation of every first firestop system. The manufacturer's technical representative to provide periodic walk-through. After every site visit the manufacturer's technical representative to submit site reports to indicate application reviewed, location and installer. Contractor to submit site reports by manufacturer to consultant within one week of each visit.

3.9 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Remove temporary dams after initial set of firestopping and smoke seal materials.

3.10 SCHEDULE

- .1 Firestop and smoke seal at:
 - .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
 - .2 Edge of floor slabs at curtain wall and insulated metal panels.
 - .3 Top of fire-resistance rated masonry and gypsum board partitions.
 - .4 Intersection of fire-resistance rated masonry and gypsum board partitions.
 - .5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
 - .6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
 - .7 Openings and sleeves installed for future use through fire separations.
 - .8 Around mechanical and electrical assemblies penetrating fire separations.
 - .9 Rigid ducts: Greater than 129 cm².

3.11 SCHEDULE OF COMMON FIRESTOPPING SYSTEMS

- .1 The following recognized and tested **through penetrations** firestopping systems are approved to be used on this project at various rated assemblies.

CONCRETE FLOORS – 1 HOUR FRR (F-RATING)		
ITEM	PENETRANT	SYSTEM / DESIGN NUMBER
1	SINGLE METAL PIPES OR CONDUIT	C-AJ-1226, F-A-1028, F-A-1017
2	SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, FRP, ENT)	F-A-2240, F-A-2025, CA-J-2078 , C-AJ-2035, CA-J-2022
3	SINGLE/CABLE BUNDLES	F-A-3007,C-AJ-3095,C-AJ-3180, C-AJ-3283
4	CABLE TRAY	C-AJ-4034, C-AJ-4071
5	SINGLE INSULATED PIPES	F-A 5015, F-A 5017, C-AJ-5090, C-AJ-5091, C-AJ-5048
6	MECHANICAL DUCTWORK WITHOUT DAMPERS NON-	C-AJ-7046, C-AJ-7051, C-AJ-7084
7	MECHANICAL DUCTWORK WITHOUT DAMPERS INSULATED	C-A-J-7145
8	MIXED PENETRANTS	C-AJ 8099, C-AJ-8056, C-AJ-8143

BLOCK MASONRY WALLS – 1 HOUR FRR (F-RATING)		
ITEM	PENETRANT	SYSTEM / DESIGN NUMBER
1	SINGLE METAL PIPES OR CONDUIT	C-AJ-1226, W-J-1067, W-J-1020
2	SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, FRP, ENT)	C-AJ-2109C-AJ-2078, W-J-2332, C-AJ-2024, C-AJ-2035, C-AJ-2022
3	SINGLE/CABLE BUNDLES	W-J-3036, C-AJ-3095, C-AJ-3180, W-J-3060, W-J-3167
4	CABLE TRAY	W-J-4027, C-AJ-4034, C-AJ-4071
5	SINGLE INSULATED PIPES	C-AJ-5090, C-AJ-5091, C-AJ 5061, W-J-5042
6	MECHANICAL DUCTWORK WITHOUT DAMPERS NON-INSULATED	C-AJ-7046, C-AJ-7051, W-J-7021, W-J-7022

BLOCK MASONRY WALLS – 1 HOUR FRR (F-RATING)		
ITEM	PENETRANT	SYSTEM / DESIGN NUMBER
7	MECHANICAL DUCTWORK WITHOUT DAMPERS INSULATED	W-J-7029, W-J-7124
8	MIXED PENETRANTS	C-AJ 8099, C-AJ 8056, W-J 8007, C-AJ 8143
GYPSUM BOARD WALLS – 1 HOUR FRR (F-RATING)		
ITEM	PENETRANT	SYSTEM / DESIGN NUMBER
1	METAL PIPES OR CONDUIT	W-L-1054, W-L-1058, W-L-1164, W-L-1506, W-L-1465
2	NON-METALLIC PIPE OR CONDUIT	W-L-2028, W-L-2061, W-L-2020
3	SINGLE OR BUNDLED CABLES	W-L-3065, W-L-3111, W-L-3112, W-L-3334, W-L-3414, W-L-3396
4	CABLE TRAY	W-L-4011, W-L-4060, W-L-4081
5	INSULATED PIPES	W-L-5028, W-L-5029, W-L-5047
6	MECHANICAL DUCTWORK WITHOUT DAMPERS NON-INSULATED	W-L-7040, W-L-7042, W-L-7155
7	MECHANICAL DUCTWORK WITHOUT DAMPERS INSULATED	W-L-7059, W-L-7153, W-L-7156, W-L-7151
8	MIXED PENETRANTS	W-L-1095, W-L-8013

- .2 The following recognized and tested **joint firestopping** systems are approved to be used on this project at various rated assemblies.

JOINT FIRESTOPPING SYSTEMS – 1 HR FRR (F-RATING)		
NOT EXCEEDING 50 MM		
ITEM	LOCATION	SYSTEM / DESIGN NUMBER
1	CONCRETE (FLOOR TO FLOOR)	FF-D-1012, FF-D-1013

JOINT FIRESTOPPING SYSTEMS – 1 HR FRR (F-RATING) NOT EXCEEDING 50 MM		
ITEM	LOCATION	SYSTEM / DESIGN NUMBER
2	CONCRETE (EDGE OF FLOOR SLAB TO WALL)	FW-D-1011, FW-D-1012, FW-D-1013
3	CONCRETE OR BLOCK WALL TO FLAT CONCRETE FLOOR (TOP-OF-WALL)	Contact Manufacturer for details.
4	CONCRETE OR BLOCK WALL TO CONCRETE OVER FLUTED METAL DECK (TOP-OF-WALL)	HW-D-0098
5	GYPSUM WALL TO FLAT CONCRETE FLOOR (TOP-OF-WALL)	HW-D-0757, HW-D-0082, HW-D-0083, HW-D-0106, HW-D-0119
6	GYPSUM WALL TO CONCRETE FLOOR (BOTTOM-OF-WALL)	BW-S-0001, BW-S-0002
7	GYPSUM WALL TO CONCRETE OVER FLUTED METAL DECK (TOP-OF-WALL)	HW-D-0045, HW-D-0154, HW-D-0292, HW-D-0295

JOINT FIRESTOPPING SYSTEMS – 1 HOUR FRR (F-RATING) GREATER THAN 50 MM BUT NOT EXCEEDING 152 MM.		
ITEM	LOCATION	SYSTEM / DESIGN NUMBER
1	CONCRETE (FLOOR TO FLOOR)	FF-D-1012, FF-D-1013
2	CONCRETE (EDGE OF FLOOR SLAB TO WALL)	FW-D-1011, FW-D-1012, FW-D-1013, FW-D-1021
3	CONCRETE OR BLOCK WALL TO FLAT CONCRETE FLOOR (TOP-OF-WALL)	Contact Manufacturer for details.
4	CONCRETE OR BLOCK WALL TO CONCRETE OVER FLUTED METAL DECK (TOP-OF-WALL)	Contact Manufacturer for details.

**JOINT FIRESTOPPING SYSTEMS – 1 HOUR FRR (F-RATING)
GREATER THAN 50 MM BUT NOT EXCEEDING 152 MM.**

ITEM	LOCATION	SYSTEM / DESIGN NUMBER
5	GYPSUM WALL TO FLAT CONCRETE FLOOR (TOP-OF-WALL)	HW-D-1011, HW-D-1012, HW-1020
6	GYPSUM WALL TO CONCRETE FLOOR (BOTTOM-OF-WALL)	Contact Manufacturer for details.
7	GYPSUM WALL TO CONCRETE OVER FLUTED METAL DECK (TOP-OF-WALL)	HWD-1011, HWD-1012, HW-1020

END OF SECTION

Project: **Pineview PS - RAAC**
Replace. & Access. Upgrades
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JOINT SEALANT
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PART 1 – GENERAL

- | | | |
|-----------------------------|----|---|
| <u>1.1</u> | .1 | General Requirements – See applicable specification section |
| <u>Related</u> | .2 | Safety Requirements – See applicable specification section |
| <u>Sections</u> | .3 | Preformed Metal Cladding – Section 074650 |
| | .4 | Modified Bitumen Membrane Roofing – Section 075200 |
| | .5 | Sheet Metal Flashings – Section 076200 |
| | .6 | Electrical & Mechanical Requirements – See applicable specification section |
| | | |
| <u>1.2</u> | .1 | CAN/CGSB-19.1-M87 Sealing Compound, One Component, Urethane Base, Solvent Curing. |
| <u>References</u> | | |
| | | |
| <u>1.3</u> | .1 | Deliver and store materials in original wrapping and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture and water. |
| <u>Delivery</u> | | |
| <u>Storage &</u> | | |
| <u>Handling</u> | | |
| | | |
| <u>1.4</u> | .1 | Comply with requirements of Workplace Hazardous Materials information System (WHMIS) regarding use, Handling, storage, and disposal of hazardous materials; And regarding labelling and provision of material safety Data sheets acceptable to Labour Canada. |
| <u>Environmental</u> | | |
| <u>& Safety</u> | | |
| <u>Requirements</u> | | |
| | .2 | Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use. |

PART 2 – PRODUCTS

- | | | |
|-------------------------|----|---|
| <u>2.1</u> | .1 | Sealant acceptable must be listed on CGSB Qualified Products List issued by CSGB Qualification Board for Joint Sealants. Where Sealants are qualified with primers use only these primers. |
| <u>Sealant</u> | | |
| <u>Materials</u> | | |
| | .2 | At reglets, metal flashings, mechanical penetrations and other locations: to CAN/CGSB-19.13-M87, single component, urethane based. Standard of Acceptance: Sonneborn NP-1, Tremco Dymonic, or approved equivalent. |

Project: **Pineview PS - RAAC**
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Page 2

- 2.2**
Back-Up
Materials
- .1 Polyethylene, Urethane, Neoprene or Vinyl Foam
 - .2 Extruded closed cell foam backer rod.
 - .3 Size: oversize 3- to 50%
 - .4 Bond breaker tape
 - .5 Polyethylene bond breaker tape which will not bond to sealant.

- 2.3**
Joint
Cleaner
- .1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.
 - .2 Primer: as recommended by manufacturer.

PART 3 – EXECUTION

- 3.1**
Preparation
of Joint
Surfaces
- .1 Remove all existing sealant from reglets to be re-used.
 - .2 Examine joint sized and conditions to establish correct depth to width relationship for installation of backup materials.
 - .3 Clean bonding joint surfaces of harmful matter substances including dust, rust oil grease, and other matter which may impair work.
 - .4 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
 - .5 Ensure joint surfaces are dry and frost free.
 - .6 Prepare surfaces in accordance with manufacturer's directions.

Project: **Pineview PS - RAAC**
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3.2
Application

.1 Sealant.

- .1 Apply sealant in accordance with manufacturer's instructions.
- .2 Apply sealant in continuous beads.
- .3 Apply sealant using gun with proper size nozzle.
- .4 Use sufficient pressure to fill voids and joints solid.
- .5 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
- .6 Tool exposed surfaces to give slightly concave shape.

.2 Curing.

- .1 Cure sealants in accordance with sealant manufacturer's instructions.
- .2 Do not cover up sealants until proper curing has taken place.

.3 Clean up.

- .1 Clean adjacent surfaces immediately and leave work neat and clean.
- .2 Remove excess and droppings, using recommended cleaners as work progresses.

-END OF SECTION-

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials, preparation and application for caulking and sealants.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittals.
- .2 Section 01 45 00 - Quality Control.

1.3 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C 919-24, Standard Practice for Use of Sealants in Acoustical Applications.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
 - .2 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.
 - .3 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittals.
- .2 Manufacturer's product to describe.
 - .1 Caulking compound.
 - .2 Primers.
 - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- .3 Submit samples in accordance with Section 01 33 00 - Submittals.
- .4 Submit duplicate samples of each type of material and colour.
- .5 Cured samples of exposed sealants for each color where required to match adjacent material.
- .6 Submit manufacturer's instructions in accordance with Section 01 33 00 - Submittals.
 - .1 Instructions to include installation instructions for each product used.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle, store and protect materials in accordance with manufacturer's recommendations.
 - .2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.
-

1.6 PROJECT CONDITIONS

- .1 Environmental Limitations:
 - .1 Do not proceed with installation of joint sealants under following conditions:
 - .1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C.
 - .2 When joint substrates are wet.
- .2 Joint-Width Conditions:
 - .1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- .3 Joint-Substrate Conditions:
 - .1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 ENVIRONMENTAL REQUIREMENTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada.
- .2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
- .3 Ventilate area of work as directed by the Consultant by use of acceptable portable supply and exhaust fans.

Part 2 Products

2.1 SEALANT MATERIALS

- .1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.
- .2 When low toxicity caulks are not possible, confine usage to areas which offgas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.
- .3 Where sealants are qualified with primers use only these primers.

2.2 SEALANT MATERIAL DESIGNATIONS

- .1 Exterior sealants: Dow Corning 790, no alternate.
- .2 Silicones One Part.
 - .1 To CAN/CGSB-19.13-M87.
- .3 Acrylic Latex One Part.
 - .1 To CAN/CGSB-19.17-M90.
- .4 Acoustical Sealant.
 - .1 To ASTM C919-24.

- .5 Other interior sealants: Dow Corning 790, Tremco Dymeric, Tremco Dymonic.
- .6 Preformed Compressible and Non-Compressible back-up materials.
 - .1 Polyethylene, Urethane, Neoprene or Vinyl Foam.
 - .1 Extruded closed cell foam backer rod.
 - .2 Size: oversize 30 to 50 %.
 - .2 Neoprene or Butyl Rubber.
 - .1 Round solid rod, Shore A hardness 70.
 - .3 Bond Breaker Tape.
 - .1 Polyethylene bond breaker tape which will not bond to sealant.

2.3 SEALANT SELECTION

- .1 Perimeters of exterior openings where frames meet exterior facade of building (i.e. brick, block, precast, masonry): Sealant type: Dow Corning 790.
- .2 Control and expansion joints in exterior surfaces of unit masonry walls: Sealant type: Dow Corning 790.
- .3 Coping joints and coping-to facade joints: Sealant type: Dow Corning 790.
- .4 Seal interior perimeters of exterior openings as detailed on drawings: Sealant type: Tremco Dymonic.
- .5 Interior control and expansion joints in floor surfaces: Sealant type: Tremco Dymeric. Sealant to be compatible with finished flooring manufacturer's written specifications.
- .6 Perimeters of interior hollow metal frames, as detailed and itemized: Sealant type: latex.
- .7 Interior masonry vertical control joints (block-to-block, block-to-concrete, and intersecting masonry walls): Sealant type: Tremco Dymonic.
- .8 Joints at tops of non-load bearing masonry walls at the underside of poured concrete: Sealant type: Tremco Dymonic.
- .9 Perimeter of bath fixtures (e.g. sinks, tubs, urinals, stools, waterclosets, basins, vanities): Sealant type: clear silicone.
- .10 Exposed interior control joints in drywall: Sealant type: Tremco Dymonic.

2.4 JOINT CLEANER

- .1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.
- .2 Primer: as recommended by manufacturer.

Part 3 Execution

3.1 PROTECTION

- .1 Protect installed Work of other trades from staining or contamination.

3.2 SURFACE PREPARATION

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

- .2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair work.
- .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .4 Ensure joint surfaces are dry and frost free.
- .5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

- .1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

- .1 Apply bond breaker tape where required to manufacturer's instructions.
- .2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

- .1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.6 APPLICATION

- .1 Sealant.
 - .1 Apply sealant in accordance with manufacturer's written instructions.
 - .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
 - .3 Apply sealant in continuous beads.
 - .4 Apply sealant using gun with proper size nozzle.
 - .5 Use sufficient pressure to fill voids and joints solid.
 - .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
 - .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
 - .8 Remove excess compound promptly as work progresses and upon completion.
- .2 Curing.
 - .1 Cure sealants in accordance with sealant manufacturer's instructions.
 - .2 Do not cover up sealants until proper curing has taken place.
- .3 Cleanup.
 - .1 Clean adjacent surfaces immediately and leave Work neat and clean.
 - .2 Remove excess and droppings, using recommended cleaners as work progresses.
 - .3 Remove masking tape after initial set of sealant.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- | | | |
|----|--------------------|------------------|
| .1 | Joint Sealing | Section 07 92 10 |
| .2 | Finish Hardware | Section 08 71 10 |
| .3 | Glazing: | Section 08 80 50 |
| .4 | Exterior Painting: | Section 09 91 13 |
| .5 | Interior Painting: | Section 09 91 23 |

1.2 REFERENCES

- | | |
|----|--|
| .1 | ASTM A653/A653M Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process. |
| .2 | ASTM A526M-85 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality. |
| .3 | CAN/ULC-S104-15-R2020 Fire Tests of Door Assemblies. |
| .4 | CAN/ULC-S105-2016-R2020 Fire Door Frames. |
| .5 | CAN/CGSB 181.1 Coating, Zinc-Rich, Organic, Ready Mixed. |
| .6 | Canadian Steel Door and Frame Manufacturers' Association, (CSDMA) Canadian Manufacturing Specifications for Steel Door and Frames, 1982. |
| .7 | NFPA 80-2025 Fire Doors and Windows. |

1.3 REQUIREMENTS OF REGULATORY AGENCIES

- | | |
|----|---|
| .1 | Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN/ULC-S104-15-R2020 and CAN/ULC-S105-2016-R2020 for ratings specified or indicated. |
| .2 | Install labelled steel fire rated doors and frames to NFPA 80-2025 except where specified otherwise. |

1.4 SHOP DRAWINGS

- | | |
|----|--|
| .1 | Submit shop drawings in accordance with Section 01 33 00 - Submittals. |
| .2 | Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, glazed openings, arrangement of hardware and fire rating. |
| .3 | Indicate each type of frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and finishes. |
-

Part 2 Products

2.1 MATERIALS

- .1 Galvanized steel sheet: lock-forming quality to ASTM A653/A653M, Coating Designation mill phosphatized.
- .2 Doors: 1.12mm base material thickness.
- .3 Door Core:
 - .1 Hollow steel: vertically stiffened with steel ribs and all voids filled with semi-rigid fibrous insulation minimum density 48 kg/m³.
- .4 Frames:
 - .1 Steel frames to exterior and interior openings 1.520mm base thickness.
- .5 Provide other door and frame components in accordance with CSDMA requirements.
- .6 Primer:
 - .1 For galvanized steel sheet: CAN/CGSB 181.1.
- .7 Foam-in-place insulation spray polyurethane to CGSB/ULC-S705.1/S705.2 Class 1.

2.2 FABRICATION

- .1 Fabricate doors and frames as detailed, to Canadian Steel Door and Frame Manufacturers' Association, (CSDMA) Canadian Manufacturing Specifications for Steel Doors and Frames, 1982; except where specified otherwise. Reinforce door and frames to suit hardware requirements specified Section 08 71 10 - Finish Hardware.
- .2 Blank, reinforce, drill and tap doors and frames for mortised hardware. Reinforce doors and frames for surface mounted hardware.
- .3 Apply, at factory, touch up primer to doors and frames manufactured from galvanized steel where coating has been removed during fabrication.

2.3 DOORS

- .1 Make provision for glazing as indicated and provide necessary glazing stops.
 - .2 Construct rail and stile doors in same manner as flush doors.
 - .3 Construct matching panels in same manner as doors.
 - .4 Fabricate doors with longitudinal edges mechanically interlocked and spot welded along edges at 300mm o.c.
 - .5 Fabricate doors with top and bottom channels flush and filled solid, extending full width of door and welded to both faces.
 - .6 Where doors have louvers supplied by mechanical, coordinate with mechanical specifications (Section 23 37 13) - Diffusers, Registers and Grilles for preparation of doors to accept louvers.
-

2.4 FRAMES

- .1 Cut mitres and joints accurately and weld continuously on inside of frame profile.
- .2 Grind welded corners and joints to flat plane, fill with metallic paste filler and sand to uniform smooth finish.
- .3 Provide adjustable jamb anchors for fixing at floor.
- .4 Install 3 bumpers on strike jamb for each single door and 2 bumpers at head for pairs of doors.
- .5 Fabricate thermally broken frames for exterior doors and exterior glazed screens using steel core, separating exterior portion of frame from interior portion with polyvinyl chloride thermal breaks.
- .6 Make provision for glazing as indicated and provide necessary glazing stops.

Part 3 Execution

3.1 INSTALLATION GENERAL

- .1 Install in accordance with National Fire Codes, Volume 4, produced by National Fire Protection Association (NFPA) 80.

3.2 DOOR INSTALLATION

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Finish Hardware.
- .2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
 - .1 Hinge side: 1.0 mm.
 - .2 Latchside and head: 1.5 mm.
 - .3 Finished floor, top of carpet, noncombustible sill and thresholds: 13 mm.
- .3 Adjust operable parts for correct function.

3.3 FRAME INSTALLATION

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.
- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.
- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5 Where noted provide foam in place insulation to seal at head and jambs. Do not distort frames out of line.

3.4 FINISH REPAIRS

- .1 Touch up with primer, galvanized finish damaged during installation.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

- .1 Section 07 92 10 - Joint Sealers.
- .2 Section 07 27 10 - Air Barriers
- .3 Section 08 71 00 - Finish hardware
- .4 Section 08 80 50 - Glazing

1.2 REFERENCES

- .1 ASHRAE/IES 90.1-2022
- .2 ANSI/ASHRAE/USGBC/IES 189.1-2020
- .3 Aluminum Association (AA): AA DAF 45-03(R2009), Designation System for Aluminum Finishes.
- .4 American Architectural Manufacturers Association (AAMA)
 - .1 AAMA CW-10-04, Care and Handling of Architectural Aluminum From Shop to Site.
 - .2 AAMA CW-11-85, Design Wind Loads and Boundary Layer Wind Tunnel Testing.
 - .3 AAMA T1R-A1-04, Sound Control for Fenestration Products.
 - .4 AAMA/FGIA 501-2015+, Methods of Test for Exterior Walls.
 - .5 AAMA 611-2014, Voluntary Specifications for Anodized Finishes Architectural Aluminum.
 - .6 AAMA 612-2015, Voluntary Specifications, Performance Requirements, and Test Procedures for Combined Coatings of Anode Oxide and Transparent Organic Coatings on Architectural Aluminum.
 - .7 AAMA 2603-2020, Voluntary Specification Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
 - .8 AAMA 2604-2022, Voluntary Specification Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
- .5 ASTM International
 - .1 ASTM A 36/A 36M-2020, Specification for Carbon Structural Steel.
 - .2 ASTM A 123/A 123M-2020, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM A240/A240M, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - .4 ASTM A653/A653M-2020, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .5 ASTM B209-2020, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - .6 ASTM B221-2020, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - .7 ASTM E283-2019, Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 - .8 ASTM E330/E330M-2020, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls, by Uniform Static Air

- Pressure Difference.
- .9 ASTM E331-2020, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform Static Air Pressure Difference.
- .10 ASTM E413-2020, Classification for Rating Sound Insulation.
- .11 ASTM E1105-2020, Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.
- .6 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 1.108-M89, Bituminous Solvent Type Paint.
 - .2 CSA A440-A440.1, Structural Design of Glass for Buildings.
- .7 CSA International
 - .1 CSA G40.20/G40.21-2020, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA S136-2020, North American Specification for the Design of Cold Formed Steel Structural Members.
 - .3 CAN/CSA-S157/S157.1-2020, Strength Design in Aluminum/Commentary on CAN/CSA-S157, Strength Design in Aluminum.
 - .4 CSA W59.2-M2020, Welded Aluminum Construction.
- .8 Society for Protective Coatings (SSPC)
 - .1 SSPC - Paint 20-02 2021, Zinc Rich Coating, Type I - Inorganic and Type II - Organic.
 - .2 SSPC - Paint 25-97 2021 BCS, Zinc Oxide, Alkyd, Linseed Oil and Primer for Use Over Hand Cleaned Steel Type 1 and Type 2.
- .9 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1113-A2023, Architectural Coatings.
 - .2 SCAQMD Rule 1168-A2017, Adhesives and Sealants Applications.

1.3 SYSTEM DESCRIPTION

- .1 Design Criteria
 - .1 Design frames and doors in exterior walls to:
 - .1 Accommodate expansion and contraction within service temperature range of - 35 to 35 degrees C.
 - .2 Limit deflection of mullions to maximum 1/175th of clear span when tested to ASTM E 330 under wind load of 1.2 kpa submit certificate of tests performed.
 - .3 Movement within system.
 - .4 Movement between system and perimeter framing components or substrate.
 - .5 Design all connections between all frames and surrounding structure (including but not limited to foundation, concrete block, steel structure, steel studs, blocking, etc) and clearly indicate designed connections on manufacturer's shop drawings along with demonstration that the connections meet the load requirements outlined above.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Co-ordination: co-ordinate work of this Section with installation of fire stopping, air barrier placement, vapour retarder placement, flashing placement, installing ductwork to rear of louvres, rough carpentry and components or materials.

1.5 EXAMINATION

- .1 Examine the structure to which work is to be fixed and report any deficiency which is detrimental to the proper installation of the work.
- .2 Verify all dimensions on site, and site dimension to ensure that adjustments in fabrication and installation are provided for and clearances to other construction have been maintained.
- .3 Report any defects discovered to the Architect and do not commence work before these have been remedied. Commencement of work shall be construed as acceptance of underlying conditions.

1.6 ACTION AND INFORMAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for curtain wall and windows components, anchorage and fasteners, glass and infill, and internal drainage details and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario.
 - .2 Indicate system dimensions, framed opening requirements and tolerances, adjacent construction, anchor details anticipated deflection under load, affected related Work, weep drainage network, expansion and contraction joint location and details, and field welding required.
- .4 Samples: Submit two samples of finish and colour for review in accordance with Section 01 33 00 - Submittals..
- .5 Test Reports:
 - .1 Submit substantiating engineering data, test results of previous tests by independent laboratory which purport to meet performance criteria, and supportive data:
 - .1 Window classifications A3, B3, C3 for opening windows, and A2, B2, C2 for fixed sash.
 - .2 Enamelled finish.
 - .3 Air tightness fixed rating.
 - .4 Water tightness B-7 rating.
 - .5 Wind load resistance C-5 rating.
 - .6 Condensation resistance I @58.1.
 - .7 Sash strength and stiffness – projecting.
 - .8 Ease of operation - windows with operable lights.
 - .9 Forced entry resistance.
 - .10 Mullion deflection - combination and composite windows.

1.7 MAINTENANCE DATA

- .1 Provide operation and maintenance data for windows for incorporation into manual specified in Section 01 77 00 - Closeout Submittals.

1.8 WASTE MANAGEMENT

- .1 Provide covered storage area to protect materials and products from sunlight, moisture, staining, and impact or other damage.
- .2 Separate protective materials for reuse or recycling.
- .3 Separate corrugated cardboard in accordance with the Waste Management Plan and place in designated areas for recycling.
- .4 Place materials defined as hazardous or toxic waste in designated containers.
- .5 Use the least toxic sealants, adhesives, sealers, and finishes necessary to comply with the requirements of this section. Refer to Section 07 92 00.
- .6 Close and seal tightly all partly used sealant containers and store protected in well ventilated fire-safe area at moderate temperature.
- .7 Place used sealant tubes and other containers in areas designated for hazardous materials.
- .8 Separate strapping, and wood and metal spreader bars for reuse or recycling.
- .9 Fold up metal banding, flatten, and place in designated area for recycling.

1.9 WARRANTY

- .1 From the date of Certificate of Substantial Performance, the hermetically sealed glazing units shall be warranted for a period of **five (5) years** against vision obstruction due to the formation of dust or film on the internal surfaces, caused by the failure of the hermetic seal other than through glass breakage.
- .2 All other parts of the work shall be warranted against defects due to faulty materials and/or workmanship for a period of **three (3) years** from the date of the Certificate of Substantial Performance.
- .3 Repair and/or replace when so directed by the Architect, within the said periods, any and all portions of work which fail to perform according to the requirements of these Specifications.

1.10 PROTECTION

- .1 Apply temporary protective coating to finished surfaces. Remove coating after erection. Do not use coatings that will become hard to remove or leave residue.
- .2 Leave protective covering in place until final cleaning of building.

PART 2 Products

2.1 MATERIALS

- .1 Aluminum

- .1 All aluminum extrusions shall be 6063 TS aluminum alloy with T5 temper. Sash members shall be tubular, with nominal wall thickness of 1.6mm generally and 2.3mm at areas receiving operating hardware.
- .2 All aluminum doors and frames shall be given an anodic oxide treatment to obtain an Architectural Class 2 Anodic Coating in accordance with Aluminum Association specification AA-M12C22A31, #17, Clear.
- .2 Weatherstripping shall be flexible vinyl spline with durometer rating 60 ±5.
- .3 All screws, bolts and fastenings, shall be either cadmium plated or stainless steel.
- .4 Aligning corner clips shall be aluminum.
- .5 Hermetically Sealed Glazed Units: shall be made from two sheets of optically clean glass separated by an insulate spacer in accordance with CAN/CGSB-12.8-M76. Refer to Specification Section 08 80 50 – Glazing.

2.2 FABRICATION

- .1 Fabricate in accordance with CAN/CSA-A440 supplemented as follows:
- .2 Fabricate units square and true with maximum tolerance of plus or minus 1.5 mm for units with a diagonal measurement of 1800 mm or less and plus or minus 3 mm for units with a diagonal measurement over 1800 mm.
- .3 Face dimensions detailed are maximum permissible sizes.
- .4 Brace frames to maintain squareness and rigidity during shipment and installation.
- .5 Finish steel clips and reinforcement with shop coat primer to 380 g/m² zinc coating to CSA-G164-18.
- .6 Provide 2mm thick aluminum drip flashing at the head of all frames.

2.3 ISOLATION COATING

- .1 Isolate aluminum from following components, by means of isolation coating:
 - .1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
 - .2 Concrete, mortar and masonry.
 - .3 Wood.

2.4 GLAZING

- .1 Glaze windows in accordance with NAFS: AAMA/WDMA/CSA 101/I.S.2/A440-22. Refer to Section 08 80 50 for glass and glazing material.

2.5 AIR BARRIER AND VAPOUR BARRIERS

- .1 Equip window frames with factory or site installed air and vapour barrier material for sealing to building air and vapour barrier as follows:
 - .1 Material: identical to, or compatible with, building air barrier and vapour retarder materials to provide required air tightness and vapour diffusion control throughout exterior envelope assembly.

- .2 Material width: adequate to provide required air tightness and vapour diffusion control to building air barrier and vapour barrier from interior.

2.6 PANNING

- .1 Provide min. 25mm x min. 25mm extruded aluminum square snap on type panning, clear anodized finish to match new frames as required to cover gap between door frames and existing brick or interior finishes.

2.7 INSULATED SANDWICH PANELS

- .1 At exposed exterior face of curtain wall framing, provide 3mm thick aluminum both sides of 19mm plywood sheathing for one sandwich panel unit for installation between exterior aluminum cap and rear mullion. Finish shall be same colour as frame.
- .2 Insulate behind sandwich panels with minimum 100mm thick semi-rigid insulation Curtainrock board insulation as manufactured by Roxwool Inc.
- .3 Where back-up insulated sandwich panels are exposed to view in the building interior, 3mm thick aluminum shall be used. Finish shall match window frame.
- .4 Where back-up insulated back-up panels are not exposed to view in the building interior, use 0.9mm thick (20 gauge) galvanized sheet steel at interior face of panel.

2.8 ALUMINUM FRAMES (CURTAIN WALL)

- .1 Acceptable Products:
 - .1 Prevost: 3400 Series
 - .2 Kawneer: 1600 System 1, UT
 - .3 Alumicor: 2500 Series

Overall mullion depth including caps shall be:

- .1 Minimum 150 mm. Refer to drawings.
- .2 Provide reinforcing of mullions as required. Caps shall be 19 mm.

The system shall be designed to meet wind load requirements, maximum stress of 0.96 KPA (20 PSI) and have a maximum deflection of L/200 of the span.

- .2 The entire frame, curtain wall system shall be designed according to the "Open Rain Screen" principle and shall provide:
 - .1 Gaskets, sleeved spigotted joints, and seals necessary to ensure rain water does not enter the cavities of the system.
- .3 Mullion sections shall be tubular extruded sections when the system is designed for spigot joinery, and split mullion extruded sections when screw spline joinery is to be used. Incorporate split mullions as required to allow for thermal expansion, and at curved windows.
- .4 All horizontal sections shall form equalized pressure and sealed gutter members.

- .5 Vertical expansion and construction joints shall be sleeved spigotted joints between mullion ends in combination with an applied sealant.
- .6 Provide structural steel supports, brackets and all anchoring to building structure, anchors shall have three-way adjustment. Welding shall be completed after frame curtain wall is aligned. Touch up painting of welded areas shall be done on site.

2.9 ALUMINUM DOORS FABRICATION

- .1 Acceptable Products:
 - .1 Kawneer, Insulclad 360 with a 152mm (6") midrail, 152mm (6") top rail and 203mm (8") bottom rail.
 - .2 Prevost and Alumicor shall be considered acceptable manufacturers contingent upon full compliance with all requirements established for the Kawneer basis-of-design and performance system as per 2.10.1.1.
- .2 Glazing stops: interlocking snap-in type for dry glazing. Exterior stops: tamperproof type.
- .3 Provide thermally broken doors for exterior.
- .4 Hardware: Supplier by Specification Section 08 71 00.
- .5 Insulated Panels (if required, refer to drawings): Solid lower panel consisting of .80 aluminum sheet each side or 3/4" plywood core. Finish to match door and frame.
- .6 Fabricate doors and frames to profiles and maximum face sizes as indicated. Provide minimum 22 mm bite for insulating glazed units.
- .7 Provide structural steel reinforcement as required.
- .8 Fit joints tightly and secure mechanically.
- .9 Conceal fastenings.
- .10 Mortise, reinforce, drill and tap doors, frames and reinforcements to receive hardware using templates provided under Section 08 71 00 - Door Hardware

PART 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for aluminum curtain wall installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Verify dimensions, tolerances, and method of attachment with other work.
 - .3 Verify wall openings and adjoining air barrier and vapour retarder materials are ready to receive work of this Section.
 - .4 Inform Consultant of unacceptable conditions immediately upon discovery.
 - .5 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION OF DOORS AND FRAMES (CURTIAN WALL TYPE)

- .1 Install in accordance with NAFS-24.
- .2 Install in accordance with approved shop drawings and with manufacturer's instructions.
- .3 Install framing plumb, level, square, free from warp, twist or other defect, and anchor securely to provide adequate resistance.
- .4 Provide all steel angles, brackets, supports, and anchors required for complete installation.
- .5 Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- .6 Make adequate provisions for thermal expansion of framing. Fasteners at window heads shall allow for minimum 12mm deflection of the building structure.
- .7 Secure and shim windows with non-corrosive and inorganic material. Anchor clips, blocking, shims, and all other attachments shall be concealed.
- .8 Install steel reinforcing in aluminum frames where necessary to meet performance requirement.
- .9 Provide all fastening and clips required for positive fastening of framing to concrete wall and concrete block wall.
- .10 Aluminum shall be isolated from dissimilar materials by means of suitable alkali-resistant material such as bituminous paint, baked enamel, epoxy resin solution or zinc chromate paint. Follow manufacturer's recommendations.
- .11 Use thermal isolation where components penetrate or disrupt building insulation.
- .12 Coordinate attachment and seal of perimeter air barrier and vapour retarder materials.
- .13 Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- .14 Install doors and hardware in accordance with hardware templates and manufacturer's instructions.
- .15 Adjust door components to ensure smooth operation.
- .16 Install glass and infill panels in accordance with Section 08 80 50 – Glazing. Place sealant on the up-slope side of the pressure plate cover caps; finish the surface with a slope to encourage drainage over the cap. Cover caps to conceal screws and ensure continuous sightline.
- .17 Install perimeter sealant to method required to achieve performance criteria. Backing materials, and installation criteria in accordance with Section 07 92 00 - Joint Sealants

3.3 CAULKING

- .1 Apply sealant in accordance with Section 07900 - Joint Sealers. Conceal sealant within window units except where exposed use is permitted by Architect.

3.4 DELIVERY AND STORAGE

- .1 Deliver, store and handle windows to prevent damage. Replace all damaged products with new, undamaged products which confirm to the Specification.
- .2 Cross brace large window units for shipping and protect finished surfaces with protective wrappings.

3.5 PROTECTION DURING CONSTRUCTION

- .1 During construction protect windows and glass against damage from plaster, mortar, and any other cause.
- .2 Protect pre-finished aluminum surfaces with protective coatings and wrappings, until installation of glazing commences. Ensure that method of protection does not damage finish.

3.6 CLEANING

- .1 Before turning the building over to the Owner During, clean the exposed glass and aluminum surfaces. Do not use abrasive materials on anodized and painted surfaces.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes: Finish Hardware for door openings, except as otherwise specified herein.
 - 1. Door hardware for steel (hollow metal) doors.
 - 2. Door hardware for aluminum doors.
 - 3. Keyed cylinders as indicated.
- .2 Intent of Hardware Groups
 - .1 Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
 - .2 Where items of hardware aren't definitely or correctly specified, are required for completion of the Work, a written statement of such omission, error, or other discrepancy to Consultant, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.

1.2 SUBMITTALS

- .1 Comply with Section 01 33 00 - Submittals.
 - .2 Special Submittal Requirements: Combine submittals of this Section with Sections listed below to ensure the "design intent" of the system/assembly is understood and can be reviewed together.
 - .3 Product Data: Manufacturer's specifications and technical data including the following:
 - .1 Detailed specification of construction and fabrication.
 - .2 Manufacturer's installation instructions.
 - .3 Wiring diagrams for each electric product specified. Coordinate voltage with electrical before submitting.
 - .4 Submit copies of catalog cuts with hardware schedule. Refer to submittals specification section.
 - .4 Shop Drawings - Hardware Schedule: Submit complete reproducible copy of detailed hardware schedule in a vertical format. Refer to submittals specification section.
 - .1 List groups and suffixes in proper sequence.
 - .2 Completely describe door and list architectural door number.
 - .3 Manufacturer, product name, and catalog number.
 - .4 Function, type, and style.
 - .5 Size and finish of each item.
 - .6 Mounting heights.
 - .7 Explanation of abbreviations and symbols used within schedule.
 - .8 Detailed wiring diagrams, specially developed for each opening, indicating all electric hardware, security equipment and access control equipment, and door and frame rough-ins required for specific opening.
-

- .5 Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.
 - .1 Templates, wiring diagrams and "reviewed Hardware Schedule" of electrical terms to electrical for coordination and verification of voltages and locations.
- .6 Samples:
 - .1 1 sample of Lever and Rose/Escutcheon design, (pair).
 - .2 3 samples of metal finishes
- .7 Contract Closeout Submittals: Comply with Division 1 including specific requirements indicated.
 - .1 Operating and maintenance manuals: Submit 3 sets containing the following.
 - .1 Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
 - .2 Catalog pages for each product.
 - .3 Name, address, and phone number of local representative for each manufacturer.
 - .4 Parts list for each product.
 - .2 Copy of final hardware schedule, edited to reflect, "As installed".
 - .3 Copy of final keying schedule
 - .4 As installed "Wiring Diagrams" for each piece of hardware connected to power, both low voltage and 110 volts.
 - .5 One set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.3 QUALITY ASSURANCE

- .1 Comply with Division 1.
 - .1 Statement of qualification for distributor and installers.
 - .2 Statement of compliance with regulatory requirements and single source responsibility.
 - .3 Distributor's Qualifications: Firm with 3 years experience in the distribution of commercial hardware.
 - 1. Distributor to employ full time Architectural Hardware Consultants (AHC) for the purpose of scheduling and coordinating hardware and establishing keying schedule.
 - 2. Hardware Schedule shall be prepared and signed by an AHC or equivalent.
 - .4 Installer's Qualifications: Firm with 3 years experienced in installation of similar hardware to that required for this Project, including specific requirements indicated.
 - .5 Regulatory Label Requirements: Provide testing agency label or stamp on hardware for labeled openings.

1. Provide ULC listed hardware for labeled and 20 minute openings in conformance with requirements for class of opening scheduled.
2. Underwriters Laboratories requirements have precedence over this specification where conflict exists.
- .6 Single Source Responsibility: Except where specified in hardware schedule, furnish products of only one manufacturer for each type of hardware.
- .2 Review Project for extent of finish hardware required to complete the Work. Where there is a conflict between these Specifications and the existing hardware, notify the Consultant in writing and furnish hardware in compliance with the Specification unless otherwise directed in writing by the Consultant.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Packing and Shipping: Comply with Division 1
 - .1 Deliver products in original unopened packaging with legible manufacturer's identification.
 - .2 Package hardware to prevent damage during transit and storage.
 - .3 Mark hardware to correspond with "reviewed hardware schedule".
 - .4 Deliver hardware to door and frame manufacturer upon request.
- .2 Storage and Protection: Comply with manufacturer's recommendations.

1.5 PROJECT CONDITIONS

- .1 Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.
- .2 Review Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

1.6 WARRANTY

- .1 Manufacturer's Warranty:
 - .1 Closers: Ten years
 - .2 Exit Devices: Three Years
 - .3 Locksets & Cylinders: Three years
 - .4 All other Hardware: Two years.

1.7 OWNER'S INSTRUCTION

- .1 Instruct Owner's personnel in operation and maintenance of hardware units.

1.8 MAINTENANCE

- .1 Extra Service Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals Section.

- .1 Special Tools: Provide special wrenches and tools applicable to each different or special hardware component.
- .2 Maintenance Tools: Provide maintenance tools and accessories supplied by hardware component manufacturer.
- .3 Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra service materials.

Part 2 Products

2.1 MANUFACTURERS

- .1 The following manufacturers are accepted subject to compliance with requirements of the Contract Documents. Acceptance of manufacturers other than those listed shall be in accordance with Division 1.

<u>Item:</u>	<u>Manufacturer:</u>	<u>Accepted Alternative:</u>
Hinges	Stanley	Hagar, McKinney, Ives
Continuous Hinges	Hagar-Roton	Select, McKinney, Ives
Locksets/Cylinders	Sargent	No Substitution
Exit Devices	Sargent AD 8500	Stanley Apex 200, VonDuprin 98F fire-rated to accept 7 pin Stanley/Best Cylinder
Closers	LCN 4040XP, 4041	No substitution
Automatic Operators	Stanley MagicForce	No substitution
Push/Pull Plates	Gallery	CBH
Protection Plates	Gallery	CGH
Overhead Stops *	Glynn Johnson	Rixon, Hagar, Sargent, Gallery
Door Stops	Gallery	CBH
Flush Bolts	Gallery	CBH
Coordinator & Brackets	Ives	Hager
Key Cabinet	Telkee	or as Accepted by Consultant
Threshold & Gasketing	KN Crowder	Pemko

* Hardware supplier to ensure OH stop is compatible with LCN closer.

2.2 MATERIALS

- .1 Hinges:
- 1. Template screw hole locations
 - 2. Minimum of 2 permanently lubricated non-detachable bearings
 - 3. Equip with easily seated, non-rising pins
 - 4. Sufficient size to allow 180-degree swing of door
 - 5. Furnish hinges with five knuckles and flush bearings
 - 6. Provide hinge type as listed in schedule.
 - 7. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
 - 8. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish
 - 9. UL10B listed for Fire

.2 Geared Continuous Hinges:

1. Tested and approved by BHMA for ANSI A156.26-1996 Grade 1
2. Anti-spinning through fastener
3. UL10B listed for 3-hour Fire rating
4. Non-handed
5. Lifetime warranty
6. Provide Fire Pins for 3-hour fire ratings
7. Sufficient size to permit door to swing 180 degrees

.3 Cylindrical Type Locks & Latches:

1. Tested and approved by BHMA for ANSI A156.13, Series 1000, Operational Grade 1, Extra-Heavy Duty, Security Grade 2 and be UL10C
2. Fit ANSI A115.1 door preparation
3. Functions and design as indicated in the hardware groups
4. Solid, 19mm throw, anti-friction latchbolt made of self-lubricating stainless steel
5. Deadbolt functions shall have a 25mm throw bolt made of hardened stainless steel
6. Latch bolt and Deadbolt are to extend into the case a minimum of 9.5mm when fully extended
7. Auxiliary deadlatch to be made of one-piece stainless steel, permanently lubricated
8. Provide sufficient curved strike lip to protect door trim
9. Lever handles must be of forged or cast brass, bronze or stainless-steel construction and conform to ANSI A117.1. Levers that contain a hollow cavity are not acceptable
10. Lock shall have self-aligning, thru-bolted trim
11. Levers to operate a roller bearing spindle hub mechanism
12. Spindle to be designed to prevent forced entry from attacking of lever
Provide locksets with removable and interchangeable core cylinders.
13. Each lever to have independent spring mechanism controlling it
14. Core face must be the same finish as the lockset
15. Where UNR (universal) locks are shipped, installer is to install locks and adjust all locks to the functions required by the end user.

.4 Exit Devices shall:

1. Tested and approved by BHMA for ANSI 156.3, Grade 1
2. Provide a deadlocking latch bolt.
3. Non-fire rated exit devices shall have cylinder dogging.
4. Touchpad shall be "T" style
5. Exposed components shall be of architectural metals and finishes.
6. Lever design shall match lockset lever design
7. Provide strikes as required by application.
8. Fire exit devices to be listed for UL10C
9. UL listed for Accident Hazard.
10. **All exit devices shall function at any time to exit the building.**

.5 Cylinders:

1. Provide the necessary cylinder housings, collars, rings & springs as recommended by the manufacturer for proper installation.
2. Provide the proper cylinder cams or tail piece as required to operate all locksets and other keyed hardware items listed in the hardware sets. **Provide owner with "Sargent" manufacturer cores. Refer to 2.4 "Keys and Keying below.**

3. Coordinate and provide as required for related sections.
 - .6 Door Closers shall:
 1. Tested and approved by BHMA for ANSI 156.4, Grade 1
 2. UL10C certified
 3. Closer shall have extra-duty arms and knuckles
 4. Conform to ANSI 117.1
 5. Maximum 2 - 61.9 mm case projection with non-ferrous cover
 6. Separate adjusting valves for closing and latching speed, and backcheck
 7. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions
 8. Full rack and pinion type closer with 38 mm minimum bore
 9. Mount closers on non-public side of door, unless otherwise noted in specification
 10. Closers shall be non-handed, non-sized and multi-sized 1 through 6
 11. Provide parallel arm unless noted otherwise.
 - .7 Door Bolts: Flush bolts for wood or metal doors.
 - .1 Provide a set of Automatic bolts ANSI/BHMA 156.3 Type 25 for hollow metal label doors.
 - .2 Provide a set of Automatic bolts ANSI/BHMA 156.3 Type 27 at wood label doors.
 - .3 Manual flush bolts ANSI/BHMA 156.16 at openings where allowed local authority.
 - .4 Provide Dust Proof Strike ANSI/BHMA 156.16 at doors with flush bolts without thresholds.
 - .9 Coordinator and Brackets: Provide a surface mounted coordinator when automatic bolts are used in the hardware set.
 1. Coordinator shall comply with ANSI/BHMA A1156.3 Type 21A full width of the opening.
 2. Provide mounting brackets for soffit applied hardware.
 3. Provide hardware preparation (cutouts) for latches as necessary.
 - .10 Kickplates: Provide with four beveled edges ANSI J102, 200 mm high by width less 50 mm on single doors and 25 mm on pairs of doors. Furnish oval-head countersunk screws to match finish.
 - .11 Mop plates: Provide with four beveled edges ANSI J103, 100 mm high by width less 25 mm on single doors and 25 mm on pairs of doors. Furnish oval-head countersunk screws to match finish.
 - .12 Push Plates: Provide with four beveled edges ANSI J301, 1.25mm thickness, size as indicated in hardware set. Furnish oval-head countersunk screws to match finish.
 - .13 Pulls: Provide ANSI J401 Pull as listed in hardware set. Provide proper fasteners for door construction.
 - .14 Push Pull Bars: Provide ANSI J504, 25.4 mm Dia. Pull and push bar model and series as listed in hardware set. Provide proper fasteners for door construction.
 - .15 Doorstops: Provide a dome floor or wall stop for every opening as listed in the hardware sets.
 1. Wall stop and floor stop shall be wrought bronze, brass or stainless steel.
 2. Provide fastener suitable for wall construction.
 3. Coordinate reinforcement of walls where wall stop is specified.
-

- 4. Provide dome stops where wall stops are not practical. Provide spacers or carpet riser for floor conditions encountered
 - .16 Over Head Stops: Provide a Surface mounted or concealed overhead when a floor or wall stop cannot be used or when listed in the hardware set.
 - .1 Surface overhead stops shall be heavy duty bronze or stainless steel.
 - .17 Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.
 - .18 Weatherstripping: Provide at head and jambs only those units where resilient or flexible seal strip is easily replaceable. Where bar-type weatherstrip is used with parallel arm mounted closers install weatherstrip first.
 - .1 Weatherstrip shall be resilient seal of (Neoprene, Polyurethane, Neoprene, Vinyl, Pile, Nylon Brush, Silicone)
 - .2 UL10C Positive Pressure rated seal set when required.
 - .3 UL10B classified seal set for rated fire doors.
 - .4 Weatherstrip to be installed before certain items of hardware as described in schedule.
 - .19 Door Bottoms/Sweeps: Surface mounted or concealed door bottom where listed in the hardware sets.
 - .1 Door seal shall be resilient seal of (Neoprene, Polyurethane, Neoprene, Nylon Brush, Silicone)
 - .2 UL10C Positive Pressure rated seal set when required.
 - .3 UL10B classified seal set for rated fire doors.
 - .20 Thresholds: Thresholds shall be aluminum beveled type with maximum height of 12 mm for conformance with ADA requirements. Furnish as specified and per details. Provide fasteners and screws suitable for floor conditions.
 - .21 Key Control: Provide one wall mounted key cabinet complete with hooks, index and tags.
 - .22 Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occurs.
 - .23 Automatic Operators:
 - .1 Be listed under UL10C and UL3 25.
 - .2 Be capable of functioning on doors weighing up to 158 kg.
 - .3 Confirm to ANSI A156.10 and A156.19 and be suitable for use in both full energy and low energy applications.
 - .4 Be non-handed.
 - .5 Incorporate the following adjustment capabilities: opening force, closing force, open speed, close speed, and open check speed.
 - .6 Incorporate a non-ferrous cover not exceeding 150mm square in section.
 - .7 Incorporate a separate On-Off-Hold Open switch within Hood.
 - .8 Be microprocessor-controlled and incorporate a position encoder.
 - .9 Readily function with standard activation and safety sensors provide activation devices as required.
 - .10 Function as a manual door closer without power applied, and shall power open/spring close with power applied.
 - .11 Function with 115 VAC electrical service for operator and standard low voltage connections for activation.
-

- .12 Units must be FURNISHED and INSTALLED.
- .13 Automatic operator to be Stanley Magic Force series. **No Alternate**

2.3 FINISH

- .1 Designations used in Schedule of Finish Hardware - 3.05, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products
- .2 Powder coat door closers to match other hardware, unless otherwise noted.
- .3 Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

2.4 KEYS AND KEYING

- .1 Cylinders to be keyed into school's existing system.
- .2 Furnish keys in the following quantities:
 - .1 2 each change keys each keyed cylinder.
- .3 Hardware supplier to supply cylinders in school's existing keyway.
- .4 **Keying of new cylinders into School's existing system is by General Contractor. General Contractor is to provide locksmith to key to school's keying system. General Contractor is to coordinate with Owner including School Maintenance staff for keying. Keying services to be purchased by General Contractor and is not School Board's scope of work.**
- .5 Finish hardware supplier to provide keying schedule.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion.
 - .1 Do not proceed until unsatisfactory conditions have been corrected.

3.2 HARDWARE LOCATIONS

- .1 Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.
 - .1 Recommended Locations for Builder's Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).
 - .2 NWWDA Industry Standard I.S.1.7, Hardware Locations for Wood Flush Doors.

3.3 INSTALLATION

- .1 Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- .2 Conform to local governing agency security ordinance.
- .3 ADA Standard: Conform to ANSI A117.1 for positioning requirements for disabled.
- .4 Installed hardware using the manufacturer's fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use "Riv-Nuts" or similar products.

3.4 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

- .1 Contractor/Installers, Field Services: After installation is complete, contractor shall inspect completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.
 - .1 Check and adjust closers to ensure proper operation.
 - .1 Adjust closer to complete full closing cycle in less than 4 to 6 seconds without abrupt change of speed between "Sweep" and "Latch" speeds.
 - .2 Adjust "Backcheck" according to manufacturer's instructions.
 - .3 Set exterior doors closers to have 8.5 lbs maximum pressure to open, interior non-rated at 5 lbs, rated openings at 12 lbs
 - .2 Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.
 - .1 Verify levers are free from binding.
 - .2 Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.
 - .3 Report findings, in writing, to Consultant and hardware supplier outlining corrective actions and recommendations.

3.5 MANUFACTURE LIST:

<u>Code</u>	<u>Name</u>
MK	Master Key
IVE	Ives
GS	Gallery Specialty Hardware
HA	Hager
KN	K.N. Crowder, Inc.
LCN	LCN Closers
PR	Precision
RO	Rockwood
RX	Rixson
SAR	Sargent
ST	Stanley
TK	Telkee
GLY	Glynn Johnson

Finish List

<u>Code</u>	<u>Description</u>
AL	Aluminum
CA	Clear Anodized
EN	Sprayed Finish, Aluminum
PC	Prime Coat
26D	Satin Chrome
32D	Satin Stainless Steel
626	Satin Chromium Plated
628	Satin Aluminum, Clear Anodized
630	Satin Stainless Steel
652	Satin Chromium Plated
USP	Spray Primed
GREY	Grey
US26D	Chromium Plated, Dull
US32D	Stainless Steel, Dull
<u>Code</u>	<u>Description</u>
12	UL FIRE LABEL EXIT DEVICES
16	CYLINDER DOGGING FEATURE
55	SIGNAL SWITCH
56	REMOTE DOGGING/LATCH RETRACTION
NRP	NON REMOVEABLE PIN STD/HEAVY WT HINGE
TAC	TACTILE LEVERS
C208	CYLINDER CAM
R705	STRAIGHT CYLINDER RING – 7.9mm

3.6 SCHEDULE OF FINISH HARDWARE:

Heading No.1

1 PR Double Doors, Exterior from South-West Vestibule 041
D041a, 2x 965 x 2150 x 57 – AL DR x AL FR LHR/RHR

* Hardware supplier to confirm active / operator leaf prior to ordering

1	Continuous Hinge 780-112 HD x 85" Clear LHR	Clear
1	Continuous Hinge 780-112 HD x 85" Clear RHR	Clear
1	Removable Mullion KR4854-84 5/8"--689 689	
1	Cylinder (cyl. dogging) 1E74 C4 RP3 626 - confirm cam	626
1	Electric Strike 6111-CON-630	630
	* Hdwe supplier to confirm voltage	
1	Exit Device 35A-NL-OP US26D 388NL-OP US26D	
	RHR 4' Bar 950 x 2150 Door	626/626
1	Cylinder 12E72 RP 626	626
2	Construction Core Brass	
1	Exit Device 35A-EO-626-950 x 2150 Door 45-LHR- 4' Bar 299	626
2	Door Pull 1180-2 x # 4B mtg.	C32D
1	Auto Operator Magic Force (Push) c/w extended spindle / arm CLA	
	* Extended spindle to clear OH stop	

2	Actuator CM60/2	SS
2	Escutcheon CM89S	SS
1	Surface Closer 4040XP REG AL (Top Jamb Mount) AL	
1	Mounting Plate 4040XP-18G 689	689
2	Overhead Door Stop 104S C32D	C32D
2	Door Sweep W-24S-CA x 950 mm	CA
1	Threshold CT-45 x 1900 mm	
2	Door Contact 679-05HM	
1	Power Supply PS902	
1	Wire Harness CON-192 (power supply to frame)	
1	Wire Harness CON-6W (power supply)	

* Weatherstripping by door and frame supplier

* Cylinders to match existing locks.

* Card Reader is connected to electric strike and to the Kanteck controller

* All required power, conduit and back boxes by Electrician

* Operator installer to initiate and conduct on-site meeting with Site Super, Electrician and Security Contractor to ensure all components are installed as per OBC requirements and proper coordination is done to achieve mode of operation.

* Auto operator installer/supplier is to provide an anodized aluminum custom mounting plate from operator hood to door frame.

*Consult with owner for wiring sequence of electric strike and accessible automatic BF operator prior to construction

*Door supplier to ensure door can accommodate overhead stop

*Door supplier to provide adjustments and/or strike to mount on the base of the frame, stop removed where strike is and exit device placement adjusted.

** Mode Of Operation

Pushing inside actuator momentarily opens electric strike and begins operator cycle at all times.

Pushing Outside actuator begins operator cycle at all times but does not operate electric strike. Actuator is turned off by key switch at lock up.

Heading No.2

1 PR Double Doors, Interior Corridor from South-West Vestibule 041
D041b, 2x 965 x 2150 x 45 – HM DR x pressed steel frame LHR/RHR

* Hardware supplier to confirm active / operator leaf prior to ordering

1	Continuous Hinge 780-112 HD x 85" Clear LHR	Clear
1	Continuous Hinge 780-112 HD x 85" Clear RHR	Clear
2	Push Bar 5030-2 Series x 4B mtg	C32D
	* Hardware supplier to confirm length prior to ordering	
2	Door Pull 1180-2 x # 4B mtg.	C32D
1	Auto Operator Magic Force (Push) c/w extended spindle / arm	CLA
	* Extended spindle to clear OH stop	
2	Actuator CM60/2	SS
2	Escutcheon CM89S	SS
1	Surface Closer 4040XP REG AL (Top Jamb Mount)	AL
1	Mounting Plate 4040XP-18G 689 689	
2	Overhead Door Stop 104S C32D	C32D

- * All required power, conduit and back boxes by Electrician
- * Operator installer to initiate and conduct on-site meeting with Site Super and Electrician to ensure all components are installed as per OBC requirements
- *Door supplier to ensure door can accommodate overhead stop

** Mode Of Operation --
Both actuators to begin operator cycle at all times

Heading No.3

1 Single Door, Interior from North-West Vestibule
D031b, 1x 1068 x 2150 x 45 – HM DR x pressed steel frame

1	Continuous Hinge 780-112 HD x 85" Clear LHR	Clear
1	Push Bar 5030-2 Series x 4B mtg	C32D
	* Hardware supplier to confirm length prior to ordering	
1	Door Pull 1180-2 x # 4B mtg.	C32D
1	Auto Operator Magic Force (Push) c/w extended spindle / arm	CLA
	* Extended spindle to clear OH stop	
1	Actuator CM60/2	SS
1	Escutcheon CM89S	SS
1	Surface Closer 4040XP REG AL (Top Jamb Mount)	AL
1	Mounting Plate 4040XP-18G 689 689	
1	Overhead Door Stop 104S C32D	C32D

- * All required power, conduit and back boxes by Electrician
- * Operator installer to initiate and conduct on-site meeting with Site Super and Electrician to ensure all components are installed as per OBC requirements
- *Door supplier to ensure door can accommodate overhead stop

** Mode Of Operation --
Both actuators to begin operator cycle at all times

Heading No.4

1 PR Double Doors, Interior Corridor from North-East Vestibule 018
D018b, 2x 965 x 2150 x 45 – HM DR x pressed steel frame LHR/RHR

- * Hardware supplier to confirm active / operator leaf prior to ordering

1	Continuous Hinge 780-112 HD x 85" Clear LHR	Clear
1	Continuous Hinge 780-112 HD x 85" Clear RHR	Clear
2	Push Bar 5030-2 Series x 4B mtg	C32D
	* Hardware supplier to confirm length prior to ordering	
2	Door Pull 1180-2 x # 4B mtg.	C32D
1	Auto Operator Magic Force (Push) c/w extended spindle / arm	CLA
	* Extended spindle to clear OH stop	
2	Actuator CM60/2	SS

2	Escutcheon CM89S	SS
1	Surface Closer 4040XP REG AL (Top Jamb Mount)	AL
1	Mounting Plate 4040XP-18G 689 689	
2	Overhead Door Stop 104S C32D	C32D

- * All required power, conduit and back boxes by Electrician
- * Operator installer to initiate and conduct on-site meeting with Site Super and Electrician to ensure all components are installed as per OBC requirements
- *Door supplier to ensure door can accommodate overhead stop

** Mode Of Operation --
Both actuators to begin operator cycle at all times

Heading No.5

1 PR Double Doors, Exterior East Main Entry Doors near Gym – D001a
D001a, 2x 965 x 2150 x 57 – AL DR x AL FR LHR/RHR

- * Hardware supplier to confirm active / operator leaf prior to ordering

1	Continuous Hinge 780-112 HD x 85" Clear LHR	Clear
1	Continuous Hinge 780-112 HD x 85" Clear RHR	Clear
1	Removable Mullion KR4854-84 5/8"--689 689	
1	Cylinder (cyl. dogging) 1E74 C4 RP3 626 - confirm cam	626
1	Electric Strike 6111-CON-630	630
	* Hdwe supplier to confirm voltage	
1	Exit Device 35A-NL-OP US26D 388NL-OP US26D	
	RHR 4' Bar 950 x 2150 Door	626/626
1	Cylinder 12E72 RP 626	626
2	Construction Core Brass	
1	Exit Device 35A-EO-626-950 x 2150 Door 45-LHR- 4' Bar 299	626
2	Door Pull 1180-2 x # 4B mtg.	C32D
1	Auto Operator Magic Force (Push) c/w extended spindle / arm CLA	
	* Extended spindle to clear OH stop	
2	Actuator CM60/2	SS
2	Escutcheon CM89S	SS
1	Surface Closer 4040XP REG AL (Top Jamb Mount) AL	
1	Mounting Plate 4040XP-18G 689	689
2	Overhead Door Stop 104S C32D	C32D
2	Door Sweep W-24S-CA x 950 mm	CA
1	Threshold CT-45 x 1900 mm	
2	Door Contact 679-05HM	
1	Power Supply PS902	
1	Wire Harness CON-192 (power supply to frame)	
1	Wire Harness CON-6W (power supply)	

- * Weatherstripping by door and frame supplier
- * Cylinders to match existing locks.
- * Card Reader is connected to electric strike and to the Kanteck controller
- * All required power, conduit and back boxes by Electrician
- * Operator installer to initiate and conduct on-site meeting with Site Super, Electrician and Security Contractor to ensure all components are installed as per OBC requirements and proper coordination is done to achieve mode of operation.

- * Auto operator installer/supplier is to provide an anodized aluminum custom mounting plate from operator hood to door frame.
- *Consult with owner for wiring sequence of electric strike and accessible automatic BF operator prior to construction
- *Door supplier to ensure door can accommodate overhead stop
- *Door supplier to provide adjustments and/or strike to mount on the base of the frame, stop removed where strike is and exit device placement adjusted.

**** Mode Of Operation**

Pushing inside actuator momentarily opens electric strike and begins operator cycle at all times.
Pushing Outside actuator begins operator cycle at all times but does not operate electric strike. Actuator is turned off by key switch at lock up.

Heading No.6

1 PR EXISTING Exterior Double Doors, from North-East Vestibule 018
D018a, EXISTING – AL DR x AL FR LHR/RHR

1	Electric Strike 6111-CON-630	630
	* Hdwe supplier to confirm voltage	
1	Auto Operator Magic Force (Push) c/w extended spindle / arm CLA	
	* Extended spindle to clear OH stop	
2	Actuator CM60/2	SS
2	Escutcheon CM89S	SS
2	Door Contact 679-05HM	
1	Power Supply PS902	
1	Wire Harness CON-192 (power supply to frame)	
1	Wire Harness CON-6W (power supply)	

- * All required power, conduit and back boxes by Electrician
- * Operator installer to initiate and conduct an on-site meeting with Site Super, Electrician and Security Contractor to ensure all components are installed as per OBC requirements and proper coordination is done to achieve mode of operation.
- * Auto operator installer/supplier is to provide an anodized aluminum custom mounting plate from operator hood to door frame.
- *Consult with owner for wiring sequence of electric strike and accessible automatic BF operator prior to construction
- *Door supplier to ensure door can accommodate overhead stop
- *Door supplier to provide adjustments and/or strike to mount on the base of the frame, stop removed where strike is and exit device placement adjusted.

**** Mode Of Operation**

Pushing inside actuator momentarily opens electric strike and begins operator cycle at all times.
Pushing Outside actuator begins operator cycle at all times but does not operate electric strike. Actuator is turned off by key switch at lock up.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 08 11 00 - Steel Doors and Frames.
- .2 Section 08 11 16 – Aluminum Doors and Frames

1.2 REFERENCES

- .1 American Society of Civil Engineers, (ASCE)
 - .1 ASCE/SEI 7-22 – Minimum Design Loads for Buildings and Other Structures
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM D 2240, Test Method for Rubber Property - Durometer Hardness.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-12.1, Tempered or Laminated Safety Glass.
 - .2 CAN/CGSB-12.3, Flat, Clear Float Glass.
 - .3 CAN/CGSB-12.6, Transparent (one-way) Mirrors.
 - .4 CAN/CGSB-12.8, Insulating Glass Units.
 - .5 CAN/CGSB-12.9, Spandrel Glass.

1.3 SYSTEM DESCRIPTION

- .1 Performance Requirements:
 - .1 Provide continuity of building enclosure vapour and air barrier using glass and glazing materials as follow:
 - .1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.
- .2 Limit mullion deflection to L/175; with full recovery of glazing materials.
- .3 Size glass units and glass dimensions to limits established in CAN/CGSB-12.20-M89.
 - .1 Design, and verify maximum glass sizes, thickness, strength, for glass types specified, to support design, and maximum allowable uniform static loads, using design factor of 2.5, in accordance with CAN/CGSB 12.20-M89, but thickness shall not be less than as indicated in this Section.
- .4 Glass to withstand seismic loads as calculated in accordance with NBC and OBC.
 - .1 Seismic performance: glass shall withstand the effects of earthquake motions determined according to ASCE/SEI 7-22.
 - .1 Importance Factor of this Building: 1 (Normal).
 - .2 Site Class: C.

1.4 SUBMITTALS

- .1 Submit shop drawings, product data and samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product Data:
-

- .1 Submit manufacturer's printed product literature, specifications and data sheets.
- .3 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.
- .4 Samples:
 - .1 Provide duplicate 300 x 300 mm samples of each glazing type.

1.5 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data including cleaning instructions for incorporation into manual specified in Section 01 33 00 - Submittal Procedures.

1.6 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

Part 2 Products

2.1 MATERIALS: FLAT GLASS

- .1 Float glass: to CAN/CGSB-12.3, Glazing quality, 6 mm thick.
- .2 "SG" - Safety glass (Temp): to CAN/CGSB-12.1, transparent, 6 mm thick.
 - .1 Type 2-tempered.
 - .2 Class B-float.
 - .3 Category: II - 540 J impact resistance.
 - .4 Horizontal tempering.
- .3 Low emissivity (Low E) coating on glass:
 - .1 Performance requirements based on PPG Solarban 60 sputtered/soft (vacuum coated), edge deleted. Other manufacturers acceptable upon compliance with specification requirements.
 - .2 Refer to the performance requirements specified in the vision glass insulating units.

2.2 VISION GLASS – INSULATING-GLASS UNITS

- .1 Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass, qualified according to CAN/CGSB-12.8, and complying with other requirements specified.
- .2 "VG" – vision glass insulating unit: to CAN/CGSB-12.8, double unit:
 - .1 Outer lite: Clear safety (tempered) glass.
 - .2 Inner lite: clear safety (tempered) glass.
 - .3 Glass thickness: 6 mm each light.
 - .4 Inter-cavity space thickness: 12 mm with low conductivity spacers, colour selected by Consultant.

- .5 Overall thickness: 25 mm
- .6 Low “e” glass coating: surface number 2.
- .7 Inert gas fill: Argon.
- .8 Glass performance:
 - .1 Visible light transmittance: 70%
 - .2 Visible Refl. out: 11%
 - .3 Visible Refl. In: 12%
 - .4 Total solar energy transmission: 33
 - .5 Total solar energy reflect: 29
 - .6 Winter nighttime U-factor: 0.24
 - .7 Solar heat gain coefficient: 0.38
 - .8 Shading coef: 0.44
 - .9 L.G.S. ration: 1.85
- .3 “ISP”- Insulated Sandwich Panel – Refer to Section 08 11 16 – Aluminum Dors and Frames

2.3 MATERIALS AND ACCESSORIES

- .1 Primer, sealers, cleaners: to manufacturer's standard.
- .2 Setting blocks: Neoprene, 70-90 Shore A durometer hardness to ASTM D 2240, 100 mm long x 6 mm high x width to suit glass thickness.
- .3 Spacer shims: Neoprene or silicone, 50-60 Shore A durometer hardness to ASTM D 2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self-adhesive on one face.
- .4 Glazing tape:
 - .1 Preformed butyl compound, paper released backed.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 EXAMINATION

- .1 Examine framing glazing, with Installer present, for compliance with the following:
 - .1 Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - .2 Presence and functioning of weep system.
 - .3 Minimum required face or edge clearances.
 - .4 Effective sealing between joints of glass-framing members.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

- .1 Clean contact surfaces with solvent and wipe dry.
- .2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .3 Prime surfaces scheduled to receive sealant.

3.4 GLAZING, GENERAL

- .1 Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- .2 Glazing channel dimensions, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Site conditions during installation.
- .3 Protect glass edges from damage during handling and installation. Remove damaged glass from site and legally dispose of off site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- .4 Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- .5 Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- .6 Do not exceed edge pressures stipulated by glass manufacturers for installing glass lights.
- .7 Provide spacers for glass lights where length plus width is larger than 1270 mm as follows:
 - .1 Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - .2 Provide 3-mm minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- .8 Provide edge blocking where indicated or needed to prevent glass lights from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- .9 Set glass lights in each series with uniform pattern, draw, bow, and similar characteristics.
- .10 Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

- .11 Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.5 INSTALLATION: INTERIOR - DRY METHOD (TAPE AND TAPE)

- .1 Perform work in accordance with FGMA Glazing Manual for glazing installation methods.
- .2 Cut glazing tape to length and set against permanent stops, projecting 1.6 mm above sight line.
- .3 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.
- .4 Rest glazing on setting blocks and push against tape for full contact at perimeter of light or unit.
- .5 Place glazing tape on free perimeter of glazing in same manner described.
- .6 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- .7 Knife trim protruding tape.
- .8 Install ceramic fire rated glass in UL labelled doors and UL labelled glazed steel screen frames as detailed on the drawings. Install ceramic fire rated glass in any door and/or steel frame that is within the line of fire separation as depicted on the drawings.

3.6 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Remove traces of primer, caulking.
- .3 Remove glazing materials from finish surfaces.
- .4 Remove labels after work is complete.
- .5 Clean glass and mirrors using approved non-abrasive cleaner in accordance with manufacture's instructions.
- .6 Wash film using cleaning solution recommended by film manufacturer.
- .7 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.7 PROTECTION OF FINISHED WORK

- .1 After installation, mark light with an "X" by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 06 10 00 - Rough Carpentry.
- .2 Section 07 21 16 - Blanket Insulation.
- .3 Section 07 92 00 - Joint Sealants.
- .4 Section 09 22 16 - Non-Structural Metal Framing.
- .5 Section 09 91 00 – Painting.

1.2 REFERENCE STANDARDS

- .1 American Society for Testing and Materials International (ASTM).
 - .1 ASTM C473-24, Standard Test Methods for Physical Testing of Gypsum Panel Products.
 - .2 ASTM C475/C475M-17, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .3 ASTM C840-24, Standard Specification for Application and Finishing of Gypsum Board.
 - .4 ASTM C919-24. Standard Practice for Use of Sealants in Acoustical Applications.
 - .5 ASTM C954-22, Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
 - .6 ASTM C1002-22, Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - .7 ASTM C1047-19, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - .8 ASTM C1177/C1177M-24, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
 - .9 ASTM C1178/C1178M-24, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Board.
 - .10 ASTM C1280-25, Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.
 - .11 ASTM C1396/C1396M-24, Standard Specification for Gypsum Board.
 - .12 ASTM C1629/C1629M-18, Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
 - .13 ASTM D3273-16, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
 - .2 Association of the Wall and Ceilings Industries International (AWCI).
 - .1 AWCI GA-214-2021 Recommended Levels of Gypsum Board Finish.
 - .3 Underwriters Laboratories of Canada (ULC).
 - .1 CAN/ULC-S604-2016, Standard for Factory-Built Type A Chimneys.
 - .2 CAN/ULC-S702.1:2014-AMD1, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification First Amendment to Third Edition.
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- .3 CSA B149.1-15 with 2017 Ontario Amendments, Natural Gas and Propane Installation Code.

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum board assemblies and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging.
- .3 Storage and Handling Requirements:
 - .1 Store gypsum board assemblies' materials level off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

1.5 AMBIENT CONDITIONS

- .1 Maintain temperature 10 degrees C minimum, 21 degrees C maximum for 48 hours before and during application of gypsum boards and joint treatment, and for 48 hours minimum after completion of joint treatment.
- .2 Apply board and joint treatment to dry, frost free surfaces.
- .3 Ventilation: ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

Part 2 Products

2.1 MATERIALS

- .1 Exterior Glass-mat Gypsum Sheathing: To ASTM C1177/C1177M, with fibreglass mat laminated to both sides, and with manufacturer's standard edges, thickness indicated, 1 220 mm wide by maximum practical length.
 - .1 Acceptable products: CertainTeed GlasRoc Sheathing; Georgia-Pacific Gypsum DensGlass Gold; National Gypsum Gold Bond, e(2)XP; USG Securock Glass Mat Sheathing.
- .2 Standard Board: To ASTM C1396/C1396M, Type X, 13 and 16 mm thick where indicated on Drawings, 1 200 mm wide by maximum practical length, ends square cut, edges bevelled.
- .3 Moisture / Mould / Abuse Resistant Board: To ASTM C1396/C1396M, ASTM C473, ASTM C1629, 16 mm thick, Type X, 1 200 mm wide by maximum practical length.

- .1 Moisture Resistance: to ASTM C473, not greater than 5% after 2 hours.
- .2 Mould Resistance: to ASTM D32373, score 10.
- .3 Abuse Resistance: to ASTM C1629.
 - .1 Abrasion: Level 3.
 - .2 Indentation: Level 1.
 - .3 Soft Body Impact: Level 2.
 - .4 Hard Body Impact: Level 1.
- .4 Glass mat water-resistant gypsum backing board: to ASTM C1178/C1178M, 16 mm thick, 1 200 mm wide x maximum practical length. Mould resistance score 10 in accordance with ASTM D3273.
 - .1 Acceptable products: Custom Building Products Wonderboard Backerboard; CGC Fiberock Aqua-Tough Tile Backerboard, CertainTeed Diamondback GlasRoc Tile Backer, Georgia-Pacific DensShield Tile Backer.
- .5 Metal furring runners, hangers, tie wires, inserts, anchors: to ASTM C1280, galvanized.
- .6 Steel drill screws:
 - .1 For wood and metal framing: to ASTM C1002, except as indicated.
 - .2 For metal framing 0.91 mm and thicker: to ASTM C954.
- .7 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, metal, zinc-coated by hot-dip process, 0.5 mm base thickness, perforated flanges, one piece length per location.
- .8 Acoustic insulation: Batt and blanket mineral fibre: to CAN/ULC-S702.1, Type 1, Formaldehyde Free, install full depth of stud cavity or as indicated.
- .9 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
- .10 Insulating strip: rubberized, moisture resistant, 3 mm thick closed cell neoprene strip, 12 mm wide, with self-sticking permanent adhesive on one face, lengths as required.
- .11 Joint compound: to ASTM C475, asbestos-free.
- .12 Joint tape:
 - .1 Standard board: paper.
 - .2 Moisture/Mould/Abuse resistant board: glass mesh.
 - .3 Glass mat water-resistant: glass mesh.
 - .4 Tile Backing Panels: As recommended by panel manufacturer.
- .13 Access Doors:
 - .1 Access Door Type **AD1**: Wall application recessed Access Door in public areas. Designed for flush installation in gypsum board and plaster wall assemblies while providing an invisible architectural appearance. Provide Access Door with factory installed layer of 16 mm GWB.
 - .1 Material: mill finish aluminum.
 - .1 Mounting frame: recessed aluminum angle extrusion.
 - .2 Door: recessed aluminum angle extrusion, rounded safety corners, concealed hinges, key operated cylinder cam latch, abloy compatible, anchor straps, fitted with layer of 16 mm GWB. Door panel: removable.
 - .2 Access Door Type **AD2**: Wall application recessed access door for back-of-house areas. Designed for flush installation in gypsum board and plaster wall assemblies.

- .1 Material: 1.2 mm cold rolled steel, paint finish.
 - .1 Mounting frame: recessed 1.2 mm cold rolled steel, exposed flanged.
 - .2 Door: recessed aluminum angle extrusion, rounded safety corners, concealed hinges, screwdriver latch, anchor straps, fitted with layer of 1 6mm GWB. Door panel: removable.
- .3 Access Door Type **AD3**: Floor application recessed access door for back-of-house areas. Designed for flush installation in concrete floor assemblies.
 - .1 Material: 6mm aluminum diamond plate, no finish.
 - .1 Mounting frame: recessed 50 x 50 mm x 6 mm aluminum angle.
 - .2 Door: recessed aluminum angle extrusion, square corners, concealed heavy duty aluminum piano hinge, 2.03 mm, recessed handle operated cam latch.
- .4 Access Door Type **AD4**: Ceiling application recessed Access Door for back-of-house areas. Designed for flush installation in gypsum board and plaster wall assemblies.
 - .1 Material: 0.9 mm Galvannealed steel door, white powder coat primer, paint finish.
 - .1 Mounting frame: 1.2 mm cold rolled steel frame, recessed, 76mm deep with 25 mm exposed flange.
 - .2 Door: upward opening, recessed galvanneal steel, rounded safety corners, concealed piano hinge, hex head slam latch outside with self-latching ring operated slam latch inside.
- .5 Sizes: refer to drawings for locations and sizes of all architectural access doors.
- .6 All access doors to be fire rated in accordance with fire separation plans.
- .7 All interior access doors to be uninsulated unless indicated otherwise by STC requirements.
- .14 Perimeter gypsum board trim at linear metal ceiling junctions:
 - .1 Straight two-piece pre-engineered and pre-finished extruded aluminum gypsum board trim, 102 mm high, integrated and pre-punched tapping flange for gypsum board attachment, colour to later selection to manufacturer's full colour range. Refer to drawings. Inside corners to be mitered at 45 degrees.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for gypsum board assemblies' installation in accordance with manufacturer's written instructions.
 - .1 Proceed with installation only after unacceptable conditions have been remedied.

3.2 ERECTION

- .1 Do application and finishing of gypsum board to ASTM C840-24 except where specified otherwise.
- .2 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C840-24 except where specified otherwise.

- .3 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- .4 Install work level to tolerance of 1:1200.
- .5 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers and grilles.
- .6 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.
- .7 Acoustic insulation
 - .1 Install insulation to maintain continuity acoustical separation.
 - .2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
 - .3 Do not compress insulation to fit into spaces.
 - .4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC-S604 Type A chimneys and CSA B149.1 Type B and L vents.

3.3 APPLICATION

- .1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work have been approved.
- .2 Apply gypsum board to metal framing or furring using screw fasteners for all layers. Maximum spacing of screws 300 mm on centre.
 - .1 Single-Layer Application:
 - .1 Apply gypsum board on ceilings before application of walls to ASTM C840-24.
 - .2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.
 - .2 Double-Layer Application:
 - .1 Install gypsum board for base layer and exposed gypsum board for face layer.
 - .2 Apply base layers at right angles to supports unless otherwise indicated.
 - .3 Apply base layer with joints over supports and face layer joints offset at least 250 mm with base layer joints.
- .3 Apply water-resistant gypsum board where epoxy paint to be applied and as indicated on plans. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads.
- .4 Apply glass mat water-resistant gypsum backing board where wall tiles to be applied. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads.
 - .1 Joint treatment: to Section 09 30 13 - Ceramic Tiling.
- .5 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.
- .6 Install gypsum board on walls vertically to avoid end-butt joints. At high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.
- .7 Install gypsum board with face side out.
- .8 Do not install damaged or damp boards.

- .9 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.4 APPLICATION - SEALANT:

- .1 STC-Rated Assemblies:
 - .1 Seal construction at full periphery of partitions, behind control joints, at openings, and penetrations with 12 mm continuous bead of acoustical sealant.
 - .2 Install acoustical sealant at each gypsum board layer in assembly except:
 - .1 For double-layer gypsum board application install maximum two continuous beads, one at each base layer.
 - .3 Comply with ASTM C919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around and through assemblies, including sealing partitions above acoustical ceilings.

3.5 INSTALLATION

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm on centre.
- .2 Install casing beads around perimeter of suspended ceilings.
- .3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.
- .4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.
- .5 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.
- .6 Locate control joints where indicated, at changes in substrate construction, at approximate 10 m spacing on runs greater than 20 m, and at approximate 15 m spacing on ceilings.
- .7 Install control joints straight and true.
- .8 Install access doors to electrical and mechanical fixtures specified in respective sections.
 - .1 Rigidly secure frames to furring or framing systems.
- .9 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.
- .10 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with AWCI GA-214-2021 Levels of Gypsum Board Finish:
 - .1 Levels of finish:
 - .1 Level 0: No taping, finishing or accessories required.
 - .1 Location: temporary construction, behind solid paneling where fire or smoke seal is not required.
 - .2 Level 1: embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable.
 - .1 Location: gypsum board above ceilings, interior side of exterior walls above finished ceilings. Concealed fire separations.

- .3 Level 2: embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.
 - .1 Location: gypsum board behind rigid wall protection, and at Glass mat water-resistant gypsum backing board installed as tile backer
- .4 Level 4: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
 - .1 Location: where gypsum board is to be painted except as indicated below.
- .11 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.
- .12 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.
- .13 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .14 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by gypsum board assemblies' installation.

3.8 SCHEDULES

- .1 Construct ULC fire rated assemblies where indicated.
- .2 Refer to Partition Type Schedule on drawings.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittals
- .2 Section 05 41 00 - Structural Metal Stud Framing.
- .3 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM C645-24, Specification for Nonstructural Steel Framing Members.
 - .2 ASTM C754-20, Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

1.3 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

Part 2 Products

2.1 MATERIALS

- .1 Non-load bearing channel stud framing: to ASTM C645-24, stud size as indicated, roll formed from 0.91 mm thickness hot dipped galvanized steel sheet for abuse or moisture resistant board otherwise standard gauge studs, for screw attachment of gypsum board. Knock-out service holes at 460 mm centres. Wherever abuse resistant or moisture resistant gypsum board is indicated provide min. 20 gauge framing.
- .2 Floor and ceiling tracks: to ASTM C645-24, in widths to suit stud sizes, 32 mm flange height.
- .3 Metal channel stiffener: 40 x 40 mm size, 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.
- .4 Insulating strip: rubberized, moisture resistant 3 mm thick foam strip, 12 mm wide, with self-sticking adhesive on one face, lengths as required.
- .5 Shaftall Steel Studs — "C-H" - shaped studs, min 2-1/2 in. deep, fabricated from min 25 MSG, galv steel. Height and spaced 406 mm OC.

Part 3 Execution

3.1 ERECTION

- .1 Align partition tracks at floor and ceiling and secure at 400 mm on centre maximum
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unless noted otherwise.

- .2 Install damp proof course under stud shoe tracks of partitions on slabs on grade.
- .3 Place studs vertically at 400 mm on center and not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .4 Erect metal studding to tolerance of 1:1000.
- .5 Attach studs to bottom and ceiling track using screws.
- .6 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .7 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.
- .8 Provide two studs extending from floor to ceiling at each side of openings wider than stud centers specified. Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.
- .9 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.
- .10 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.
- .11 Provide 40 mm stud or furring channel secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions.
- .12 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .13 Extend partitions to ceiling height except where noted otherwise on drawings.
- .14 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use double track slip joint as indicated.
- .15 Install continuous insulating strips to isolate studs from uninsulated surfaces.
- .16 Install insulating strip under studs and tracks around perimeter of sound control partitions.
- .17 Install shaftwall steel studs as per UL and manufacturer's specifications and details.

3.2 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED DOCUMENTS

- .1 Drawings and General Provisions of Contract, including General Conditions and other Division 1 Specification Sections, apply to the Work of this Section.

1.1 SUBMITTALS

- .1 Product Data: Submit Manufacturer's technical information and installation instructions for each type of terrazzo, accessory items, and materials.
- .2 Certification: Submit manufacturer's written certification that terrazzo materials meet or exceed specified NTMA properties.
- .3 Samples: Match existing adjacent terrazzo in pattern and color; submit two 6" square samples of each pattern of terrazzo.

1.2 QUALITY ASSURANCE

- .1 NTMA Standards: Comply with specified provisions and recommendations of National Terrazzo and Mosaic Association, Inc. (NTMA), as outlined in the "Terrazzo Specifications and Design Guide" (available at www.ntma.com).

Part 2 Products

2.1 CEMENTITIOUS TERRAZZO MATERIALS

- .1 Portland Cement: ASTM C 150, Type I, except as modified to comply with NTMA requirements for compressive strength. Obtain cement from a single source for each required color.
 - .1 Provide non-staining white cement for terrazzo matrix.
 - .2 Provide standard gray cement for underbed.
 - .2 Sand: Comply with ASTM C 33.
 - .3 Water: Clean, potable, free of oil, soluble salts or other deleterious substances.
 - .4 Aggregate: Natural, sound, crushed marble chips without excessive flats or flakes, complying with NTMA requirements.
 - 1. Colors and gradation of aggregate sizes, as required, to match the existing terrazzo.
 - .5 Matrix Pigments: Pure mineral or synthetic pigments, resistant to alkalis and non-fading. Mix pigments with matrix to provide required colors.
 - .6 Underbed Reinforcement: Galvanized welded wire fabric, 2" X 2" WO.3 X WO.3 (16 ASW gage or 0.0625" diameter); comply with ASTM A 185 and ASTM A82, except for minimum wire size.
 - .7 Curing Compound: Liquid-membrane-forming compound, ASTM C 309, Type 1.
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2.2 TERRAZZO ACCESSORIES

- .1 Divider Strips: Depth and style required for terrazzo type and thickness. Width, material and color as indicated. Angle or "T"-type for adhesive bonding to substrate.
 - .1 Unless otherwise indicated, use white zinc alloy divider strips with 1/4" wide top.

Part 3 Execution

3.1 PREPARATION

- .1 Clean and prepare substrate to comply with NTMA specifications for type of terrazzo application indicated. Clean substrate of loose chips and foreign matter. Grind concrete substrate to provide surfaces within tolerances required by NTMA for type of terrazzo application.

3.2 INSTALLATION, GENERAL

- .1 For cementitious terrazzo, comply with NTMA recommendations for proportioning mixes, installation of strips, and for placing, curing, grinding, grouting and finishing.
- .2 Place and finish terrazzo around obstructions to achieve continuous color, pattern and finish.
- .3 Install divider and accessory strips in adhesive setting bed, in accordance with manufacturer's instructions, without voids below strips. Provide mechanical anchorage as required for adequate attachment of strips to substrate.

3.3 CEMENTITIOUS TERRAZZO

- .1 Sand Cushion Terrazzo: Comply with NTMA Technical Manual and "Guide Specification for Sand Cushion Terrazzo". Prepare sub-slab surfaces to insure positive bonding with underbed. Thoroughly clean areas of foreign matter immediately before placing bond coat. Place underbed while bond coat is still plastic.
- .2 Surfacing: Grout cured terrazzo topping in accordance with NTMA specifications. Delay grinding and finishing until heavy trade work is completed and construction traffic through the area is restricted. Finish by fine grinding with abrasive grit of size specified by NTMA, or as otherwise required to match existing adjacent terrazzo.

3.4 CLEANING, SEALING, AND PROTECTION

- .1 Clean terrazzo after installation and finishing operations are completed, complying with sealer manufacturer's instructions.
- .2 Apply sealer to cleaned terrazzo surfaces to comply with sealer manufacturer's instructions.
- .3 Protect terrazzo from damage and wear during construction operations and until formally accepted by owner.

3.5 FINAL CLEANING

- .1 Clean terrazzo as recommended by manufacturer of sealer and machine buff when area is ready for occupancy.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittals.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C 635-18, Specifications for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
 - .2 ASTM C 636-20, Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
 - .3 ASTM E 1477-98a(2003), Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-92.1-M89, Sound Absorptive Prefabricated Acoustical Units.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .4 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-18, Surface Burning Characteristics of Building Materials and Assemblies.

1.3 SUBMITTALS

- .1 Submit samples in accordance with Section 01 33 00 - Submittals.
 - .1 Submit duplicate 300 x 300 mm samples of each type acoustical units.
- .2 Submit shop drawings in accordance with Section 01 33 00 - Submittals.
 - .1 Submit reflected ceiling plans for special grid patterns as indicated.
 - .2 Indicate lay-out, insert and hanger spacing and fastening details, splicing method for main and cross runners, and acoustical unit support at ceiling fixture.
 - .3 Provide seismic shop drawings stamped and signed by a registered professional engineer licensed in the province of Ontario.

1.4 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittals.
- .2 Submit one representative module of each type ceiling suspension system.
- .3 Ceiling system to show basic construction and assembly, treatment at walls, recessed fixtures, splicing, interlocking, finishes, acoustical unit installation.

1.5 DESIGN REQUIREMENTS

- .1 Maximum deflection: 1/360th of span to ASTM C635-24 deflection test.

1.6 STORAGE AND HANDLING

- .1 Store materials inside, level, under cover. Protect from weather, damage from
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construction operations and other causes, in accordance with manufacturer's printed instructions.

- .2 Handle materials to prevent damage to edges or surfaces. Protect metal accessories and trim from being bent or damaged.

Part 2 Products

2.1 ACOUSTICAL CEILING PANELS

- .1 Acoustic tile: to CAN/CGSB-92.1 Certainteed **PBT 197** colour white non-directional fissured tile, fire-rated 610x1220 as indicated on drawings. No Alternate.

2.2 ACOUSTICAL SUSPENSION SYSTEMS

- .1 T-Bar suspension system: CertainTeed Fire Secure Stab system, fire rated system, colour white, 24 mm wide.
- .2 Intermediate duty system to ASTM C635-20.
- .3 Basic materials for suspension system: commercial quality cold rolled steel, zinc coated.
- .5 Suspension system: fire rated, two directional exposed tee bar grid.
- .6 Exposed tee bar grid components: shop painted satin sheen, white. Components die cut. Main tee with double web, rectangular bulb and rolled cap on exposed face. Cross tee with rectangular bulb; web extended to form positive interlock with main tee webs; lower flange extended and offset to provide flush intersection.
- .7 Hanger wire: galvanized soft annealed steel wire, 2.6 mm diameter for access tile ceilings.
- .8 Hanger inserts: purpose made.
- .9 Accessories: splices, clips, wire ties, retainers and wall molding flush, to complement suspension system components, as recommended by system manufacturer.
- .10 Install outside bullnose track at all bullnose corner unit blocks.

Part 3 Execution

3.1 INSTALLATION OF SUSPENSION SYSTEM

- .1 Installation: in accordance with ASTM C636-20 except where specified otherwise.
- .2 Do not erect ceiling suspension system until work above ceiling has been reviewed and accepted by the Consultant.
- .3 Secure hangers to overhead structure using attachment methods acceptable by the Consultant. **Do not suspend or secure to steel deck.**
- .4 Install hangers spaced at maximum 1200 mm centres and within 150 mm from ends of main tees.
- .5 Lay out system according to reflected ceiling plan.

- .6 Install wall molding to provide correct ceiling height.
- .7 Completed suspension system to support super-imposed loads, such as lighting fixtures diffusers grilles and speakers.
- .8 Support at light fixtures diffusers with additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- .9 Interlock cross member to main runner to provide rigid assembly.
- .10 Finished ceiling system to be square with adjoining walls and level within 1:1000.

3.2 INSTALLATION OF ACOUSTIC PANELS

- .1 Install acoustical panels and tiles in ceiling suspension system.
- .2 Co-ordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, to be built into acoustical ceiling components.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 09 30 13 – Ceramic Tiling.
- .2 Section 09 68 13 – Tile Carpeting.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM D2047-17, Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
 - .2 ASTM F1066-04(2018), Standard Specification for Vinyl Composition Floor Tile.
 - .3 ASTM F1344-15, Standard Specification for Rubber Floor Tile.
 - .4 ASTM F1700-18a, Standard Specification for Solid Vinyl Floor Tile.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-25.21-95, Detergent-Resistant Floor Polish.
- .3 Underwriters Laboratories of Canada (ULC).
 - .1 CAN/ULC-S102.2:2018, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for resilient tile flooring and include product characteristics, performance criteria, physical size, finish and limitations.
 - .3 Samples:
 - .1 Submit duplicate tile in size specified, 300 mm long base, feature strips, edge strips.
 - .4 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 50% of construction wastes were recycled or salvaged.
 - .2 Recycled Content:
 - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing percentages of post-consumer and post-industrial content.
 - .3 Regional Materials: submit evidence that project incorporates required percentage 10% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.
 - .4 Low-Emitting Materials:
 - .1 Submit listing of adhesives and sealants and paints and coatings used in building, showing compliance with VOC and chemical component limits or restriction requirements.
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1.4 MAINTENANCE DATA

- .1 Provide maintenance data for resilient flooring for incorporation into manual.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Provide maintenance materials of resilient tile flooring, base and adhesive in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Deliver 10m2 of each colour, pattern and type flooring material required for this project for maintenance use.
- .3 Extra materials from same production run as installed materials.
- .4 Identify each container of floor tile and each container of adhesive.
- .5 Deliver to Owner, upon completion of the work of this section.
- .6 Store where directed by Owner.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, well-ventilated area.
 - .2 Store and protect specified materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
 - .4 Develop Construction Waste Management Plan related to Work of this Section.
 - .5 Packaging Waste Management: remove for reuse and return to manufacturer pallets, crates, padding, and packaging materials in accordance with Section 01 74 20 – Construction Demolition/Waste Management and Disposal

1.7 ENVIRONMENTAL REQUIREMENTS

- .1 Maintain air temperature and structural base temperature at flooring installation area above 20°C for 48 hours before, during and for 48 hours after installation.

Part 2 Products

2.1 MATERIALS

- .1 Vinyl composition tile: to ASTM F1066, 3.0 mm thick, 305 mm x 305 mm size, colour to match existing. Armstrong Excelon, and Azrock are approved manufacturers. Refer to drawings for locations.
- .2 Resilient base: to ASTM F1344, rubber, cove, minimum 1500 mm length and 152 mm high x 3mm thick, of colours to be selected later, Johnsonite, Flexco, Burke, Amtico or acceptable alternate.

- .3 Primers and adhesives: recommended by flooring manufacturer for specific material on applicable substrate, above, at or below grade.
- .4 Sub-floor filler and leveler: white premix latex requiring water only to produce cementitious paste as recommended by flooring manufacturer for use with their product.
- .5 Metal Edge strips: brushed stainless steel with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.

Part 3 Execution

3.1 INSPECTION

- .1 Ensure concrete floors are dry, by using test methods recommended by tile manufacturer.

3.2 SUB-FLOOR TREATMENT

- .1 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.
- .2 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.
- .3 Prime concrete to flooring manufacturer's printed instructions.

3.3 TILE APPLICATION

- .1 Apply adhesive uniformly using recommended trowel in accordance with flooring manufacturer's instructions. Do not spread more adhesive than can be covered by flooring before initial set takes place.
- .2 Lay flooring with joints parallel to building lines to produce symmetrical tile pattern. Border tiles minimum half tile width.
- .3 Install flooring to ashlar/staggered pattern with pattern grain alternating to produce basket weave pattern.
- .4 As installation progresses, roll flooring in 2 directions with 45 kg minimum roller to ensure full adhesion.
- .5 Cut tile and fit neatly around fixed objects.
- .6 Install flooring in pan type floor access covers. Maintain floor pattern.
- .7 Continue flooring through areas to receive movable type partitions without interrupting floor pattern.
- .8 Terminate flooring at centerline of door in openings where adjacent floor finish or colour is dissimilar.
- .9 Install edge strips at unprotected or exposed edges where flooring terminates.
- .10 Do not slit tiles. Tile to cure by adhesive method.
- .11 Install tile in accordance with tile manufacturer's strict written specifications and/or details.

- .12 Install curved nosing all as per manufacturer's written specifications.
- .13 Provide a mock-up of the coloured pattern tile before proceeding with installation for Consultant review.

3.4 BASE APPLICATION

- .1 Lay out base to keep number of joints at minimum. Base joints at maximum length available or at internal or premoulded corners.
- .2 Set base in adhesive tightly by using 3 kg hand roller, against wall and floor surfaces.
- .3 Install straight and level to variation of 1:1000.
- .4 Scribe and fit to door frames and other obstructions. Use premoulded end pieces at flush door frames.
- .5 Cope internal and external corners. Do not wrap around corner with cove base.

3.5 CLEANING AND WAXING

- .1 Clean in accordance with Section 01 74 11 – Cleaning.
- .2 Remove excess adhesive from floor, base and wall surfaces without damage.
- .3 Strip, shampoo and prepare VCT tile flooring as recommended by manufacturer. Owner will provide final waxing and polishing.
- .4 Progress Cleaning: leave Work area clean at end of each day.
- .5 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

3.6 WASTE MANAGEMENT

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20 – Construction Demolition/Waste Management and Disposal.

3.7 PROTECTION OF FINISHED WORK

- .1 Protect new floors from time of final set of adhesive until final inspection.
- .2 Prohibit traffic on floor for 48 hours after installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00: Submittals.
- .2 Section 01 45 00: Quality Control.
- .3 Section 01 78 00: Closeout Submittals.
- .4 Section 06 20 00: Finish Carpentry.
- .5 Section 06 40 00: Architectural Woodwork.
- .6 Section 08 11 14: Steel Doors and Frames.

1.2 REFERENCES

- .1 Architectural Painting Specifications Manual, Master Painters Institute (MPI).
- .2 Systems and Specifications Manual, SSPC Painting Manual, Volume Two, Society for Protective Coatings (SSPC).
- .3 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).
- .4 National Fire Code of Canada.
- .5 SCAQMD Rule#1168 South Coast Air Quality Management District.
- .6 SCAQMD Rule#1113 South Coast Air Quality Management District.
- .7 GS-11 Green Seal Environmental Standard - Paints.
- .8 GS-03 Green Seal Environmental Standard - Anti-Corrosive Paints.

1.3 QUALITY ASSURANCE

- .1 Contractor shall have a minimum of five years proven satisfactory experience. When requested, provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.
 - .2 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.
 - .3 Conform to latest painting manufacturer's requirements for interior painting work including preparation and priming.
 - .4 Other paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer and shall be compatible with other coating materials as required.
 - .5 Retain purchase orders, invoices and other documents to prove conformance when requested by the Consultant.
-

- .6 Standard of Acceptance:
 - .1 Walls: No defects visible from a distance of 1000 mm at 90° to surface.
 - .2 Ceilings: No defects visible from floor at 45° to surface when viewed using final lighting source.
 - .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.4 SCHEDULING OF WORK

- .1 Submit work schedule for various stages of painting to the Consultant for acceptance. Submit schedule minimum of 48 hours in advance of proposed operations.
- .2 Obtain written acceptance from the Consultant for any changes in work schedule.
- .3 Schedule painting operations to prevent disruption of occupants in and about the building.

1.5 SUBMITTALS

- .1 Submit product data and manufacturer's installation/application instructions for each paint and coating product to be used in accordance with Section 01 33 00 - Submittals.

1.6 SAMPLES

- .1 Submit full range colour sample chips in accordance with Section 01 33 00 - Submittals. Indicate where colour availability is restricted.
- .2 Submit 200 x 300 mm sample panels of each paint or clear coating with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards.
- .3 When accepted, sample panels shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on site.

1.7 DELIVERY, HANDLING AND STORAGE

- .1 Labels shall clearly indicate:
 - .1 Manufacturer's name and address.
 - .2 Type of paint or coating.
 - .3 Compliance with applicable standard.
 - .4 Colour number in accordance with established colour schedule.
- .2 Remove damaged, opened and rejected materials from site.
- .3 Provide and maintain dry, temperature controlled, secure storage.
- .4 Observe manufacturer's recommendations for storage and handling.
- .5 Store materials and supplies away from heat generating devices.
- .6 Store materials and equipment in a well-ventilated area with temperature range 7° C to 30° C.
- .7 Store temperature sensitive products above minimum temperature as recommended by

manufacturers.

- .8 Keep areas used for storage, cleaning and preparation, clean and orderly to acceptance of the Consultant. After completion of operations, return areas to clean condition to acceptance of the Consultant.
- .9 Remove paint materials from storage only in quantities required for same day use.
- .10 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
- .11 Fire Safety Requirements:
 - .1 Provide one 9 kg Type ABC fire extinguisher adjacent to storage area.
 - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from Site on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with applicable law.

1.8 SITE REQUIREMENTS

- .1 Heating, Ventilation and Lighting:
 - .1 Perform no painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10 ° C for 24 hours before, during and after paint application until paint has cured sufficiently.
 - .2 Where required, provide continuous ventilation for seven days after completion of application of paint.
 - .3 Coordinate use of existing ventilation system with the Contractor and ensure its operation during and after application of paint as required.
 - .4 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
 - .5 Perform no painting work unless a minimum lighting level of 323Lux is provided on surfaces to be painted.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 Unless specifically accepted by the Owner, Consultant and the applied product manufacturer, perform no painting work when:
 - .1 Ambient air and substrate temperatures are below 10 ° C.
 - .2 Substrate temperature is over 32 ° C unless paint is specifically formulated for application at high temperatures.
 - .3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.
 - .4 The relative humidity is above 85% or when the dew point is less than 3 ° C variance between the air/surface temperature.
 - .5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
- .2 Perform no painting work when the maximum moisture content of the substrate exceeds:
 - .1 12% for plaster and gypsum board.
 - .2 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".

.3 Test concrete, masonry and plaster surfaces for alkalinity as required.

- .3 Surface and Environmental Conditions:
- .1 Apply paint finish only in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint only to adequately prepared surfaces and to surfaces within moisture limits noted herein.
 - .3 Apply paint only when previous coat of paint is dry or adequately cured.
- .4 Additional Interior Application Requirements:
- .1 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

Part 2 Products

2.1 MATERIALS

- .1 Paint materials that are acceptable for use on this project are as follows: Dulux X-PERT waterborne alkyd, Benjamin Moore Advance Waterborne Alkyd, Para-Premium Hybrid waterborne alkyd and Sherwin Williams Promar 200. No alternates.
- .2 Paint materials for paint systems shall be products of a single manufacturer.
- .3 All transition primer to be "B-I-N" by Zinsser.

2.2 COLOURS

- .1 Colours to be determined.
- .2 Main and accent colours to later selection by owner. Only Dulux, Benjamin Moore, Para and Sherwin Williams paints to be used. NO ALTERNATE.
- .3 Selection of colours will be from manufacturer's full range of colours.
- .4 Where specific products are available in a restricted range of colours, selection will be based on the limited range.
- .5 Second coat in a three-coat system to be tinted slightly lighter colour than topcoat to show visible difference between coats.

2.3 MIXING AND TINTING

- .1 Perform colour tinting operations prior to delivery of paint to Site. On site tinting of painting materials is allowed only with the Consultant.
- .2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.
- .3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.
- .4 Thin paint for spraying according in strict accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from

manufacturer and provide copy of instructions to the Consultant.

- .5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

- .1 Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following values:

Gloss Level Category	Units @ 60°	Units @ 85°
G1 - matte finish	0 to 5	max. 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish(pearl)	20 to 35	min. 35
G5 - semi-gloss finish(melamine)	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	> 85	

- .2 Gloss level ratings of painted surfaces shall be as specified herein and as noted on Finish Schedule.

2.5 INTERIOR PAINTING SYSTEMS

- .1 Concrete Masonry Units:

- .1 New Block walls (and areas behind removed equipment/fixtures/etc: G4
- .1 Provide block filler: Dulux type as required ready to receive primer.
 - .2 Primer coat: Dulux X-Pert Int/Ext waterborne alkydprimer sealer, 23010.
 - .3 Two top coats: G5, Dulux X-Pert Waterborne Alkyd, Semi-Gloss, 22010.
- .2 Existing Block walls: G4
- .1 Provide block filler: Dulux type as required ready to receive primer.
 - .2 Provide Zinsser "B-I-N" primer transition paint as the primer.
 - .3 Primer coat: Dulux X-Pert Int/Ext waterborne alkydprimer sealer, 23010.
 - .4 Two top coats: G5, Dulux X-Pert Waterborne Alkyd, Semi-Gloss, 22010.

- .2 Hollow metal doors and frames (non-cementitious primer) G5 (semi-gloss):
- .1 Primer coat: B-1-N Shellac – Base Primer Sealer by Zinsser – Assume all existing paint is oil base. **Note: Prepare existing surfaces ready to receive primer. Refer to "Cleaning and Preparation" in this specification prior to existing surfaces to be painted. Consult with paint manufacturer for surface preparation requirements and submit written application procedures to Consultant prior to applying primer coat.**

- .2 Two top coats: Dulux X-pert Waterborne Alkyd Semi-Gloss, 22010.
- .3 Plaster and Gypsum Board:
 - .1 Walls: G4 (melamine):
 - .1 Primer coat: Dulux X-Pert waterborne alkyd, 23010.
 - .2 Two top coats: G4, Dulux X-Pert waterborne alkyd, 22010.
- .4 Concrete surfaces (including ceilings):
 - .1 Provide Zinsser "B-I-N" primer transition paint as required.
 - .2 Two top coats: G4, Dulux X-Pert waterborne alkyd, 22010.
- .5 Wood Cabinetry and millwork:
 - .1 Refer to drawings.
- .6 If alternate paint manufacturer is used (see 2.1.1 listing) contractor to submit paint name and paint number of products listed in 2.5, paragraphs 2.5.1 to and including 2.5.5.

Part 3 Execution

3.1 GENERAL

- .1 Perform preparation and operations for interior painting in accordance with MPI Painting Specifications Manual except where specified otherwise.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.2 EXISTING CONDITIONS

- .1 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to the Consultant. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- .2 Maximum moisture content as follows:
 - .1 Plaster and Gypsum Board: 12%.
 - .2 Concrete: 12%.

3.3 PROTECTION

- .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore to the satisfaction of the Consultant.
- .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .3 Protect factory finished products and equipment.
- .4 Removal of electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings shall be done prior to undertaking any painting operations by the Contractor. Items shall be securely stored and re-installed after painting is completed by the Contractor.
- .5 Move and cover furniture and portable equipment as necessary to carry out painting

operations. Replace as painting operations progress.

- .6 As painting operations progress, place "WET PAINT" signs in occupied areas to acceptance of the Consultant.

3.4 CLEANING AND PREPARATION

- .1 Clean and prepare surfaces in accordance with MPI Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
 - .1 Carefully remove paint peelings and surface debris by mechanical means and prepare existing surfaces such that new primer adheres as per paint manufacturers written specifications.
 - .2 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.
 - .3 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
 - .4 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .5 Allow surfaces to drain completely and allow to dry thoroughly.
 - .6 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
 - .7 Use trigger operated spray nozzles for water hoses.
- .2 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.
- .3 Where possible, prime surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
 - .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
 - .2 Apply wood filler to nail holes and cracks.
 - .3 Tint filler to match stains for stained woodwork.
- .4 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
- .5 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by blowing with clean dry compressed air, or vacuum cleaning.
- .6 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.
- .7 Do not apply paint until prepared surfaces have been accepted by the Consultant.
- .8 For preparation of existing previously painted oil type painted surfaces, sand as required in strict accordance with paint manufacturer's written specification's and/or instructions. Also, refer to drawing A1.1, General Notes, item no.9.

3.5 APPLICATION

- .1 Method of application to be as accepted by the Consultant. Apply paint by brush or roller. Conform to manufacturer's application instructions unless specified otherwise.
- .2 Brush and Roller Application:
 - .1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.
 - .2 Work paint into cracks, crevices and corners.
 - .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
 - .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple unless accepted by the Consultant.
 - .5 Remove runs, sags and brush marks from finished work and repaint.
- .3 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically accepted by the Consultant.
- .4 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .5 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .6 Sand and dust between coats to remove visible defects.
- .7 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.
- .8 Finish closets and alcoves as specified for adjoining rooms.
- .9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.
- .10 Paint all walls behind lockers.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

- .1 Unless otherwise specified, paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.
- .2 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.
- .3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.
- .4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .5 Do not paint over nameplates.
- .6 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

- .7 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .8 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.
- .9 Do not paint interior transformers and substation equipment.

3.7 FIELD QUALITY CONTROL

- .1 Advise the Consultant when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been accepted.
- .2 Co-operate with inspection personnel and provide access to areas of work.

3.8 RESTORATION

- .1 Clean and re-install all hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust to accepted of the Consultant. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as accepted by the Consultant.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 1.40-97, Anti Corrosive Structural Steel Alkyd Primer.
 - .2 CAN/CGSB-1.104-M91, Semigloss Alkyd Air Drying and Baking Enamel.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA B355-00(R2005), Lifts for Persons With Physical Disabilities.
 - .2 CSA C22.1-06, Canadian Electrical Code, Part I (20th edition), Safety Standard for Electrical Installations.
 - .3 CSA W59-03, Welded Steel Construction (Metal Arc Welding).
- .3 Green Seal Environmental Standards
 - .1 Standard GS-03-93, Anti-Corrosive Paints.
 - .2 Standard GS-11-97, Architectural Paints.
- .4 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.
- .5 Specification Section 28 16 00 Card Electronic Access Control

1.2 SYSTEM DESCRIPTION

- .1 Provide handicap platform lift as follows:
- .2 Platform: refer to drawings.
- .3 Rated load: 340 kg uniformly distributed on top of platform.
- .4 Travel: Total is +/-914mm (from lower Corridor floor to top of Stage) and is **TO BE SITE VERIFIED**. Serves two landings. Refer to drawings.
- .5 Speed: 3 metres per minute.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .3 Provide shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario.
 - .4 Quality Control Submittals:
 - .1 Manufacturer's Instructions: manufacturer's installation instructions.
 - .5 Closeout Submittals:
 - .1 Provide maintenance data for lift maintenance for incorporation into maintenance manual specified in Section 01 77 00 - Project Closeout.
-

- .2 Include:
 - .1 Description of platform lift system's method of operation.
 - .2 Manufacturers' instructions covering maintenance requirements and parts catalogue giving complete list of repair and replacement parts with cuts and identifying numbers.
 - .3 Legible schematic wiring diagrams covering electrical equipment as supplied and installed, including changes made in final work, with symbols listed corresponding to identity or markings on equipment.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Products/Workmanship.

1.5 WARRANTY

- .1 **Lift manufacturer shall warranty the lift materials and factory workmanship for five years following completion of installation. All doors must work in conjunction with the lift control panel.**
- .2 **Lift manufacturer and/or Supplier shall include preventative maintenance for five years following completion of installation.**

Part 2 Products

2.1 COMPONENTS

- .1 Platform lift: Series 3 Genesis Shaftway by Garaventa Lift. Platform, mid-size, 340 kg capacity, top and bottom for shaftway style, mast to suit travel and pit depth. Refer to drawings for platform size. Contact: Eric Mingelinckx at Upper Canada Elevators, located at 1057 Carp Road, Ottawa, On. K2S 1B9, Office- 613-836-8080. Website www.uppercanadaelevators.com.
- .2 Hollow metal door frame (min. 16ga.) of 1118mm wide x 2206mm high to fit min. 914mm wide x 2033 high hollow metal door slab (min. 18ga.). Doors & frames to be 45min. fire rated, UL labelled c/w glazed vision window – UL labelled for 90min. with “firelite” glazing, min. glazed vision area of 152mm wide x min. 660mm high and located approximately 152mm from lockset door jamb edge and 500mm from door jamb head. Doors located at top and bottom for shaftway style. Provide stainless steel heavy duty non-slip threshold, level with existing floors. Provide auto operators concealed within head of doors.
- .2 “Controls: card swiped switches, delayed opening, in use light. Confirm with Owner exact locations of “card swipes and “keyed switches”. Coordinate with Electrical for Kantech Controllers and proximity readers and refer to Electrical Specification Section 28 16 00, Card Electronic Access Control System. The Kantech system is supplied by Div.28.
- .3 Use major components from standard product line of one manufacturer, or combine with products of another manufacturer provided such items are designed and produced under coordinated specifications to ensure safe and smooth operating system.
- .4 Use components which have performed satisfactorily together under conditions of normal use in not less than two other installations of similar design and for a period of at least one year. Furnish to Consultant names and addresses of owners or managers of buildings, in which proposed combination of major components has so performed.

- .5 Vertical wheelchair platform lifts by "Savaria Elevator" and "Federal Elevator" are approved alternatives on the proviso it meets all requirements of this specification.

2.2 ELECTRICAL WIRING, CONDUIT AND FITTINGS

- .1 Use steel compression type fittings where electrical metallic tubing is used. Do not use fittings with set screws.
- .2 Do not use rigid pvc (unplasticized) conduit.

2.3 POWER SUPPLY

- .1 Power supply: 120 V, 1 phase, 60 Hz.
- .2 Do not parallel conductors to increase current carrying capacity, unless individually fused.
- .3 Do not use armoured flexible metal conduit as grounding conductor.

2.4 FINISH

- .1 Ferrous metal:
 - .1 Clean metal surfaces, treat with phosphate.
 - .2 Apply one coat of primer in accordance with CAN/CGSB 1.40.
 - .3 Apply one coat of paint finish in accordance with CAN/CGSB-1.104.
- .2 Fasteners:
 - .1 Zinc or cadmium finish.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 FIELD QUALITY CONTROL

- .1 Site Tests:
 - .1 Perform and meet tests required by Consultant.
 - .2 Supply instruments and carry out additional specified tests to acceptance of Consultant.
 - .3 Submit to Owner test and approval certificates issued by jurisdictional authorities.
 - .4 Test by operating platform with rated load in up direction at rated speed.
- .2 Manufacturer's Field Services:
 - .1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 The auto operators concealed within head of door slabs works off the platform lift controller. Swipe card activates the button, and upon activating the button and lift arrives at the landing, the door to automatically open. If the platform lift is stationary at the floor, activate the swipe card, and upon activating the button, the door is to automatically open. Installer to set the

door open time, coordinated with Owner. The door will automatically close in the allotted time.

- .4 All doors must work in conjunction with the lift control panel.

3.3 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.

3.4 DEMONSTRATION

- .1 Instruct designated accommodation maintenance personnel in care, adjustment and operation of platforms.

END OF SECTION

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21 06 01	Portable Fire Extinguishers	2
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22 13 16	Drainage Waste and Vent Piping – Cast Iron and Copper	2
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23 23 00	Copper Tubing & Fittings Refrigerant	3
23 31 14	Ductwork – Low Pressure – Metallic to 500 Pa (2 in)	4
23 33 00	Air Duct Accessories	2
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23 81 20	Ductless Split Air Conditioning Units	2

1 GENERAL

- .1 This section covers items common to all sections of Division 20, 22, 23. Division 20 items apply to Divisions 20, 22, 23.
- .2 Obtain and pay for all required permits and approvals.
- .3 The following codes shall apply:
 - .1 Ontario Building Code; O.B.C.
 - .2 Ontario Building Code; Part 7 Plumbing.
 - .3 Ontario Fire Code.
 - .4 Ontario Gas Utilization Code.
 - .5 National Fire Protection Association; N.F.P.A.
 - .6 Technical Standards and Safety Authority (T.S.S.A.) Safety Act and associated documents.
- .4 All code references shall be the latest edition, including revisions and addenda.
- .5 Materials and equipment to be new and free from blemishes, oxidation, damage, etc.. New materials and equipment to be of proven design and quality, and for which replacement parts are readily available. Use current models of equipment.
- .6 It is the intent of the specification that there be one prime contractor for all of Division 20, 22, 23 work. The prime mechanical shall be responsible for all Division 20, 22, 23 subtrades. The prime mechanical shall be responsible for overall coordination and commissioning of systems.
- .7 Concealed mechanical services and equipment includes services and equipment in hung ceilings, crawl space and non-accessible chases and furred spaces. Exposed mechanical equipment and services include mechanical equipment and services exposed in finished room, mechanical and equipment rooms.
- .8 All equipment and services provided by the mechanical Subcontractor shall be supplied, installed and connected by mechanical Subcontractor unless noted otherwise in the Specifications or drawings.

2 EQUIPMENT INSTALLATION

- .1 Unions or flanges: provide for ease of maintenance and disassembly.
- .2 Space for servicing, disassembly and removal of equipment and components: provide as recommended by manufacturer or as indicated.
- .3 Equipment drains: pipe to drains, or funnel floor/hub drains.
- .4 Install equipment, rectangular cleanouts and similar items parallel to or perpendicular to building lines.
- .5 Provide and install all necessary vibration control components.
- .6 Provide and install all backflow preventers necessary to protect the potable water system.
- .7 Pipe humidifier and other interior mounted equipment drains, such as fan coils, to funnel floor/hub drains.

3 ANCHOR BOLTS AND TEMPLATES

- .1 Supply and install anchor bolts and templates for equipment provided by this Division.

4 EQUIPMENT USAGE

- .1 Consultant may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing. Trial usage to apply to all systems.

5 DEFINITIONS

- .1 This definition shall apply to all sections and drawings of Division 20, 21, 22, 23.
 - .1 "CONCEALED" - mechanical services and equipment in hung ceilings and non-accessible chases and furred spaces.
 - .2 "EXPOSED" - will mean "not concealed" as defined herein, e.g. Mechanical Rooms.
 - .3 "PROVIDE" - will mean supply, installation and connection.
 - .4 "T.S.S.A." shall mean "Technical Standards and Safety Authority".

6 PROTECTION OF OPENINGS

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

7 ELECTRICAL

- .1 Electrical work to conform to Division 26, 27, 28 including the following.
- .2 Provide all controls, disconnects, magnetic starters, transformers, relays, wiring and panels for all motors and devices for packaged equipment as indicated in various specification sections.
- .3 Electrical equipment shall bear CSA labels and/or ULC approvals to comply with Ontario Hydro requirements. Conform to the requirements of the Canadian Electrical Code, Ontario Building Code, local, municipal and provincial authorities.
- .4 Control panels to be complete with barriered numbered terminal strip for interconnecting of conductors between master control panel and remote control panel and associated equipment.
- .5 Controls
 - .1 All power and control wiring, relays, transformers and wiring related to motorized dampers, thermostats, controllers, sensors, control panels, control devices, valves, pressure limit switches, etc., which are related to control systems to be provided by Division 22 and 23, unless specifically indicated on electrical drawings otherwise. Refer to electrical control schematics.
 - .2 All wiring in walls to be run in conduit. All wiring in plenum spaces to be plenum rated type FT6. Refer to Division 26 for further details.
 - .3 Control wiring to be copper conductor type RW 90 (XLPE); minimum #14 AWG for power circuits and minimum #18 AWG for control only.
 - .4 Conduit to be E.M.T. minimum 21mmC complete with set screw cast couplings. Provide ground conductor in all conduit runs.
 - .5 Use liquid tight flexible conduit for final connection to motorized dampers and vibrating equipment.
- .6 Panels to be complete with required components including but not limited to:

- .1 One main fused switch suitable current rating for the station load. Pad lockable in both open and closed positions. Mechanically panel interlocked door to prevent opening when handle is in "ON" position.

- .7 Ensure that electrical contractor has provided for auxiliary contacts for the building control systems.

8 MOTORS

- .1 Provide motors for mechanical equipment as specified.
- .2 If delivery of specified motor will delay delivery or installation of any equipment, install motor approved by Consultant for temporary use. Final acceptance of equipment will not occur until specified motor is installed.
- .3 Motors under 373W (1/2hp): speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120V, unless otherwise specified or indicated.
- .4 Motors 373W (1/2hp) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40°C (22°F), 3 phase, 208V, inverter duty unless otherwise specified or indicated.
- .5 Motor efficiency shall be in accordance with CSA C390. Motors 746W (1 hp) and larger to be energy efficient motors conforming to ASHRAE 90.1.
- .6 Power factor correction shall apply to all motors with 3.73kW (5 hp) rating or more.
- .7 All motor starters for loads with a running ampacity (RLA) greater than 20 amps shall be of the solid state reduced voltage type with current ramp and current limit capability. Current limit shall be set at 4 times RLA and ramped to this value over a period of not less 1½ seconds.

9 EQUIPMENT SUPPORTS

- .1 Equipment supports supplied by equipment manufacturer: specified elsewhere in Division 22, 23.
- .2 Equipment supports not by equipment manufacturer: fabricate from structural grade steel.
- .3 Provide all necessary mechanical equipment vibration control, specified or recommended by equipment manufacturer.
- .4 Size anchor bolts to withstand seismic zone acceleration and velocity forces for region of installation.
- .5 Provide seismic restraint of equipment, ducting, piping, tanks and machinery in accordance with Section 20 05 20 – Seismic Restraints.
- .6 Mount base mounted equipment on chamfered edge housekeeping pads, minimum of 100mm (4 in.) high and 150mm (6 in.) larger than equipment dimensions all around. Concrete shall be as specified in Section 03 30 00 - Cast-in-Place Concrete. Housekeeping pads for equipment shall be the responsibility of Division 3.

10 SLEEVES

- .1 Pipe sleeves: at points where pipes pass through masonry, concrete or fire rated

assemblies and as indicated.

- .2 Schedule 40 steel pipe.
- .3 Cast iron sleeves or steel sleeves with annular fin continuously welded at midpoint:
 - .1 Through foundation walls.
 - .2 Where sleeve extends above finished floor.
- .4 Sizes: maximum 6mm (1/4 in.) clearance all around, between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Terminate sleeves flush with surface of concrete and masonry walls, concrete floors on grade and 25mm (1 in.) above other floors. For equipment room floors, terminate 100mm (4 in.) above floor and provide concrete curb.
- .6 Fill voids around pipes:
 - .1 Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof fire retardant non-hardening mastic.
 - .2 Where sleeves pass through walls or floors, provide space for firestopping. Where pipes/ducts pass through fire rated walls, floors and partitions, maintain fire rating integrity.
 - .3 Ensure no contact between copper tube or pipe and ferrous sleeve.
 - .4 Fill future-use sleeves with lime plaster or other easily removable filler.
 - .5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CAN/CGSB 1.181-99.
- .7 This Division shall prepare sleeving drawings indicating the size and locations of openings required in concrete floor slabs, roof slabs/decks and walls for piping, ductwork and equipment. In case of failure to provide information in time (i.e. before the concrete is poured) any extras incurred shall be at the expense of this Division.

11 PREPARATION FOR FIRESTOPPING

- .1 Firestopping material and installation within annular space between pipes, ducts, insulation and adjacent fire separation: Section 07 84 00 - Firestopping and Smoke Seals.
- .2 Uninsulated unheated pipes not subject to movement: no special preparation.
- .3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit to move without damaging firestopping material.
- .4 Insulated pipes and ducts: ensure integrity of insulation and vapour barrier at fire separation. Insulation material used to meet requirements of ULC listing of firestopping system.

12 ESCUTCHEONS

- .1 On pipes passing through walls, partitions, floors and ceilings in finished areas. On pipes passing through millwork and cabinetry.
 - .2 Chrome or nickel plated brass or Type 302 stainless steel, one piece type with set screws. Use cast iron type in equipment rooms.
 - .3 Outside diameter to cover opening or sleeve.
-

- .4 Inside diameter to fit around finished pipe.
- .5 Do not use split-type escutcheon plates.
- .6 Secure to pipe on finished surface but not insulation.

13 TESTS

- .1 Give at least 48h written notice of date for tests.
- .2 Insulate or conceal work only after testing and approval by Consultant.
- .3 Conduct tests in presence of Consultant or authority having jurisdiction.
- .4 Bear costs including retesting and making good.
- .5 Piping:
 - .1 General: maintain test pressure without loss for 4h unless otherwise specified.
 - .2 Hydraulically test hydronic piping systems at 1½ times system operating pressure or minimum 860 kPa (125 psig), whichever is greater.
 - .3 Test drainage, waste and vent piping to Ontario Building Code and authorities having jurisdiction.
 - .4 Test domestic hot, cold and recirculation water piping at 1½ times system operating pressure or minimum 860 kPa (125 psig), whichever is greater.
 - .5 Test natural gas system to CAN/CSA B149.1 and requirements of authorities having jurisdiction.
- .6 Equipment: test as specified in relevant sections.
- .7 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.
- .8 Provide written confirmation for each test conducted.
- .9 Provide any equipment required to conduct tests.
- .10 Test water shall be potable water and should be from a municipal system that treats water with chlorination or some other appropriate means to kill bacteria.

14 PAINTING

- .1 To Section 09 91 23 - Interior Painting.
- .2 Apply at least two coats of corrosion resistant primer paint to ferrous supports and site fabricated work.
- .3 Prime and touch up marred finished paintwork to match original.
- .4 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up. Items suffering major damage to finish shall be replaced entirely, if in the opinion of the Consultant, the damage is too extensive to be remedied by touch up.
- .5 Convector, wall fins, unit heaters, cabinet unit heaters (force flows) and other mechanical equipment exposed in finish areas shall be finish painted by manufacturer with minimum baked enamel finish. Color to be selected by Architect during shop drawing submittals.

15 ACCESS DOORS

- .1 Supply access doors to concealed mechanical equipment for operating, inspecting, adjusting and servicing.
- .2 Flush mounted 600 x 600mm (24 in. x 24 in.) for body entry and 300 x 300mm (12 in. x 12 in.) for hand entry unless otherwise noted. Doors to open 180°, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.
- .3 Material:
 - .1 Special areas such as tiled or marble surfaces: use stainless steel with brushed satin or polished finish as directed by Consultant.
 - .2 Remaining areas: use prime coated steel.
- .4 Installation:
 - .1 Locate so that concealed items are accessible.
 - .2 Locate so that hand or body entry is achieved.
 - .3 Installation by Division 09.
- .5 Standard of Acceptance: Acudor UF-5000
 - .1 Alternate: Mifab UA.
- .6 Fire rated access panels: 1.6mm (16 Ga.) mounting frame, 1.0mm (20 Ga.) sandwich type insulated self-closing door with concealed hinge, 50mm (2 in.) thickness of fire rated insulation in door, self-latching ring pull latch, primer coated, 1½ hour rating.
 - .1 Standard of Acceptance: Acudor FW-5050
 - .2 Alternate: Mifab MPFR
- .7 Access doors must maintain fire rating if installed in a fire rated assembly. Refer to Architectural Drawings for location of fire rated walls and ceilings.

16 DIELECTRIC COUPLINGS

- .1 General:
 - .1 To be compatible with and to suit pressure rating of piping system.
 - .2 Where pipes of dissimilar metals are joined.
- .2 Pipes NPS 2 and under: isolating unions.
- .3 Pipes NPS 2½ and over: isolating flanges.

17 DRAIN VALVES

- .1 Locate at low points and at section isolating valves unless otherwise specified. Locate so that exterior piping and coils can be drained.
- .2 Minimum NPS 3/4 unless otherwise specified: bronze, with hose end male thread and complete with cap and chain.

18 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

- .1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

- .2 Where specified elsewhere in Mechanical Specification, manufacturers to provide demonstrations and instructions.
- .3 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Where deemed necessary, Consultant may record these demonstrations on video tape for future reference.
- .6 Demonstration and Operating and Maintenance Instructions to building operating staff to be completed prior to requesting Certification of Substantial Performance. Provide a written certificate that all training has been completed signed by each manufacturer's representative and the Owner's representative.

19 OPERATION AND MAINTENANCE MANUAL

- .1 Provide operation and maintenance data for equipment supplied. Faxed and/or scanned copies are not acceptable. Photocopied data must be clear.
- .2 Operation and maintenance manual to be approved by, and final copies deposited with, Consultant before final inspection. Operation and Maintenance Manuals shall be prepared in English.
- .3 Operation data to include:
 - .1 Control schematics for each system including environmental controls.
 - .2 Description of each system and its controls.
 - .3 Description of operation of each system at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for each system and each component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .8 Symbol and legend description.
- .4 Maintenance data shall include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .3 Replacement parts list.
 - .4 Warranties.
- .5 Performance data to include:
 - .1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified elsewhere.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
 - .1 Submit 1 copy of draft Operation and Maintenance Manual to Consultant for review. Submission of individual data will not be accepted unless so directed by Consultant. Manual must be compiled in a hard cover, 3-ring, 'D' ring binder complete with inside pockets, index page and index tabs. The name of the project

- must be clearly visible on the front and spine of each binder.
- .2 Make changes as required and re-submit as directed by Consultant.
- .3 Submit one (1) copies of the approved operation and maintenance manual in hard copy format, and one copy on a USB flash drive to the Consultant two weeks prior to substantial completion.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.
 - .2 The contact information (name, address, contact, telephone number, fax number) of the Mechanical and all Sub-Contractors and all suppliers must be included in the manual.
- .8 Conform also to Section 01 77 00 - Project Closeout and Section 01 79 00 - Demonstration and Training.

20 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit electronic copies (i.e. PDF files) produced from electronic sources or 6 copies of shop drawings and product data for equipment supplied. Refer to Section 01 33 00 – Submittals:
 - .1 Faxed and/or scanned copies of equipment data will not be accepted.
 - .2 Shop drawings indicating a range of models and sizes with no selection shown will not be accepted.
- .2 Shop drawings and product data shall show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances. E.g. access door swing spaces.
 - .3 Make model and nameplate data for each piece of equipment.
 - .4 Size and capacity of each piece of equipment.
 - .5 Electrical characteristics.
- .3 Shop drawings and product data shall be accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify as to current model production.
 - .5 Certification of compliance to applicable codes.
 - .6 All operating and performance data indicated in relevant specification sections.
- .4 Shop drawings shall be submitted by specification section. Do not combine more than one section into one submission.
- .5 Shop drawings shall indicate clearly the materials and/or equipment actually being supplied, all details of construction, accurate dimensions, capacity, operating characteristics and performance. Each shop drawing shall give the identifying number of the specific pump, fan, etc. for which it was prepared (e.g. fan F-7).
- .6 Each shop drawing for non-catalogue items shall be prepared specifically for this project. Shop drawings and brochures for catalogue items shall be marked clearly to show the items being supplied.
- .7 Each shop drawing or catalogue sheet shall be stamped and signed by the contractor to indicate that he has checked the drawing for conformance with all requirements of the drawings and specifications, that he has co-ordinated this equipment with other equipment to which it is attached and/or connected and that he has verified all dimensions to ensure

the proper installation of equipment within the available space and without interference with the work of other trades. Ensure that electrical co-ordination is complete before submitting drawings for review. If shop drawings are submitted without the contractors stamp and initials, or it is apparent that the contractor has not completed their review, the shop drawings will be returned by the Consultant and identified to be resubmitted.

- .8 Installation of any equipment shall not start until after final review of shop drawings by the Consultant has been obtained.
- .9 When requested, shop drawings shall be supplemented by data explaining the theory of operation - for example: a variable speed motor control - the Consultant may also request that this information be added to the maintenance and operating manual.
- .10 Provide a lead sheet with the project name, issue date, issue number, specification section number, title of section and with space for shop drawing review stamps for the Contractor and Consultant.
- .11 One original shop drawing will be returned. All copies required for the trades, suppliers or other consultants will be printed by the Contractor.
- .12 Any equipment data, requested calculations, written certifications or other similar information specified or shown on the drawings shall be included with shop drawing submittals.
- .13 The Contractor shall make notations with respect to the following aspects and any other deviations from the contract documents:
 - .1 Deviation from specified performance, electrical requirements and equipment specified.
 - .2 Changes in dimensions from equipment indicated or specified, including confirmation that equipment will fit into space allotted. Contractor shall provide written notation how deviations are being addressed and what coordination with other affected trades has been or will be undertaken.
- .14 Consultant review of shop drawings is for general conformance only, and does not relieve the contractor from meeting all aspects of specification. The contractor is solely responsible for the completeness, correctness, and all information presented on shop drawings. There shall be no additional cost to Project for failure of the consultant to complete a thorough review of shop drawings for compliance. The contractor shall not assume consultant has performed a thorough review and the contractor shall be ultimately responsible for completeness of shop drawings and the equipment conformance with specifications.
- .15 Shop drawings shall be submitted in order of delivery requirements. That is, the items which have long deliveries or are to be installed first shall be submitted first. Not all shop drawings shall be submitted at once. The contractor shall coordinate the sequence of submittals with the Consultant at start of project. The Consultant requires 2 weeks to review individual submissions. For submission of complete systems or for multiple units, such as fan coils submissions, the Consultant requires 3 weeks for their review. The Contractor shall allow for Consultant review times in their schedule.

21 **CLEANING**

- .1 Clean interior and exterior of all systems including strainers.
- .2 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition including replacement of all filters in all air and piping systems.

- .3 Upon completion remove temporary protection. Remove stains and smudges from paint work. Wash and polish plumbing fixtures.
- .4 During the course of construction, each - Subcontractor shall keep his work tidy and not allow an accumulation of debris resulting from his work.
- .5 Upon completion of this work he shall leave the premises in a broom clean condition.
- .6 Replace broken, damaged or scratched fixtures.

22 AS-BUILT DRAWINGS

- .1 Site records:
 - .1 The Consultant will provide the mechanical contractor with two extra sets of white prints on which the mechanical contractor shall clearly mark, as the job progresses, all changes and deviations from that shown on contract drawings. This shall also include changes to existing mechanical systems, control systems and low voltage control wiring. It will not be sufficient to check off line locations. Definite measurements shall be taken for each service line. Drawings shall be kept up-to-date during construction and in addition to field measurements shall include variation orders, field instructions and all other changes. On completion of the building, the mechanical contractor shall forward to the Consultant the two sets of drawings indicating all such changes and deviations for review by the Consultant.
 - .2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection at all times.
- .2 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing (TAB), finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12mm (1/2 in.) high as follows: - AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
 - .3 Submit to Consultant for approval and make corrections as directed.
 - .4 TAB to be performed using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .3 Submit copies of as-built drawings for inclusion in final TAB report.
- .4 Conform also to Section 01 77 00 - Project Closeout.

23 EXAMINATION OF SITE AND INFORMATION

- .1 The contractor, before tendering shall examine the site, the existing building construction and services, the Architectural, Structural, Mechanical and Electrical drawings and he shall familiarize himself with the building construction and finish in order that his tender may include everything necessary for the proper completion of the work.
- .2 It shall be this contractor's responsibility that material and equipment be brought in such assemblies and sizes as to enter into the spaces where they are to be located and to be small enough to be hoisted onto the building without difficulty. Any cutting, patching, etc.

involved in getting large assemblies into place shall be the responsibility of this contractor.

- .3 Immediately inform the Consultant, in writing, of all discrepancies, errors, omissions, contradictions and ambiguities. The necessary Addendum or bulletin will be issued to all Bidders. Include a complete cross-checking of Drawing and Specifications for sizes and quantities to correspond correctly. Data mentioned in the Specifications and not shown on Drawings, and vice-versa, must be interpreted as part of the Work. Oral, telephone or "Telex" instructions are not valid. All questions must be submitted to the Project Manager. Bring obvious discrepancies or omissions to the attention of the Consultant during the Tender Period. Questions may be presented in writing by bidders up to seven days before tender closing. Where the contractor is not able to obtain directions on questions, they shall prepare quotation based on specifications or drawings and include all items required to comply. Where discrepancies still exist within the documents, contractors shall allow for the more demanding installation, more stringent requirement or more expensive equipment specification. Contractors shall instruct all suppliers and distributors of this time limitation.
- .4 The drawings and specifications are intended to describe complete working systems including all necessary labour and materials. Where items required to complete working system are not specified or showing on drawings, contractor shall include costs at no additional expense to Project.

24 CUTTING AND REMEDIAL WORK

- .1 Assume full responsibility for laying out mechanical work and for any damage caused by incorrectly located equipment and mechanical services.

25 CO-ORDINATION

- .1 Locate distribution systems, equipment and materials to provide minimum interference and maximum useable space.
- .2 Where interference occurs, Consultant shall approve relocation of equipment and materials.
- .3 This contractor shall notify other Subcontractors who are concerned, of all openings, foundation work, hangers, inserts, anchors, or other provisions necessary in their work for the installation of this work and he shall furnish all information and necessary materials in ample time so that proper provisions can be made for same, and shall supply and correctly and accurately place all inserts, sleeves, anchors, etc.
- .4 Division 20 Contractor shall supply inserts, hangers, sleeves, anchors, etc. which must be placed within concrete forms to other subcontractors that are concerned with their installation. Division 20 Contractor shall inform responsible contractor of locations. Where anchors are required to be drilled and placed, Division 20 Contractor shall be responsible for their supply and installation. Pipe hangers and supports listed in Section 20 05 29 – Pipe Hangers and Supports shall be provided by Mechanical Contractor.

26 REQUIREMENTS OF INSPECTION DEPARTMENTS

- .1 All work shall be installed in accordance with all laws and regulations of all authorities having jurisdiction in each case, particularly all affected departments of the Municipality and Province. Electrical equipment supplied must conform to the regulations of CSA and the local utility. Anything necessary to make the work comply with these requirements shall be provided by this contractor without additional cost to the Project if reasonably could have been foreseen when tendering.

- .2 The contractor shall prepare drawings in addition to Consultant's drawings as may be required by various Inspection Departments having jurisdiction, and obtain their approval before proceeding with the work.
- .3 In the event that the Inspection Department's request deviates from the Consultant's layout, contractor shall consult the Consultant before proceeding with same.
- .4 Provide all inspection certificates prior to request for substantial completion. Include copy of inspection certificates in Operation and Maintenance Manuals.

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DRAWINGS

- .1 The drawings shall be considered to show the general character and scope of the work and not the exact details of the installation. The installation shall be complete with all accessories required for a complete and operative installation.
- .2 The drawings show the approximate location for the special apparatus and the materials throughout the building. The arrangement shown on the drawings is more or less diagrammatic and as such approximate only, and may be altered, as approved by the Consultant, to meet the requirements of the apparatus, etc., and of the building. Each Subcontractor shall be held responsible for all measurements for his work throughout, and he shall arrange his piping, wiring and apparatus to conform to the Architectural and Structural details in a satisfactory manner and shall cooperate with other contractors to ensure that work shall meet all requirements of diverse Contracts.
- .3 The contractor is particularly cautioned that small scale Consultant's plans must be supplemented by his own detail drawings where necessary for proper coordination of the work.
- .4 Items shown on the drawings but not specified or specified but not shown shall be included.
- .5 Items obviously required to provide a complete working system, but not specified nor shown shall be included.
- .6 In order to show more clearly the arrangement of the work, plans and sections do not show every valve, thermometer, pressure gauge or other system accessory. Refer to the Mechanical Standards details and to the specifications to determine the requirements.
- .7 Certain details indicated on the drawings are general in nature and specific labelled detail references to each and every occurrence of use are not indicated, however, such details shall be applicable to every occurrence on the drawings.
- .8 The location and size of existing services shown on the drawings are based on the best available information. The actual location of existing services shall be verified in the field before work is commenced. Particular attention shall be paid to buried services.
- .9 Changes and modifications necessary to ensure co-ordination and to avoid interference and conflicts with other trades, or to accommodate existing conditions, shall be made at no extra cost to the Project.
- .10 Leave areas clear of piping and ducts where space is indicated reserved for future equipment, and equipment for other trades.
- .11 Adequate space and provisions shall be left for removal of coils and servicing of equipment, with minimum inconvenience to the operation of systems.

- .12 Before fabricating piping or ducting for installation, make certain that such items can be installed as shown on the drawings without interfering with the structure or the work of all other trades. Any problems that cannot be solved in agreement with the other trades affected, shall be submitted to the Consultant for decision. If piping or ducting is prefabricated prior to the investigation and reaching of a solution to possible interference problems, necessary changes in such prefabricated items shall be made at no extra cost to the Project.
- .13 Off-sets in piping or ducting may not be indicated in all cases, but are to be included in the contract as required.
- .14 All piping and ductwork in finished areas shall be concealed in ceiling spaces and shafts or chased into walls. No exposed piping or ductwork shall be installed in such areas unless specifically reviewed by the Consultant. No piping shall be concealed in outside walls.
- .15 Vent pipes, exhaust hoods or other mechanical equipment mounted on roof, or housing for such equipment, shall not be closer to the edge of roof than 1800mm (6 ft.), unless specifically reviewed by the Consultant.
- .16 The actual location of thermostats, switches, etc. shall be reviewed by the Consultant before installation.
- .17 Where equipment is shown to be 'roughed-in only' obtain accurate information from the Consultant before proceeding with the work.

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INSTALLATION, INTERFERENCE AND SETTING DRAWINGS

- .1 Installation, interference and setting drawings dimensioned and to scale, shall be submitted for review to the Consultant, as may be required or requested by the Consultant to make clear the work intended or to show its relation to adjacent work or to the work of other trades. When an alternative piece of equipment is to be substituted for equipment shown, drawings of the area involved shall be prepared by this division. Three copies of such drawings shall be submitted for review, of which one will be retained by the Consultant.
- .2 Installation working drawings to 1:50 scale for the mechanical room showing plan and sections of the plant, services, bases, curbs, drains, motor terminals, shall be prepared by this division.
- .3 Interference drawings are required for shafts, ceiling spaces and wherever there is possible conflict in the positioning of mechanical equipment, piping, ductwork subtrades or architectural features.
- .4 The design of the structural framing of the mechanical equipment and major pipe run supports has been based on assumed loadings supplied during the design phase. Well ahead of the construction of the affected areas, prepare and submit drawings for review to the Consultant showing the layout and weights of all finally selected mechanical equipment including details of concrete pads, concentrated pipe loads and point reactions of the equipment onto the structure. Structural design has been based on equipment listed by model number. Alternate equipment shall not exceed weight and dimensions of equipment listed without prior approval of Consultant. If alternate equipment is not approved by Consultant, contractor shall supply equipment listed at no additional cost to project. If alternate equipment is selected, contractor shall provide all structural revisions necessary and pay all cost including engineering.

- .5 Pump capacities, control valve sizing, etc., have been based on equipment specified. Upon submission of shop drawings, contractor shall review with consultant all design and equipment changes and where required to accommodate design or equipment changes contractor shall consult and revise equipment capacities as required. There shall be no extra cost to Project for changes to equipment to accommodate changes discussed above. No installations shall proceed until this coordination has been completed.

29 ALTERNATES

- .1 Tenders shall be prepared only on the basis of specified or listed equivalent material.
- .2 The design, space allocation, orientation, piping, control systems, etc., are arranged to suit the material and equipment named by model number in the text of the specifications and shown on the drawings. Assume responsibility for adjustments or extension of the work of this or other Division necessary for the accommodation of equivalent or substitute equipment.
- .3 Structural design has been based on equipment listed by model number. Alternate equipment shall not exceed weight and dimensions of equipment listed without prior approval of Consultant. If alternate equipment is not approved by Consultant, Contractor shall supply equipment listed at no additional cost to project. If alternate equipment is approved and selected, contractor shall provide all structural revisions necessary and pay all cost including engineering.

30 ENERGY CONSUMPTION

- .1 Consultant may reject equipment submitted for approval on basis of performance or energy consumed or demanded.

31 CONFORMANCE

- .1 Materials specified by referenced standard, select any material that meets or exceeds the specified standard.
- .2 Materials specified by "Prescriptive" or "Performance" specification, select any material meeting or exceeding specification.
- .3 When materials are specified by a Standard, Prescriptive or Performance specifications, upon request of the Consultant, obtain from manufacturer an independent testing laboratory report showing that the material or equipment meets or exceeds the specified requirements.
- .4 Materials specified by naming one or more materials, select any material named. Where only one name appears in the specification, the tender shall include for the specified equipment. For the purpose of these specifications, the term "Acceptable Material" is deemed to be a complete and working commodity as described by a manufacturer's name, catalogue number, trade name or any combination thereof.
- .5 Manufacturers or subcontractors specified by naming one or more, select any one named. Where only one name appears in the specification, the tender shall include for the specified name.

32 STATEMENT OF PRICES

- .1 To form a basis for progress payments the successful bidder shall submit a statement of

his estimated prices for the various portions of the work, including labour, materials and equipment shown separately. The total price of all portions of the work shall equal the total price of the work covered under the mechanical division.

- .2 The successful bidder shall confer with the Consultant to determine the breakdown of work for this contract.
- .3 The breakdown shall have commissioning cost separated. A minimum of 2% of the contract value shall be assigned for commissioning.
- .4 The breakdown shall have the EMCS controls separated, with a separate breakdown as per Section 23 09 36.
- .5 Equipment values shall not be paid out in full until the equipment is commissioned and working as intended by the design. Ten percent of the equipment value will be held back until such time that the equipment is commissioned and all closeout documentation requested is also submitted.

33 METRIC CONVERSIONS

- .1 Particular care shall be taken with imperial versus S.I. metric conversions. This applies to all services including, but not limited to, equipment, pipes, ductwork and site services in both new and existing installations.
- .2 When converting from one form of measure to the other, do not round-off numbers.

34 ASHRAE 90.1

- .1 All mechanical equipment must meet the minimum efficiency standards set out in ASHRAE 90.1-2013. Submit all necessary information to substantiate conformance.

35 SCHEDULE

- .1 This contractor shall provide a schedule outlining all aspects of the work in sufficient detail to track the progress of the work. Include all critical dates, including delivery to and return of shop drawings to Consultant, inspection dates, dates for training and commissioning systems. Submit schedule to Consultant for review at start of project.
- .2 Contractor shall review schedule on a regular basis and at each construction meeting. The contractor shall provide additional workers as required to meet the schedule. Update schedule as required in conjunction with General Contractor and Consultant.

36 PIPE TROUGHS

- .1 Avoid running piping above electrical, telephone and server rooms. If unavoidable provide pipe troughs beneath piping.
- .2 Provide galvanized steel troughs below all pipes or groups of pipes passing over electrical, telephone and server rooms.
- .3 Troughs to be fabricated from 1.0mm (20 Ga.) galvanized steel, formed wide enough to catch drips from piping.
- .4 Troughs to be adequately supported and sloped for positive drainage. Provide low point drain and pipe to nearest funnel floor drain, hub drain or janitor sink.

37 HOISTING AND RIGGING

- .1 Provide and arrange for transportation, of all equipment and materials to site, and for the rigging, hoisting, storing and setting in place of equipment.

38 WORKMANSHIP AND QUALIFICATIONS OF WORKERS

- .1 Perform the work in a neat and careful manner so that items are installed, and will remain, plumb, square and straight. Items not so installed will be rejected and redone at no extra cost to the Consultant.
- .2 When required either by the specifications or manufacturer's instructions, have manufacturer or his accredited agent or the supplier supervise the work.
- .3 Provide qualified tradespeople to perform all the work. Provide an on site supervisor to supervise the work of Division 20, 22, 23. When requested of the Consultant provide documentation demonstrating experience of tradespeople and supervisor. If tradesperson or supervisor does not have adequate experience or qualifications remove from site and provide suitable replacement. Site supervisor to have minimum of 10 years of experience with demonstrated supervisory experience on similar sized projects. Provide resume of site supervisor to Consultant prior to start of project. Consultant has the right to reject or remove at any time any worker or site supervisory if in his opinion the individual does not possess the required experience or qualifications. When a personnel has been removed or rejected provide suitable replacement.
- .4 No horseplay will be tolerated on site at any time. The contractor shall be responsible for putting an immediate end to all horseplay.

39 CERTIFICATES, PERMITS & FEES

- .1 The contractor shall give all necessary notices, obtain all required permits, and pay all fees, in order that the work herein specified may be carried out, and he shall furnish any certificates needed as evidence that the work installed conforms with the laws and regulations of the Municipality and Province and as approved by the local utility.

40 SPECIAL TOOLS

- .1 Provide one set of special tools required to service equipment as recommended by manufacturers.

41 INSPECTION/TAKEOVER PROCEDURES

- .1 Conform to Section 01 11 13 - General Instruction and Section 01 77 00 - Project Closeout.
- .2 Contractor's Inspection: The Contractor and all Subcontractors shall conduct an inspection of the Work, identify deficiencies and defects; repair as required. Notify the Consultant in writing of satisfactory completion of the contractor's Inspection and that corrections have been made. Request a Consultant's review.
- .3 Consultant's review: Consultant and the Contractor will perform an review of the Work to identify obvious defects or deficiencies. The contractor shall correct Work accordingly. If during the Consultant's review it is obvious that the work is incomplete, the Consultant will notify the Contractor without provision of a deficiency list and the contractor shall complete and correct deficiencies as per item .1
- .4 Final Review: When the items noted above are complete, request a final review of the
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Work by the Consultant. If Work is deemed incomplete by the Consultant, complete the outstanding items and request another review.

- .5 Declaration of Substantial Performance: When the Consultant consider deficiencies and defects have been corrected and it appears requirements of the Contract have been substantially performed, make application for Certificate of Substantial Performance. All other requirements noted elsewhere shall be completed prior to request for Certificate of Substantial Completion.
- .6 Do not apply for substantial performance until:
 - .1 All systems are complete and operation.
 - .2 All systems have been commissioned and successfully passed testing over the entire range of their operating capacities under automatic control. (Note: seasonal or environmental conditions resulting in the delay of some testing will be accommodated by issuance of conditional certificate).
 - .3 Commissioning and testing reports have been submitted for the Consultant's review.
 - .4 Air and water balancing has been completed and reports have been submitted for the Consultant's review.
 - .5 "As-built" and/or record drawings have been prepared and submitted for the Consultant's review.
 - .6 Final Operations and Maintenance Manuals have been prepared and submitted to the Consultant.
 - .7 The Owner, operating and maintenance personnel have received training on all systems and equipment and the required certificate has been submitted to the Consultant.
 - .8 Controls verification and training session.
 - .9 Boiler certification and training session.
 - .10 HVAC unit certification and training session.

42 SCHEDULE, ACCESS, PROTECTION AND CLEAN-UP

- .1 The construction schedule places restrictions on the duration of construction within areas and the duration of shut-down of equipment. Refer to the General Requirements and General contractor for all requirements.
- .2 Access to the site is limited to location and time of day. Access to areas of the building is limited to location and time of day. Refer to the General Requirements for all requirements.
- .3 Refer to the security and protection requirements in the General Requirements, conform to all requirements. In particular no open flames shall be used without prior written approval of the Consultant. There shall be no smoking, and the site shall be kept clean at all times.
- .4 Contractor shall complete all work required in the various spaces during the time scheduled for that phase. Where work or connections are to be made into systems located in a prior phase, the contractor shall complete the work or connections outside of normal hours of operations. Contractor shall complete all work required to systems. Contractor shall place systems back into operation prior to start of normal hours of operation. Include in tender for all overtime costs.

43 CUTTING AND PATCHING

- .1 The cost of cutting, patching and finishing is not included in this divisions contract.
- .2 This division shall advise the trade responsible for cutting, in advance of the time

required, of the location and extent of cutting required, and any other pertinent information.

- .3 This division shall advise the trade responsible for patching and finishing of any pertinent information such as, clearance requirements.
- .4 Refer also to item 27, Coordination and 12, Sleeves for other coordination requirements.
- .5 In case of costs arising to correct work, due to failure to provide coordination information on time, incorrect sizes or locations or other incorrect pertinent information, shall not be extra to Project.

44 GUARANTEE

- .1 This contractor shall guarantee all material and workmanship used in the work to be in strict accordance with the specifications, of best quality and type obtainable to give first-class construction and proper and efficient operation, and free from any defects. Any such defects which may appear in any of the work within one year after written acceptance of this work shall be repaired and replaced by this contractor without additional expense to the Owner. Where such defects occur, this contractor shall be held responsible for all costs incurred in making the defective work good.
- .2 This shall not obsolete any longer warranties on specific items of equipment.
- .3 All injuries to adjacent work particularly plaster, wood finishes or other materials, or damage to other equipment, caused by such defects of this contractor's work or by subsequent replacement and repairs, shall be made good at the expense of this contractor. All repair work shall be done by trades responsible for the original work.
- .4 Guarantee period begins upon acceptance of Substantial Completion.

45 SPARE PARTS

- .1 Furnish spare parts as specified in relevant sections.

46 PROTECTION OF EQUIPMENT

- .1 Temporarily protect all equipment and systems throughout construction from damage as required. Remove measures of protection at end of job.
 - .2 Temporarily enclose boilers in plywood box designed and constructed to protect boiler jacketting from damage due to work above. Remove enclosures at end of job.
 - .3 Any damaged equipment shall be replaced by contractor at no cost to Owner.
 - .4 Do not use equipment or systems as support platforms for work above, provide necessary work platforms as required.
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47 EXISTING SYSTEMS

- .1 Connections into existing systems to be made outside normal hours of operation for building. Request approval of time when connections can be made.
- .2 Be responsible for damage to existing plant by this work.
- .3 Where connections are made to existing services, existing insulation shall be made good under this division.

48 INTERRUPTION OF SERVICES

- .1 Any interruption of mechanical services to any part of the building shall be scheduled with the Owner and General Contractor and shall be completed outside of normal hours of operation of the building. Make all necessary arrangements with those concerned and include for any overtime required to ensure that the interruption is held to a minimum.
- .2 All such overtime work shall be carried out without additional cost to the Project.

19 DEMOLITION

- .1 Division 20 contractor shall remove existing systems and equipment indicated on drawings. In order to determine the extent of the demolition of the existing system, the contractor, before quoting, shall examine the site and determine the extent of existing systems to be removed. The contractor shall be responsible for obtaining an understanding of the extent of the existing systems. No additional cost to the Project will be entertained due to failure of the contractor from reviewing on site the extent of the existing systems to be removed. Existing chiller and water cooled system and components slated for removal must remain until new chilled water system is installed, operational and ready for use.
- .2 The demolition drawings showing existing mechanical systems may not represent "as-built" conditions and it shall be the responsibility of the contractor to verify on site the extent of the existing systems. Contractor shall visit site and confirm extent of existing equipment and system before submitting tender price to determine extent of systems to be demolished. No extras will be allowed for failure of the contractor in completing a thorough review of the site prior to submitting tender price.
- .3 Provide temporary equipment and systems as indicated on the drawings and remove upon completion.
- .4 For exact details and total extent each service must be carefully checked on site. Before removing any service, follow the service through to its source to ensure other areas of the building are not adversely affected by the removal of this service. Open shafts, walls and ceilings as required to examine the service.
- .5 If there are no isolating valves readily available to isolate sections of pipe that requires removal, add valves as required. Install caps on all services. Add caps to all valves at the termination point of existing services.
- .6 Where valves are removed, remove valve tags, revise existing charts and hand tags over to Engineer.
- .7 Where services are to be removed as part of the demolition, obtain written consent from the owner before starting any work or removing any services.

- .8 Unless noted otherwise, removed equipment shall become the property of the contractor and disposed of off-site at an approved location.
- .9 Provide paperwork to indicate appropriate disposal of regulated materials.

50 ABANDONED SERVICES

- .1 Within the work areas of the existing building unknown abandoned services may be encountered. Obtain clarification from the owner regarding these services and remove any sections of services from the work areas as directed.

51 CERTIFICATION

- .1 All equipment and trim shall be certified for use in Ontario, by a qualified testing agency (e.g. CSA).

52 GAS APPLICATION

- .1 This project does not require a new natural gas meter.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Do the work in accordance with the following standards except where specified otherwise:
 - .1 ANSI/ASME B31.1: ASME Code for Pressure Piping and Power Piping.
 - .2 ANSI/ASME Boiler and Pressure Vessels Code:
 - .1 Section 1: Power Boilers.
 - .2 Section V: Non-destructive Examinations.
 - .3 Section IX: Welding and Brazing Qualifications.
 - .3 CSA W47.2 Aluminum welding qualification code.
 - .4 CSA W48 series Electrodes.
 - .5 CSA B51 Boiler, Pressure Vessel and Pressure Piping Code.
 - .6 CAN/CSA-W117.2, Code for safety in welding and cutting (Requirements for welding operators).
 - .7 CSA W178, Qualification code for welding inspection organizations.
 - .8 CSA W178.2, Certification of welding inspectors.
 - .9 AWS B3.0, Welding procedures and performance qualifications.
 - .10 AWS C1.1, Recommended practices for resistance welding.
 - .11 AWS W1, Welding inspection.
 - .12 Technical Standards and Safety Authority, Pressure Vessels Branch (T.S.S.A.).
 - .13 Boiler and Pressure Vessels Regulation (O.Reg. #220/01).

1.2 WELDERS QUALIFICATIONS

- .1 Welding qualifications to be in accordance with CSA B51 and T.S.S.A.
- .2 Use qualified and licensed welders possessing certificate for each procedure to be performed from T.S.S.A.
- .3 Furnish welder's qualifications to Consultant.
- .4 Each welder to possess identification stamp issued by T.S.S.A.

1.3 INSPECTORS QUALIFICATIONS

- .1 Inspectors to be qualified to CSA W178.2-14 and T.S.S.A.

1.4 WELDING PROCEDURES

- .1 Registration of welding procedures in accordance with CSA B51 and T.S.S.A.
- .2 Copy of welding procedures to be available for inspection at all times.
- .3 Safety in welding, cutting and allied processes to be in accordance with CAN/CSA-W117.2-12.

Part 2 Products

2.1 ELECTRODES

- .1 Electrodes: in accordance with CSA W48 series.
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Part 3 Execution

3.1 WORKMANSHIP

- .1 Welding to be in accordance with ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX, using procedures conforming to relevant AWS codes.
- .2 Welding to conform to standards governed by T.S.S.A. and Boiler and Pressure Vessels Regulation (O.Reg. #220/01).

3.2 INSTALLATION REQUIREMENTS

- .1 Identify each weld with welder's identification stamp.
- .2 Fittings:
 - .1 NPS 2 and smaller: install welding type sockets.
 - .2 Branch connections: install welding tees or forged branch outlet fittings.

3.3 INSPECTION AND TESTS - GENERAL REQUIREMENTS

- .1 Review all weld quality requirements and defect limits of applicable codes and standards with Consultant before any work is started.
- .2 Formulate "Inspection and Test Plan" in co-operation with Consultant.
- .3 Do not conceal welds until they have been inspected, tested and approved by inspector.
- .4 Provide for inspector to visually inspect all welds during early stages of welding procedures. Repair or replace all defects as required by codes and as specified herein.
- .5 Inspector shall be an independent agency qualified as per Section I of ASME Boiler and Pressure Vessel Code and T.S.S.A.. Contractor to pay cost of independent inspection agency to act on behalf of Owner.

3.4 SPECIALIST EXAMINATIONS AND TESTS

- .1 General.
 - .1 Perform examinations and tests at contractors' expense by specialist qualified in accordance with CSA W18 and W178.2 and approved by Consultant.
 - .2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.
 - .3 As required by T.S.S.A.
- .2 Hydrostatically test all welds to requirements of ANSI/ASME B31.1, and ASME Boiler and Pressure Vessels Code.
- .3 Visual examinations: include entire circumference of weld externally and wherever possible internally.
- .4 Failure of visual examinations:
 - .1 Upon failure of any weld by visual examination, perform additional testing as directed by Consultant of a total of up to 10% of all welds, selected at random by Consultant by radiographic tests.

3.5 DEFECTS CAUSING REJECTION

- .1 General:
 - .1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.

3.6 REPAIR OF WELDS WHICH FAILED TESTS

- .1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

3.7 CLAIMS AGAINST OWNER FOR DELAYS

- .1 Claims against Owner for delays in completion of project will not be entertained for reasons of failures of welds to pass examinations.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit descriptive data and shop drawings in accordance with Section 20 05 01 – Mechanical General Requirements.
- .2 Descriptive Data
 - .1 Catalog cuts or data sheets on vibration isolators and specific restraints detailing compliance with the specification.
 - .2 Detailed schedules of flexibly and rigidly mounted equipment, showing vibration isolators and seismic restraints by referencing numbered descriptive drawings.
- .3 Shop Drawings
 - .1 Submit fabrication details for equipment bases, including dimensions, structural member sizes, and support point locations.
 - .2 Provide all details of suspension and support for equipment hung from the ceiling.
 - .3 Where walls, floors, slabs, or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for ducts, conduit, and pipe must be included and approved before the condition is accepted for installation. Restraint manufacturers' submittals must include spacing, static loads, and seismic loads at all attachment and support points.
 - .4 Provide specific details of seismic restraints and anchors; include number, size, and locations for each piece of equipment.

1.2 DESIGN REQUIREMENTS

- .1 The contractor shall retain and pay for a specialty consultant or equipment manufacturer to develop and implement a seismic restraint system and perform seismic calculations in accordance with the Ontario Building Code and local codes and additional requirements specific in this section. Calculations, restraint selections, and installation details shall be done by a professional engineer experienced in seismic restraint design and installation and licensed in the Province of Ontario.
 - .2 The seismic restraint design, consisting of calculations, restraint selection, installation details, and other documentation, shall be submitted. This submittal shall be signed and sealed by a professional engineer, as stated above.
 - .3 The seismic restraint design shall clearly indicate the attachment points to the building structure and all design forces (in X, Y, and Z direction) at the attachment points. The seismic restraint engineer shall coordinate all attachments with the building's structural engineer of record, who shall verify the attachment methods and the ability of the building structure to accept the loads imposed. The seismic restraint design shall be based on actual equipment data (dimensions, weight, center of gravity, etc.) obtained from submittals or the manufacturers. The equipment manufacturer shall verify that the attachment points on the equipment can accept the combination of seismic, weight, and other loads imposed.
 - .4 Analysis should include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure. Analysis should detail anchoring methods, bolt diameter, embedment, and/or welded length. All seismic restraint devices should be designed to accept, without failure, the forces through the equipment or system's center of gravity.
 - .5 All seismic restraints and combination isolator/restraints should have verification of their
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seismic capabilities. Manufacturers may verify their capabilities by testing that is witnessed by an independent professional engineer.

- .6 Engineering Design Criteria
 - .1 Design system in accordance with Ontario Building Code for a building of "High" importance.
 - .2 Seismic design must be considered for machinery, equipment, ducts, tanks and pipes.
- .7 The following companies that provide seismic systems are acceptable:
 - .1 HTS Engineering, Brian Gerow, 1646 Woodward Drive, Ottawa, Ontario, K2C 3R8 (613) 728-7400.
 - .2 Tecoustic Ltd., Ryan Belluz, 5036 South Service Road, Burlington, Ontario, L7L 5Y7, (905) 681-6077.
 - .3 E.H. Price, Carmelo Cambareri, 3236 Hawthorne Road, Ottawa, Ontario, K1G 3W9, (613) 725-2029.
 - .4 Capital Seismic & Engineering Ltd., Craig Andrews, Ottawa, Ontario, (613) 222-0141.

Part 2 Products

2.1 ELASTOMERIC PADS DESIGNED FOR THE APPLICATION

- .1 Pads may be either a single layer or two layers separated horizontally by a 1.6mm (16 Ga.) galvanized shim. Load distribution plates shall be used as required. If bolting through the pad is required, type 4 bushings should be used.

2.2 NEOPRENE MOUNTINGS HAVING ALL-DIRECTIONAL SEISMIC CAPABILITY

- .1 The mount should consist of a ductile iron casting or welded steel housing containing a molded neoprene element. The element should prevent the central threaded sleeve and attachment bolt from contacting the housing during normal operation. The neoprene should be compounded to bridge bearing specifications.

2.3 ONE-PIECE MOLDED BRIDGE BEARING NEOPRENE WASHER/BUSHING

- .1 The bushing should surround the anchor bolt and have a flat washer face to avoid metal-to-metal contact.

2.4 SPRING MOUNTINGS

- .1 As in the ASHRAE Handbook, Chapter 46, type 3, should be built into a ductile casting or welded steel housing to provide all-directional seismic snubbing. The snubber should be adjustable vertically and allow a maximum of 6mm (1/4 in.) travel in all directions before contacting the resilient snubbing collars.

2.5 SEISMIC CABLE RESTRAINTS

- .1 Should consist of steel cables sized to resist seismic loads with a minimum safety factor of 2 and arranged to provide all-directional restraint. Cables should be prestretched to achieve a certified minimum modulus of elasticity. Cable end connections should be steel assemblies that swivel to the final installation angle and utilize two clamping bolts to provide proper cable engagement. Alternatively, 45 degree bent steel plates, with holes for attachment to the structure and for steel cable loops with thimbles and wire rope clamps, are acceptable. A minimum of two wire rope clamps is required at each end of

the cable assembly.

2.6 SEISMIC SOLID BRACES

- .1 Should consist of steel angles, channels, or strut channels to resist seismic loads with a minimum safety factor of 2 and arranged to provide all-directional restraint. Seismic solid brace end connectors should be steel assemblies that swivel to final installation angle and utilize two through-bolts to provide proper attachment.

2.7 STEEL ANGLES OR STRUT CHANNELS

- .1 Sized to prevent buckling should be clamped to vertical support rods utilizing a minimum of two clamps at each restraint location when required. Clamp assemblies may be ductile casting or strut channels assemblies.

2.8 PIPE CLEVIS CROSS

- .1 Bolt braces should be required at all restraint locations. They may be special purpose preformed channels deep enough to be held in place by bolts passing over the cross bolt or pipe sections installed over the cross bolt with a minimum of 3mm (1/8 in.) wall thickness.

2.9 SEISMIC SNUBBERS

- .1 Should consist of interlocking steel members restrained by molded neoprene bushings or pads of bridge bearing neoprene. Bushings or pads should be replaceable and a minimum of 6mm (1/4 in.) thick. A minimum air gap of 3mm (1/8 in.) should be incorporated in the snubber design before contact is made between the rigid and resilient surfaces. Snubbers must have a minimum of two bolt holes for attachment to the structure.

2.10 ALL-DIRECTIONAL SEISMIC SNUBBERS

- .1 Should consist of interlocking steel members restrained by shock absorbent neoprene material compounded of bridge bearing neoprene. Neoprene should be a minimum of 3/4 in. 19mm (3/4 in.) thick. Snubbers should be manufactured with an air gap between hard and resilient material of not less than 3mm (1/8 in.) or more than 6mm (1/4 in.). Snubbers should be installed with factory set clearances. Submittals should include the load deflection curves in the X, Y, and Z planes.

2.11 ALL-DIRECTIONAL ACOUSTICAL PIPE ANCHORS

- .1 Consisting of two sizes of steel tubing, pipes, or plates should be separated by a minimum 3mm (1/2 in.) thick neoprene. Vertical restraint should be provided by similar material arranged to prevent vertical travel in either direction. The design should be balanced for equal resistance in any direction.

2.12 PIPE GUIDES

- .1 Should consist of an acoustically telescopic arrangement of two sizes of steel tubing or pipes separated by a minimum 13mm (1/2 in.) thickness of neoprene. The guides should be preset with a device for the setting of the height to allow vertical motion due to pipe expansion or contraction. Guides should be capable of $\pm 41\text{mm}$ ($\pm 1\text{-}5/8$ in.) motion or to meet location requirements.

Part 3 Execution

3.1 GENERAL NOTES

- .1 All seismic restraint systems should be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.
 - .2 Installation of seismic restraints should not cause any change of position of equipment, piping, or ductwork, resulting in stresses or misalignment.
 - .3 No rigid connections between equipment and the building structure should be made that degrade the noise and vibration-isolation system specified.
 - .4 The contractor shall not install any equipment, piping, duct, or conduit that makes rigid connections with the building unless isolation is not specified. "Building" includes, but is not limited to, slabs, beams, columns, studs, and walls.
 - .5 Coordinate work with other trades to avoid rigid contact with the building.
 - .6 Any conflicts with other trades that will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions should be brought to the consultant's attention prior to installation.
 - .7 Prior to installation, bring to the consultant's attention any discrepancies between the specifications and the field conditions or changes required due to specific equipment selection.
 - .8 Overstressing of the building structure should not occur because of overhead support of equipment. Contractor should submit loads to the structural engineer of record for approval. Generally, bracing may occur from:
 - .1 flanges of structural beams,
 - .2 upper truss cords in bar joist construction, and
 - .3 concrete anchors.
 - .9 Type 6 cable restraints should be installed slightly slack to avoid short-circuiting the isolated suspended equipment, ductwork, piping, or conduit. When cables are installed slack a safety factor of 5 shall be used.
 - .10 Type 6 cable assemblies should be installed taut on nonisolated systems. Type 7 seismic solid braces may be used in place of cables on rigidly attached systems only.
 - .11 Cables should not be installed over sharp corners.
 - .12 At locations where type 6 or 7 restraints are located, the support rods should be braced when necessary to accept compressive loads with type 8 braces. Welding of compression braces to the vertical support rods is not acceptable.
 - .13 At all locations where type 6 or 7 restraints are attached to a pipe clevis, the clevis cross bolt should be reinforced with type 9 braces.
 - .14 The vibration-isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails should not be permitted.
 - .15 Post-installed concrete anchors should be as specified in Section 20 05 29 – Pipe Hangers and Supports.
 - .16 When vertical pipe risers are flexibly supported to accommodate thermal motion and/or
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pipe vibration concerns, the pipe shall be guided with type 13 pipe guides, located to maintain pipe stability and provide horizontal seismic restraint. Where necessary, the riser shall also be anchored with type 12 pipe anchors, located to provide thermal control and vertical seismic restraint.

- .17 Seismic restraints should be mechanically attached to the system. It is not sufficient to loop restraints around the system.
- .18 Piping crossing building seismic joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the pipe, equipment connections, or support connections. Pipe offsets, loops, anchors, and guides shall be installed as shown on the plans or as required to provide required motion capability and limit motion of adjacent piping.
- .19 Water tanks should be secured to their saddles by welding or proper concrete attachment, and those saddles should be properly attached to the structure.
- .20 Do not brace a system to two different structures, such as a wall and a ceiling.

3.2 CERTIFICATION

- .1 At the completion of the installation the seismic specialist shall visit the site and review that the installation of restraint for system is in accordance with their design. The specialist shall provide written and stamped certification that the systems have been correctly restrained.

END OF SECTION

Part 1 General

1.1 CODES AND REFERENCES

- .1 Perform work and material to be in accordance with the following:
 - .1 ANSI/ASME B31.1, Power Piping, (SI Edition).
- .2 MSS-SP-58, Pipe Hangers and Supports - Materials, Design and Manufacturer.
- .3 MSS-SP-69, Pipe Hangers and Supports - Erection and Application.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Submit shop drawings and product data for following items:
 - .1 Upper attachment.
 - .2 Middle attachment.
 - .3 Pipe attachment.
 - .4 Riser clamps.
 - .5 Shields and saddles.

1.3 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

1.4 DESIGN REQUIREMENTS

- .1 Construct pipe hanger and support to manufacturer's recommendations utilizing equipment manufacturer's regular production components, parts and assemblies.
- .2 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
- .3 Provide for vertical adjustments after erection and during commissioning.
- .4 Ensure that supports, guides, anchors do not transmit excessive quantities of stress or heat to building structure.
- .5 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS-SP-58.

Part 2 General

2.1 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP-58.
 - .2 Support from structural members, where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members. Do not suspend from metal deck.
-

- .3 All supplementary structural members and supports shall be hot dipped galvanized after fabrication. All steel hangers and rods shall be hot dipped galvanized. All supports beneath liquid levels in tanks shall type 304L stainless steel.
- .4 Provide seismic bracing of piping in accordance with Section 20 05 20 - Seismic Restraints.
- .5 Provide rubber hose over threaded rod on all pipe clamps.
- .6 Provide restraining clips on all c-clamps.
- .7 All steel hangers and rods shall be galvanized.

2.2 UPPER ATTACHMENTS

- .1 Upper Attachments:
 - .1 Concrete:
 - .1 Hollow core block concrete: Adhesive material applied with screen tube.
 - .1 Acceptable material: Hilti Hit Adhesive Anchors, HY 70.
 - .2 Coordinate minimum embedment of adhesive anchors with anchor manufacturer.
 - .3 Submit anchor manufacturer's recommendations for anchoring to structural engineer prior to drilling for supports.
 - .2 Solid cast in place concrete or hollow core slabs: Adhesive material fastened into solid base.
 - .1 Acceptable material: Hilti Hit Adhesive Anchors, HY 200 (Safe Set).
 - .2 Coordinate minimum embedment of adhesive anchors with anchor manufacturer.
 - .2 Steel beam (bottom flange):
 - .1 Cold piping NPS 2 and under: malleable iron C clamp to MSS-SP-58, type 23. ULC listed.
 - .1 Standard of Acceptance: Anvil Int'l. fig.86 or fig.92 c/w fig.89/89x in seismic applications).
 - .2 Cold piping NPS 2-1/2 and larger and all hot piping: malleable iron beam clamp to MSS-SP-58, type 28 or 29. ULC listed.
 - .1 Standard of Acceptance: Anvil Int'l. fig.228.
 - .3 Steel beam (top):
 - .1 Cold piping NPS 2 and under: malleable iron "top of beam" C clamp to MSS-SP-58, type 19. ULC listed.
 - .1 Standard of Acceptance: Anvil Int'l. fig.94.
 - .2 Cold piping NPS 2-1/2 and larger and all hot piping: steel jaw, hook rod with nut, spring washer and plain washer, to MSS-SP-58, type 25. ULC listed.
 - .1 Standard of Acceptance: Anvil Int'l. fig.227.
 - .4 Steel joist:
 - .1 Cold piping NPS 2 and under: steel washer plate with double locking nuts.
 - .1 Standard of Acceptance: Anvil Int'l. fig.60.
 - .2 Cold piping NPS 2-1/2 and larger and all hot piping: steel washer plates with double locking nut, carbon steel clevis and malleable iron socket.
 - .1 Standard of Acceptance: Anvil Int'l.: washer plate fig.60; welded beam attachment fig.66; with weldless eye nut fig.290.
 - .5 Steel channel or angle (bottom):

- .1 Cold piping NPS 2 and under; malleable iron C clamp to MSS-SP-58, type 23. ULC listed.
 - .1 Standard of Acceptance: Anvil Int'l. fig.86 c/w fig.89 (89x in seismic applications)
- .2 Cold piping NPS 2-1/2 and larger and all hot piping; universal channel clamp. ULC listed.
 - .1 Standard of Acceptance: Anvil Int'l. fig.94.
- .6 Steel channel or angle (top):
 - .1 Cold piping NPS 2 and under; malleable iron "top of beam" C clamp to MSS-SP-58, type 19. ULC listed.
 - .1 Standard of Acceptance: Anvil Int'l. fig.94.
 - .2 Cold piping NPS 2-1/2 and larger and all hot piping: steel jaw, hook rod with nut, spring washer and plain washer, to MSS-SP-58, type 25. ULC listed.
 - .1 Standard of Acceptance: Anvil Int'l. fig.227.

2.3 MIDDLE ATTACHMENT (ROD)

- .1 Carbon steel threaded rod electro-galvanized finish.
 - .1 Standard of Acceptance: Anvil Int'l. fig.146.
- .2 Ensure that hanger rods are subject to tensile loading only.
- .3 Provide linkages where lateral or axial movement of pipework is anticipated.

2.4 PIPE ATTACHMENT

- .1 Cold piping, steel or cast iron: hot piping steel, with less than 25mm (1 in.) horizontal movement; adjustable clevis to MSS-SP-58, type 1. ULC listed. Electro galvanized finish.
 - .1 Standard of Acceptance: Anvil Int'l. fig.260.
- .2 Uninsulated Cold copper piping; uninsulated hot copper piping with less than 25mm (1 in.). horizontal movement; adjustable clevis to MSS-SP-58, type 1. Copper plated.
 - .1 Standard of Acceptance: Anvil Int'l. fig.CT-65.
- .3 Suspended hot piping, steel and copper, with horizontal movement in excess of 25mm (1 in.); pipe roller to MSS-SP-58, type 43.
 - .1 Standard of Acceptance: Anvil Int'l. fig.171.
- .4 Bottom supported hot piping, steel and copper: pipe roller stand to MSS-SP-58, type 45.
 - .1 Standard of Acceptance: Anvil Int'l. fig.271.
- .5 Pipe hangers and supports on all cold pipework and hot pipework above NPS 1 must be oversized to accommodate thermal insulation and to avoid penetrating the vapour barrier.

2.5 RISER CLAMPS

- .1 Steel or cast iron pipe: galvanized carbon steel to MSS-SP-58, type 42. ULC listed.
 - .1 Standard of Acceptance: Anvil Int'l. fig.261.
- .2 Copper pipe: carbon steel copper finished to MSS-SP-58, type 42.
 - .1 Standard of Acceptance: Anvil Int'l. fig. CT-121.

2.6 SADDLES AND SHIELDS

- .1 Cold piping and hot copper piping NPS 1-1/4 and over: protection shield with high density

insulation (maximum 25.4mm (1 in.) thick polyisocyanurate) under shield with uninterrupted vapor barrier.

.1 Standard of Acceptance: Anvil Int'l. fig.167.

.2 Hot piping steel NPS 1-1/4 and over: protective saddle with insulation under saddle.

.1 Standard of Acceptance: Anvil Int'l. fig.160 to 166A.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps, boilers, chillers, cooling towers, elsewhere as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to be to industry standards.

.3 Steel pipes: Install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: Install below joint.

.4 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.6 Use approved constant support type hangers where:

.1 Vertical movement of pipework is 13mm (1/2 in.) or more, transfer of load to adjacent hangers or connected equipment is not permitted.

.7 Use variable support spring hangers where:

.1 Transfer of load to adjacent piping or to connected equipment is not critical.

.2 Variation in supporting effect does not exceed 25% of total load.

.8 Support plastic piping as per manufacturer recommendations.

3.2 HANGER SPACING

.1 Spacing and middle attachment (rod) diameter as specified in paragraphs below or as in table below, whichever is more stringent.

.1 Plumbing piping: most stringent requirements of Ontario Building Code, Part 7, or authority having jurisdiction.

.2 Gas piping: Gas Code.

.3 Copper piping: up to NPS 1/2: every 1.5m (5 ft.).

.4 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

.5 Within 300mm (12 in.) of each horizontal elbow.

Pipe Size	Rod Diameter		Maximum Spacing Steel		Maximum Spacing Copper	
	Millimeters	Inches	Meters	Feet	Meters	Feet
Up to 1-1/4	9.5	3/8	2.1	6.9	1.8	5.9
1-1/2	9.5	3/8	2.7	8.9	2.4	7.8
2	9.5	3/8	3.0	9.8	2.7	8.9
2-1/2	9.5	3/8	3.6	11.8	2.7	8.9
3	9.5	3/8	3.6	11.8	3.0	9.8
3-1/2	9.5	3/8	3.9	12.8	3.0	9.8
4	15.9	5/8	4.2	13.7		
5	15.9	5/8	4.8	15.7		
6	22.2	7/8	5.1	16.7		

3.3 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.
- .4 Do not suspend from metal deck.
- .5 Anchoring of piping shall be as per manufacturers recommendations. Submit anchorage system for review before installation.
- .6 The use of perforated band, wire chain, or solid ring type hangers will not be accepted.

3.4 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4° from vertical.
- .2 Where horizontal pipe movement is less than 13mm (1/2 in.), offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.5 FINAL ADJUSTMENT

- .1 Adjust hangers and supports.
 - .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.
- .2 Adjustable clevis.
 - .1 Tighten hanger load nut securely to ensure proper hanger performance.
 - .2 Tighten upper nut after adjustment.
- .3 C-clamps.
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam. Provide restraining clips on all c-clamps.
- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

3.6 SEISMIC RESTRAINTS

- .1 Provide bracing of piping and equipment in accordance with Section 20 05 20 – Seismic Restraints.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-24.3, Identification of Piping Systems.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Product data to include paint colour chips, all other products specified in this section.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Do not dispose of unused paint material into streams, lakes onto ground or in other locations where it will pose a health or environmental hazard.
- .2 Unused paint materials are to be returned to the paint depot or disposed at an official hazardous materials collection site.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 All manufactured equipment to have factory install nameplates.
- .2 Information to include, as appropriate:
 - .1 Equipment: Manufacturer's name, model, size, serial number, capacity.
 - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

- .1 Colours:
 - .1 Hazardous: red letters, white background.
 - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
 - .1 3mm (1/8 in.) thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
 - .1 9mm (3/8 in.) to 12mm (1/2 in.).
 - .2 Use maximum of 25 letters/numbers per line.
- .4 Locations:
 - .1 Terminal cabinets, control panels, disconnects, switches, equipment, pumps & control valves.

2.3 EXISTING IDENTIFICATION SYSTEMS

- .1 Apply new identification system to existing systems.
-

2.4 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify contents by background colour marking; direction of flow by arrows. To CAN/CGSB 24.3.
- .2 Pictograms:
 - .1 Where required, to Workplace Hazardous Materials Information System (WHMIS) regulations.
- .3 Legend:
 - .1 Block capitals to sizes and colours listed in CAN/CGSB-24.3.
- .4 Arrows showing direction of flow:
 - .1 Outside diameter of pipe or insulation less than 75 mm (3 in.): 100 mm (4 in.) long x 50 mm (2 in.) high.
 - .2 Outside diameter of pipe or insulation 75 mm (3 in.) and greater: 150 mm (6 in.) long x 50 mm (2 in.) high.
 - .3 Use double-headed arrows where flow is reversible.
- .5 Extent of background colour marking:
 - .1 To full circumference of pipe or insulation.
 - .2 Length to accommodate pictogram, full length of legend and arrows.
- .6 Materials for background colour marking, legend, arrows:
 - .1 Pipes and tubing 20 mm (3/4 in.) and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.
 - .2 All other pipes: Pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150°C (300°F) and intermittent temperature of 200°C (400°F).
- .7 Colours and Legends:
 - .1 Where not listed, obtain direction from Consultant.
 - .2 Colours for legends, arrows: To following table:

Background Colour	Legend
Yellow	Black
Green	White
Red	White

- .3 Background colour marking and legends for piping systems:

Contents	Background Colour	Legend
Potable Water	Green	POTABLE WATER
Domestic Cold Water Supply	Green	DOM. CWS
Domestic Hot Water Supply	Green	DOM. HWS
Domestic Hot Water Recirculation	Green	DOM. HW RECIRC.
Conduit for Low Voltage Control Wiring	To Section 23 09 36	

2.65 IDENTIFICATION DUCTWORK SYSTEMS

- .1 50 mm (2 in.) high stencilled letters and directional arrows 150 mm (6 in.) long x 50 mm (2 in.) high.
- .2 Colours: Black, or co-ordinated with base colour to ensure strong contrast.

- .3 Stencil over final finish only.

2.6 VALVES, CONTROLLERS

- .1 Brass tags with 12 mm (1/2 in.) stamped identification data filled with black paint.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.7 CONTROLS COMPONENTS IDENTIFICATION

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.

2.8 CONCEALED VALVE AND EQUIPMENT IDENTIFICATION

- .1 Identify locations of concealed valves and equipment with 25mm (1 in.) diameter coloured round labels with adhesive backing.

Equipment or Valve Type	Round Label Colour
Heating	Red
Cooling	Blue
Domestic Hot and Cold Water	Green
Fan Coils	Yellow
Fans	Brown
Fire Dampers	Orange
Coils	Black

2.9 LANGUAGE

- .1 Identification to be in English.

Part 3 Execution

3.1 TIMING

- .1 Provide identification only after all painting specified Section 09 91 23 - Interior Painting has been completed.

3.2 INSTALLATION

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

3.3 NAMEPLATES

- .1 Locations:
.1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
.1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection

- .1 Do not paint, insulate or cover in any way.

3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

- .1 On long straight runs in open areas. At not more than 17m (50 ft.) intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 On both sides of separations such as walls, floors, partitions.
- .4 Where system is installed in pipe chases, ceiling spaces, other confined spaces, at entry and exit points, and at each access opening.
- .5 At beginning and end points of each run and at each piece of equipment in run.
- .6 At point immediately upstream of major manually operated or automatically controlled valves, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .7 Identification to be easily and accurately readable from usual operating areas and from access points.
 - .1 Position of identification to be approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.
- .8 Beside each duct access door.
- .9 On both sides of visual obstructions or where run is difficult to follow.

3.5 VALVES, CONTROLLERS

- .1 Valves and operating controllers. Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Consultant. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Consecutively number valves in system.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CAN/CGSB-51.10-92, Mineral Fibre Board Thermal Insulation.
- .2 CAN/CGSB-51.11-92, Mineral Fibre Thermal Insulation Blanket.
- .3 CAN/CGSB-51.12-M95, Cement, Thermal Insulating and Finishing.
- .4 CGSB 51-GP-52MA, Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .5 American Society of Heating, Refrigeration and Air Conditioning Engineering (ASHRAE).
 .1 ASHRAE Standard 90.1.
- .6 Manufacturer's Trade Associations.
 .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.
- .7 ASTM C411-11, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
- .8 CAN/ULC-S102-10, Surface Burning Characteristics of Building Materials and Assemblies.
- .9 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .10 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

1.2 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

1.3 QUALIFICATIONS

- .1 Installer to be specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather and construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperature and conditions required by manufacturer.

1.5 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as defined herein, including mechanical and equipment rooms, etc...
 - .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

1.6 SAMPLES

- .1 Provide sample installation of round and rectangular ductwork for review by Consultant. Samples shall be accepted prior to start of installations.

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre as specified herein includes glass fibre, rock wool, slab wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C 335.
- .3 Insulation is required on the following ductwork:
 - .1 All supply ductwork with the exception of supply ductwork exposed in space serviced by system.
 - .2 On ductwork systems where both thermal insulation is required and acoustic lining is indicated on the drawings, acoustic lining only shall be provided for the sections indicated and thermal insulation shall be provided for the remainder.
 - .3 For cabinet exhaust fans and range hoods: exhaust air ducting from fan damper to exhaust louver/cowl.
 - .4 Thickness.
 - .1 Supply ducting: 38mm (1-1/2 in.).
 - .2 Exhaust ducting: 38mm (1-1/2 in.).
- .4 Mineral fiber blanket to CGSB-51.11 with vapour barrier to CGSB-51-GP-52MA.
 - .1 For use on all ductwork requiring insulation.

2.3 ACCESSORIES

- .1 Vapour retarder lap adhesive:
 - .1 Water based, fire retardant type, compatible with insulation.
- .2 Indoor Vapour Retarder Finish:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.
- .4 ULC Listed Canvas Jacket:
 - .1 220 g/m² (6 oz/yd²) cotton, plain weave, treated with dilute fire retardant lagging

adhesive to ASTM C 921.

- .5 Tape: self-adhesive, aluminum, reinforced, 75mm (3 in.) wide minimum.
- .6 Contact adhesive: quick-setting.
- .7 Canvas adhesive: washable.
- .8 Tie wire: 1.5mm (16 ga.) stainless steel.
- .9 Banding: 19mm (3/4 in.) wide, 0.5mm (26 ga.) thick stainless steel.
- .10 Facing: 25mm (1 in.) galvanized steel hexagonal wire mesh stitched on one face of insulation.
- .11 Fasteners: 4mm (0.157 in.) diameter pins with 38mm (1-1/4 in.) square clips, length to suit thickness of insulation.

Part 3 Execution

3.1 PRE- INSTALLATION REQUIREMENTS

- .1 Pressure testing of ductwork systems to be complete, witnessed and certified.
- .2 Surfaces to be clean, dry, free from foreign material.

3.2 INSTALLATION

- .1 Install in accordance with TIAC National Standards, NFPA 90A and NFPA 90B.
- .2 Apply materials in accordance with manufacturer's instructions and this specification.
- .3 Maintain uninterrupted continuity and integrity of insulation and vapour retarder jacket and finishes.
 - .1 Hangers, supports, standing duct seams to be outside vapour retarder jacket.
 - .2 Insulation and vapour barrier to be without interruption at sleeves and supports.
- .4 Supports, hangers in accordance with Section 20 05 29 - Hangers and Supports for HVAC Piping and Equipment.
 - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.2, Thermal Insulation, Calcium Silicate, for Exhaust Piping, Machinery and Boilers.
 - .2 CAN/CGSB-51.9, Mineral Fibre Thermal Insulation for Piping and Round Ducting.
 - .3 CAN/CGSB-51.12, Cement, Thermal Insulating and Finishing.
 - .4 CAN/CGSB-51.40, Thermal Insulation, Flexible, Elastomeric, Unicellular, Sheet and Pipe Covering.
 - .5 CGSB 51-GP-52Ma, Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .6 CGSB 51.53, Jacketing, Polyvinyl, Chloride Sheet, for Insulating Pipes, Vessels and Round Ducts.
- .2 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
- .3 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.
- .4 American Society of Testing Materials.
 - .1 ASTM A167, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
 - .2 ASTM C335, Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulations.
 - .3 ASTM C411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

1.2 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves and jointing recommendations.

1.3 QUALIFICATIONS

- .1 Installer to be specialist in performing work of this section and have at least 3 years successful experience in this size and type of project. Installer to be qualified to standards of TIAC.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Delivery materials to site in original factory packaging, labelled with manufacturer's name, address.
 - .2 Protect from weather, construction traffic.
 - .3 Project against damage from any source.
 - .4 Store at temperatures and conditions required by manufacturer.
-

1.5 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as defined herein.

1.6 SAMPLES

- .1 Provide sample mockup of each type of insulation including mock-up of insulation at pipe supports and valves. Samples shall be reviewed and accepted by Consultant prior to start of installations.

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed 0.034 W/m °C at 24°C (75°F) mean temperature when tested in accordance with ASTM C 335.
- .3 Rigid moulded mineral fiber to CGSB-51.9 with factory applied vapour retarder jacket to CGSB-51-GP-52Ma, for use on:
 - .1 Domestic cold water piping.
 - .2 Domestic hot water piping.
 - .3 Storm drainage piping.
 - .4 Valves and fittings for above piping systems.
 - .65 Thickness:
 - .1 Domestic cold water:
 - .1 up to NPS 1 = 25mm (1 in.).
 - .2 NPS 1-1/4 & up = 38mm (1-1/2 in.).
 - .2 Domestic hot water:
 - .1 up to NPS 1-1/4 = 25mm (1 in.) thick.
 - .2 NPS 1-1/2 & up = 38mm (1-1/2 in.) thick.
 - .3 Storm drainage piping:
 - .1 All sizes: 25mm (1 in.) thick.
- .4 Flexible unicellular tubular elastomer for use on:
 - .1 Refrigeration suction and liquid lines.
 - .2 Thickness:
 - .1 Suction lines all sizes: 25 mm (1 in.) thick.
 - .2 Liquid Lines:
 - .1 up to NPS 1: 25 mm (1 in.) thick.
 - .2 NPS 1-1/4 and over: 40 mm (1-1/2 in.) thick.
 - .3 Exterior Piping Jacket: Flex-Clad 400 or Aluminum.
- .5 Insulation systems shall include all flanges, fittings, unions, and other equipment within piping systems. Insulation systems shall include all valves. Insulation for valves and other equipment requiring regular maintenance shall be easily removable and installed per

TIAC standards.

2.3 INSULATION SECUREMENT

- .1 Tape: Self-adhesive, aluminum, reinforced, 50mm (2 in.) wide minimum.
- .2 Contact adhesive: Quick setting.
- .3 Canvas adhesive: Washable.
- .4 Tie wire: 1.5mm (16 Ga.) diameter stainless steel.
- .5 Bands: Stainless steel, 19mm (3/4 in.) wide, 0.5mm (26 Ga.) thick.

2.4 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.

2.5 JACKETS

- .1 Aluminum:
 - .1 To ASTM B 209.
 - .2 Thickness: 0.5 mm (14 Ga.) sheet. 1 mm thick jacket for piping.
 - .3 Finish: Stucco embossed.
 - .4 Joining: Longitudinal and circumferential slip joints with 50 mm (2 in.) laps, weatherproof "Z" type longitudinal joint.
 - .5 Fittings: 0.5 mm (14 Ga.) thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm (3/4 in.) wide, 0.5 mm (26 Ga.) thick at 300 mm (12 in.) spacing.
- .2 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type to CGSB 51.53 with pre-formed shapes as required. One piece moulded preferred shapes to be used for all fitting types including mechanical grooved joint fittings and couplings.
 - .2 Colours: white.
 - .3 Minimum service temperatures: -20°C (-4°F).
 - .4 Maximum service temperature: 65°C (149°F).
 - .5 Moisture vapour transmission: to ASTM E96.
 - .6 Thickness: 0.75mm (0.03 in.).
 - .7 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.
 - .8 Special requirements:
 - .1 Outdoor: UV rated material at least 0.5mm (0.02 in.) thick.

2.6 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS

- .1 Non-shrink, permanently flexible, for applications with insulation systems.
- .2 Service temperature range: -73°C to 149°C (-100°F to 300°F).

.3 Average non-volatile: 97% by weight.

.4 Color: gray.

Part 3 Execution

3.1 PRE- INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces to be clean, dry and free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer's instructions and this specification.

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75mm (3 in.).

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.5 Supports, Hangers:

.1 Apply high compressive strength insulation (maximum 25.4mm (1 in.) thick polyisocyanurate), suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

.6 Install in accordance with ANSI/NFPA 90A and ANSI/NFPA 90B.

.7 Preformed: sectional up to NPS12, sectional or curved segmented above NPS 12.

.8 Multi-layered: staggered butt joint construction.

.9 Vertical pipe over NPS 3: insulation supports welded or bolted to pipe directly above lowest pipe fitting. Thereafter, locate on 5m (15 ft.) centres.

.10 Expansion joints in insulation: terminate single layer and each layer of multiple layers in straight cut at intervals recommended by manufacturer. Leave void of 25mm (1 in.) between terminations. Pack void lightly with flexible mineral insulation.

.11 Seal and finish exposed ends and other terminations with aluminum jacket.

.12 Expansion joints in piping: provide for adequate movement of expansion joint without damage to insulation or finishes.

.13 Flanges and unions at equipment, expansion joints, valves, other components requiring regular maintenance: omit insulation and bevel away from studs and nuts to permit use of tools without damage to insulation, install insulation and finish to permit easy disassembly and replacement without damage to adjacent insulation and finishes.

.14 Secure pipe insulation by tape at each end and centre of each section, but not greater than 900mm (36 in.) on centres.

- .15 Apply thermal insulation on heat traced piping only after the heat tracing has been tested and accepted. Obtain written confirmation of heat trace acceptance.
- .16 Insulate underside of roof drain body with flexible elastomeric unicellular sheet pipe covering (CGSB-51.40) held in place with 100% coverage of adhesive.
- .17 Protect insulation from weather throughout installation and replace any insulation which has become wet.
- .18 Temporarily protect all equipment and systems when working above. Do not use equipment or systems as support during insulation work, provide necessary work platforms as required.

3.3 REMOVABLE PRE-FABRICATED, INSULATION AND ENCLOSURES

- .1 Design: To permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.
- .2 Insulation:
 - .1 Insulation, fastenings, finishes and jackets same as system.
- .3 Removable covers for valves and pump heads shall be installed per TIAC National Standards.

3.4 PIPING INSULATION JACKET SCHEDULES

- .1 Finishes:
 - .1 Outdoors: Water-proof Aluminum jacket.
 - .2 Exposed indoors: PVC jacket.
 - .3 Exposed in mechanical rooms: PVC jacket.
 - .4 Concealed, indoors: No further finish.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

- .1 Insulation to remain dry at all times. Overlaps to manufacturer's instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

END OF SECTION

Part 1 General

1.1 CODES

- .1 Perform work in accordance with the following:
 - .1 NFPA 10, Portable Fire Extinguishers.
 - .2 Ontario Fire Code Part 6.
 - .3 All references to be the latest edition.

1.2 RELATED WORK

- .1 Painting: Section 20 05 01 - Mechanical General Requirements.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.

1.4 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

Part 2 Products

2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS

- .1 Stored pressure rechargeable type with hose and shut-off nozzle, ULC labeled for A, B and C class protection.
- .2 FE-1: surface mounted on bracket.

2.2 EXTINGUISHER BRACKETS

- .1 Type recommended by extinguisher manufacturer.

2.3 IDENTIFICATION

- .1 Identify extinguishers in accordance with recommendations of NFPA 10 and OFC.
- .2 Attach tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

Part 3 Execution

3.1 INSTALLATION

- .1 Mount extinguishers in cabinets on brackets with top of extinguisher at 1200mm (48 in.) above finished floor.
- .2 Install portable fire extinguishers in the following areas:
 - .1 As indicated on drawings.

3.2 SERVICE

- .1 Provide initial servicing for all extinguishers installed at occupancy. Provide inspection tag
-

with servicing dated punched out. Date of punched tag to match date of Occupancy.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ANSI/ASME B16.15, Cast Copper Alloy Threaded Fittings: Classes 125 and 250.
- .2 ANSI B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
- .3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
- .4 ANSI/ASME B16.24, Copper Alloy Pipe Flanges and Fittings: Classes 150, 300, 600, 900, 1500 and 2500.
- .5 ASTM B88, Specification for Seamless Copper Water Tube (Metric).
- .6 CSA B242, Grooved and Shoulder Type Mechanical Pipe Couplings.
- .7 MSS-SP-67, Butterfly Valves.
- .8 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Submit data for following:
 - .1 Valves

1.3 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

Part 2 Products

2.1 PIPING

- .1 Domestic hot, cold and recirculation systems, within building.
 - .1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.
 - .2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.
 - .3 Tubing to be USA/Canada only.

2.2 FITTINGS

- .1 Copper alloy pipe flanges and flanged fittings, Class 150: to ANSI B16.24.
 - .2 Cast copper alloy threaded fittings, Class 125: to ANSI/ASME B16.15.
 - .3 Cast copper, solder type: to ANSI B16.18.
 - .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
 - .5 Fittings to be USA/Canada only.
-

2.3 JOINTS

- .1 Rubber gaskets, 1.6mm (1/16 in.) thick: to ANSI/AWWA C111/A21.11.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3 Solder: lead free solder containing less than 0.2% lead in accordance with ASTM B32 "solder metal".
- .4 Teflon tape: for threaded joints.
- .6 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.

2.4 VALVES GENERAL

- .1 The following manufacturers are acceptable:
 - .1 Crane
 - .2 Jenkins
- .2 All other brands of valves installed under this Contract will be identified for removal and replacement with specified valves prior to issuing Substantial Performance.
- .3 Valves to be USA/Canada only.

2.5 GLOBE VALVES

- .1 NPS 2 and under, soldered.
 - .1 To MSS SP-80, Class 150, 1034 kPa (150 psi) bronze body, renewable composition disc, screwed over bonnet.
 - .2 Lockshield handles.
- .2 NPS 3 and under, screwed:
 - .1 To MSS SP-80, Class 125, 860 kPa (125 psi) bronze body, screwed over bonnet, renewable composition disc.
 - .2 Lockshield handles: as indicated.

2.6 SWING CHECK VALVES

- .1 NPS 3 and under, soldered or threaded ends.
 - .1 To MSS SP-80, Class 150, 1304 kPa (150 psi) bronze body, bronze swing disc, screw in cap, regrindable seat.
 - .2 Standard of acceptance: Crane 1342.
- .2 NPS 4 and over, flanged:
 - .1 To MSS SP-71, Class 125, 860 kPa (125 psi), cast iron body, flat flange faces, regrind renewable seat, bronze disc, bolted cap.

2.7 BALL VALVES

- .1 NPS 3 and under:
 - .1 2 piece standard port to MSS SP-80, Class 150, 2758 kPa (400 psi) WOG bronze body, stainless steel ball, PTFE Packing, PTFE seal, and steel lever handle, soldered or threaded ends.

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with Ontario Building Code Part 7 Plumbing and local authority having jurisdiction.
- .2 Cut square, ream and clean tubing and tube ends, clean recessed of fittings and assemble without binding.
- .3 Assemble all piping using fittings manufactured to ANSI standards.
- .4 Install tubing close to building structure to minimize furring, conserve headroom and space. Group exposed piping and run parallel to walls.
- .5 Install CWS piping below and away from HWS and HWR and all other hot piping so as to maintain temperature of cold water as low as possible.
- .6 Connect to fixtures and equipment in accordance with manufacturer's instructions unless otherwise indicated.
- .7 Buried tubing:
 - .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
 - .2 Bend tubing without crimping or constriction. Minimize use of fittings.
- .8 Piping installed through or within masonry walls shall be protected with polywrap so that the piping does not come in contact with concrete. This includes all insulated piping.

3.2 VALVES

- .1 Isolate equipment, fixtures and branches with ball valves.

3.3 PRESSURE TESTS

- .1 Conform to requirements of Section 20 05 01 – Mechanical General Requirements.
- .2 Test pressure: greater of 1½ times maximum system operating pressure or 860 kPa (125 psi).
- .3 Test in accordance with Ontario Building Code.

3.4 DISINFECTION

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction.
 - .2 Upon completion, provide laboratory test reports on water quality for Consultant review.
 - .3 Provide necessary chemicals and equipment and disinfect system to requirements of the Ontario Building Code. Disinfection shall be in accordance with the procedures outlined in Appendix item A-7.6.2.8.(1) Flushing and Disinfecting Water Services Pipes, in the 2012 Ontario Building Code and supplemented as follows:
 - .1 All lines shall be disinfected, including distribution lines within building and including lines smaller than 100mm (4 in.) in diameter.
 - .2 Free chlorine residual at ends of lines after disinfection to be greater than 0.05mg/L.
 - .3 The Contractor shall carry out three consecutive tests of water samples (24
-

hours apart or greater) at all remote points of system for E-coli, total coliform, and heterotrophic plate count. Results shall show zero presence, and results shall be reviewed and accepted by Consultants.

- .4 Contractor shall repeat the above disinfection procedures until satisfactory test results are received and accepted by the Consultant.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CAN/CSA-B181.2, PVC Drain, Waste and Vent Pipe and Pipe Fittings.
- .2 CAN/CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with Section 20 05 01 – Mechanical General Requirements.
 - .1 Piping.
 - .2 Couplings.
 - .3 Firestopping devices.

MAINTENANCE DATA

1.3

- .1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 – Mechanical General Requirements.

Part 2 Products

2.1 PIPING AND FITTINGS

- .1 Plastic piping shall be used in the following applications:
 - .1 Buried applications for sanitary, storm and vent.
 - .2 Above ground applications for sanitary, storm and vent piping. Above ground plastic piping to be PVC DWV and listed by ULC to have a maximum flame spread no greater than 25, and a maximum smoke developed of no greater than 50 when tested in accordance with CAN/ULC S102. Provide certified firestopping devices where plastic piping penetrates fire separations. The firestopping devices shall be certified to the Standard CAN4-S115.
- .2 Materials to conform to:
 - .1 CAN/CSA-B181.2.
 - .2 CAN/CSA-B182.1.
- .3 Standard of Acceptance: IPEX System XFR.

2.2 JOINTS

- .1 Solvent weld for PVC: to CSA-B181.2.
- .2 Solvent weld for ABS: to CSA-B181.1.
- .3 The VOC content of adhesives and sealants used in the interior of the building envelope must be less than the VOC content limits of SCAQMD Rule #1168.
 - .1 Subcontractor to provide cut sheets, Material Safety Data Sheets, signed attestations or other official literature from manufacturers clearly identifying product emission rates. Documentation showing amount (in gallons) of each materials used should also be provided.

2.3 FIRE STOP DEVICES FOR PVC PLASTIC PIPE

- .1 On all PVC piping where piping passes through a fire rated wall or ceiling.
-

- .1 Certified to CAN4-S115.
- .2 Acceptable material: 3M fire barrier plastic pipe device.
- .3 Rated to maintain rating of penetrated wall – refer to architectural drawings for wall ratings.

Part 3 Execution

3.1 INSTALLATION

- .1 Install and test in accordance with Ontario Building Code Part 7 Plumbing and local authority having jurisdiction.
- .2 Install buried pipe on 150mm (6 in.) bed of washed clean sand or granular 'A' shaped to accommodate fittings, to line and grade as indicated. Backfill with same material.
- .3 Support of piping to be in accordance with O.B.C. Part 7. Spacing of supports shall not exceed loading for structural systems.
- .4 Manufacturer's representative shall review installation prior to concealment and provide written certification that piping installation and firestopping is installed correctly and as per ULC listings.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
- .2 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
- .3 CAN/CSA-B64 Series, Backflow Preventers and Vacuum Breakers.
- .4 CAN/CSA-B79, Commercial and Residential Drains and Cleanouts.
- .5 CSA-B356, Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .6 PDI-G101, Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.
- .7 PDI-WH201, Water Hammer Arresters.
- .8 Ontario Building Code Part 7.

1.2 SUBMITTALS

- .1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 For shop drawings, indicate dimensions, construction details and materials for all materials specified in this section.
- .3 For product data, indicate dimensions, construction details and materials for all items specified herein.

1.3 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.
- .2 Data to include:
 - .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.

Part 2 Products

2.1 ROOF DRAINS

- .1 RD-1: pan-formed copper drain body, deck flange and straight copper outlet with brass ferrule, stainless steel bolts welded to drain, brass stabilizer ring, cast aluminum under-deck clamping ring cast aluminum dome strainer, flow control accessory.
 - .1 Acceptable Material: Thaler RD-4C.

2.2 WATER HAMMER ARRESTORS

- .1 Hard drawn copper construction, piston type: to PDI-WH 201.
-

- .2 Standard of Acceptance: Watts SG-Series.
- .3 Acceptable Alternates: Amtrol, Jay R. Smith, Wade, Zurn.
- .4 Size and capacity as indicated on drawings.

2.3 PLUMBING ROOF FLASHINGS

- .1 For all plumbing vents passing through the roof: Insulated vandal proof aluminum stack jack flashing with aluminum hood and perforated collar, thick pre-molded urethane insulation liner, EPDM base seal, and bituminous painted deck flange.
 - .1 Acceptable Material: Thaler SJ-31.

Part 3 Execution

3.1 INSTALLATION

- .1 Install and test in accordance with Ontario Building Code Part 7 Plumbing and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.
- .3 Provide backflow preventors on domestic water connections to any non-potable systems and equipment.

3.2 WATER HAMMER ARRESTORS

- .1 Install on branch supplies to each fixture or group of fixtures as indicated.

3.3 START-UP

- .1 Floor drains:
 - .1 Prime, using trap primer.
- .2 Roof drains:
 - .1 Clean out baskets.
 - .2 Adjust flow control to value indicated on plan.
- .3 Rectify start-up deficiencies.

3.4 COMMISSIONING

- .1 After start-up, test, adjust and provide operation as indicated, to suit site conditions such as:
 - .1 Clean out strainers periodically until clear.

END OF SECTION

Part 1 General

1.1 TAB AGENCY

- .1 General:
 - .1 All work described in this section to be performed by independent TAB Agency.
- .2 Certification:
 - .1 Submit documentation to confirm qualifications, experience of TAB Agency personnel.
- .3 Quality assurance:
 - .1 Perform TAB to standards of NEBB.
- .4 Co-ordination:
 - .1 Co-ordinate all work specified in this Section.
 - .2 Provide all facilities required by TAB Agency in order to carry out work of this Section.
- .5 Adequacy of work for TAB:
 - .1 TAB Agency to review contract documents before work is started and confirm in writing to Consultant adequacy of provisions for TAB and all other aspects of installation pertinent to TAB.
- .6 The following companies are acceptable:
 - .1 E.B. Balancing Inc.
 - .2 Kanata Air Balancing and Engineering.
 - .3 Data Air Testing and Balancing Ltd.
 - .4 Airwaso Ltd.
 - .5 Maxima Air Balancing.
 - .6 McKinley Air Balancing.
 - .7 TAB Inspecting Limited.

1.2 GENERAL

- .1 TAB: means to test, adjust and balance all systems to perform in accordance with Contract Documents and to do all other work as specified in this section.
 - .2 Follow start-up procedures as recommended by manufacturer unless otherwise specified.
 - .3 Special start-up procedures may be specified elsewhere.
 - .4 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with all other related systems under all normal and emergency loads and operating conditions.
 - .5 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.
 - .6 Notify Consultant 7 days prior to start of TAB.
 - .7 Operate all systems to permit TAB to be performed.
 - .8 TAB to apply to systems, equipment and related controls specified in Divisions 22 and 23.
-

- .9 Reference organization standards:
 - .1 Do TAB over entire operating range in accordance with most stringent conditions of this specification and standard of following organization.
 - .1 AABC (Associated Air Balance Council).
 - .2 NEBB (National Environmental Balancing Bureau).
 - .3 SMACNA (Sheet Metal & Air Conditioning Contractors National Association).
 - .4 ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers).
- .10 Start TAB only when building is essentially completed, including:
 - .1 Installation of ceilings, doors, windows and other construction affecting TAB.
 - .2 Application of sealing, caulking and weatherstripping.
 - .3 All pressure, leakage and other tests specified elsewhere in Divisions 22 and 23 completed.
 - .4 All provisions for TAB are installed and operational.
 - .5 Start-up, verification for proper, safe and normal operation of mechanical and associated electrical and control systems affecting TAB including, but not limited to, the following:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Air Systems:
 - .1 Filters in place and in clean conditions.
 - .2 Duct systems clean of debris.
 - .3 Air shafts, ceiling plenums are airtight to within specified tolerances.
 - .4 Correct fan rotation.
 - .5 Fire and volume dampers in place and open.
 - .6 Coil fins cleaned and combed.
 - .7 Access doors closed and duct end caps in place.
 - .8 All outlets installed and connected.
- .11 Accuracy tolerances:
 - .1 Do TAB to following tolerances of design values:
 - .1 HVAC systems: $\pm 5\%$.
 - .2 Measurements to be accurate to within plus or minus 2 % of actual values.
- .12 Instrument calibration: to be in accordance with TAB referenced organization standard, and completed within 3 months of commencement of TAB.
 - .1 Provide proof of calibration to Consultant upon request.
- .13 Submittals prior to commencement of TAB:
 - .1 Proposed methodology and procedures for performing TAB.
 - .2 Proposed check lists and report forms.
 - .3 List of instrumentation, including details and certificates of calibration.
- .14 Report:
 - .1 Format to be in accordance with TAB referenced organization standard, but using SI units.
 - .2 Report to include record full system schematics showing results of TAB.
 - .3 Submit, prior to formal submission of TAB reports, for checking and approval by Consultant, sample of rough TAB sheets. Include:
 - .1 Details of instruments used.
 - .2 Details of TAB procedures employed.
 - .3 Calculations procedures.
 - .4 Summaries.
 - .4 Submit 1 draft copy of TAB reports, each in "D" ring binders, complete with index

- tabs for verification and approval of Consultant. Digital copies (PDF are also acceptable for draft copy).
- .5 Refer to attached sample TAB sheets for expected format.
- .6 Submit 1 hard copy and 1 PDF copy of approved TAB reports with O&M.
- .15 Verification:
 - .1 Reported measurements shall be subject to verification by Consultant. Provide instrumentation and manpower to verify results of up to 30 % of all reported measurements. Number and location of verified measurements to be at discretion of Consultant.
 - .2 Bear costs to repeat TAB, as required, to satisfaction of Consultant.
- .16 Settings: lock and permanently mark settings as required by reference standard.
- .17 Completion: TAB to be considered complete only when final reports are reviewed and accepted by Consultant.
- .18 The project will be considered incomplete until a TAB report is accepted by Consultant. Substantial completion will only be issued once the TAB report is accepted by Consultant.
- .19 TAB Contractor shall provide pulley and belt changes as required. Parts shall be provided by Division 20 Contractor.

1.3 AIR MOVING SYSTEMS

- .1 General: measurements as required by referenced organization standards, including, but not limited to, following:
 - .1 Measurements:
 - .1 Air velocity.
 - .2 Static pressure.
 - .3 Velocity pressure.
 - .4 Flow rate.
 - .5 Pressure drop.
 - .6 Temperature.
 - .1 Wet bulb.
 - .2 Dry bulb.
 - .7 Cross sectional area.
 - .8 RPM.
 - .9 Electrical power:
 - .1 Voltage.
 - .2 Current draw.
 - .10 Noise and vibration.
 - .2 Location of equipment measurements:
 - .1 Inlet and outlet of each:
 - .1 Fan.
 - .2 Coil.
 - .3 Filter.
 - .4 Damper.
 - .5 Other auxiliary equipment.
 - .3 Location of system measurements at:
 - .1 Main ducts.
 - .2 Main branch ducts.
 - .3 Sub-branch ducts.
 - .4 Each supply, exhaust and return air inlet and outlet.
 - .5 Other auxiliary equipment.

.6 All areas served by system.

Part 2 Products

2.1 NOT USED

.1 Not Used

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 CODES AND REFERENCE

- .1 All work and material to be in accordance with following:
 - .1 ANSI B16.22, Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings.
 - .2 ANSI B16.24, Bronze Pipe Flanges and Flanged Fittings, Class 150 and 300.
 - .3 ANSI B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
 - .4 ANSI/ASME B31.5, Refrigeration Piping.
 - .5 ASTM B88M, Specification for Seamless Copper Water Tube.
 - .6 ASTM B280, Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
 - .7 CSA B52, Mechanical Refrigeration Code.
 - .8 EPS 1/RA/1, Code of Practice for the Reduction of CFC's (Environment Canada).
 - .9 References shall be the latest update version.

Part 2 Products

2.1 TUBING

- .1 Provide processed tubing for refrigeration installation, deoxidized, dehydrated, and sealed.
- .2 Hard copper tube, type ACR, or L to ASTM B88M.
- .3 Annealed copper tube to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5.
- .4 Tubing to be USA/Canada only.

2.2 FITTINGS

- .1 Service: design pressure 2070 kPa (300 psig) and temperature 121°C (250°F).
- .2 Brazed: wrought copper to ANSI B16.22.
- .3 Flanged: bronze or brass, Class 150 and Class 300 to ANSI B16.24.
- .4 Flare: Bronze or brass, for refrigeration, to ANSI B16.26.
- .5 Fittings to be USA/Canada only.

2.3 JOINTS

- .1 Brazing: silver solder, 45% Ag-15% Cu or copper-phosphorous, 95% Cu-5%P.
- .2 Gaskets: non-metallic to ANSI B16.21.

2.4 ACCESSORIES

- .1 Provide check valves, sight glasses, filter driers, mufflers as recommended by the equipment supplier.

2.5 VALVES

- .1 NPS 3/4 and under: Class 500, 3.5 MPa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moistureproof seal for below freezing applications, brazed connections.
-

- .2 Over NPS 3/4: Class 375, 2.5 MPa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moistureproof seal for below freezing applications, brazed connections.

Part 3 Execution

3.1 GENERAL

- .1 Install and test in accordance with CSA B52.
- .2 EPS 1/RA/1 and ASME B31.5.
- .3 Do work in accordance with manufacturers recommendations.
- .4 Pipe between computer room air conditioning units and air cooled condensing units. Piping layout and sizes to be verified by equipment supplier.
- .5 Connect to equipment with isolating valves and unions.
- .6 Provide space for servicing, disassembly and removal of equipment and components all as recommended by manufacturer.
- .7 Protect all openings in piping against entry of foreign material.

3.2 BRAZING PROCEDURES

- .1 Bleed inert gas into pipe during brazing.
- .2 Remove valve internal parts, solenoid valve coils, sight glass.
- .3 Do not apply heat near expansion valve and bulb.

3.3 PIPING INSTALLATION

- .1 General:
 - .1 Soft annealed copper tubing: bend without crimping or constriction. Hard drawn copper tubing: do not bend. Minimize use of fittings.
- .2 Hot gas lines:
 - .1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
 - .2 Provide trap at base of risers greater than 2400 mm (8 ft.) high and at each 7600 mm (25 ft.) thereafter.
 - .3 Provide inverted deep trap at top of each riser.
 - .4 Provide double risers for compressors having capacity modulation.
 - .1 Large riser: install traps as specified above.
 - .2 Small riser: size for 5.1 m/s (16.7 ft./s) at minimum load. Connect of traps on large riser.

3.4 PRESSURE AND LEAK TESTING

- .1 Close valves on factory charged equipment and other equipment not designed for test pressures.
- .2 Leak test to CSA B52 before evacuation to 2 MPa and 1 MPa on high and low sides respectively.
- .3 Test Procedure: Build pressure up to 35 kPa (5 psig) with refrigerant gas on high and low

sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

3.5 DEHYDRATION AND CHARGING

- .1 Close service valves on factory charged equipment.
- .2 Ambient temperatures to be at least 13°C (55°F) for at least 12 h before and during dehydration.
- .3 Use copper lines of largest practical size to reduce evacuation time.
- .4 Use 2-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5 Pa absolute and filled with dehydrated oil.
- .5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.
- .6 Triple evacuate all system components containing gases other than correct refrigerant or having lost holding charge as follows:
 - .1 Twice to 14 Pa absolute and hold for 4 h.
 - .2 Break vacuum with refrigerant to 14 kPa.
 - .3 Final to 5 Pa absolute and hold for at least 12 h.
 - .4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.
 - .5 Submit all test results to Consultant.
- .7 Charging:
 - .1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.
 - .2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.
 - .3 Re-purge charging line if refrigerant container is changed during charging process.
- .8 Checks:
 - .1 Make all checks and measurements as per manufacturer's operation and maintenance instructions.
 - .2 Record and report all measurements to Consultant.

3.6 INSTRUCTIONS

- .1 Post instructions in frame with glass cover in accordance CSA B52.

3.7 REGISTRATION AND INSPECTION

- .1 Register refrigeration system with Technical Standards and Safety Authority when required by CSA B52 and Technical Standard and Safety Act 2000. Apply, pay for and have T.S.S.A. inspect refrigeration system when required by CSA B52 or Technical Standards and Safety Act 2000.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- .2 SMACNA HVAC Duct Leakage Test Manual.
- .3 CSA B228.1, Pipe Ducts and Fittings for Residential Type Air Conditioning Systems.
- .4 ASTM A480/A480M, Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
- .5 ASTM A525M, Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process. (Metric).
- .6 ASTM A621/A621M, Specification for Steel Sheet and Strip, Carbon, Hot-Rolled, Drawing Quality.
- .7 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .8 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.
- .9 All reference standards shall be the latest editions.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 20 05 01 – Mechanical General Requirements.
- .2 Indicate the following:
 - .1 Sealants

1.3 CERTIFICATION OF RATINGS

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 SEAL CLASSIFICATION

- .1 Classification as follows:

Maximum Pressure	SMACNA Seal Class
Pa (in. w.c.)	--
up to 500 (2)	A

- .2 Seal classification:
 - .1 Class A: All transverse joints, longitudinal seams, and duct wall penetrations.

2.2 SEALANT

- .1 Sealant: oil resistant, polymer type, water based, flame resistant duct sealant. Temperature range of minus 37°C (19°F) to plus 93°C (200°F).
 - .1 Standard of Acceptance: Bakor Duckseal.

2.3 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows:
 - .1 Rectangular: standard radius and/or short radius with single thickness turning vanes, centreline radius: 1.5 times width of duct. Provide single thickness turning vanes in standard radius elbows where indicated on the drawings.
 - .2 Round: smooth radius, 4 piece. Centreline radius: 1.0 times diameter.
- .3 Mitred elbows, rectangular:
 - .1 To 900 mm (36 in.): single thickness turning vanes.
 - .2 Over 900 mm (36 in.): single thickness turning vanes, supported at 900 mm (36 in.) maximum centres.
- .4 Branches:
 - .1 Rectangular main and branch: 45° entry on branch.
 - .2 Round main and branch: enter main duct at 90° with conical connection.
 - .3 Provide volume control damper in branch duct near connection to main duct.
- .5 Transitions:
 - .1 Diverging: 20° maximum included angle.
 - .2 Converging: 30° maximum included angle.
- .6 Offsets:
 - .1 Full radiused elbows.
- .7 Obstruction deflectors: maintain full cross-sectional area. Maximum included angles: as for transitions.

2.4 FIRESTOPPING

- .1 Retaining angles all around duct, on both sides of fire separation.
- .2 Firestopping material and installation must not distort duct.
- .3 Provide firestopping material according to Section 07 84 00 – Firestopping and Smoke Seals.

2.5 GALVANIZED STEEL

- .1 Lock forming quality: to ASTM A525M, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to ASHRAE and SMACNA.
- .3 Joints: to ASHRAE and SMACNA.
- .4 All round duct to be spiral wound rigid duct.

2.6 HANGERS AND SUPPORTS

- .1 Hanger configuration: to ASHRAE and SMACNA.
- .2 Hangers: prime painted steel angle with black steel rods to the more stringent requirement of SMACNA or the following table:

Duct Size		Angle Size		Rod Size	
mm	in.	mm	in.	mm	in.
Up to 1050	Up to 42	40 x 40 x 3	1-½ x 1-½ x 1/8	6	1/4
1051 to 1500	43 to 60	40 x 40 x 3	1-½ x 1-½ x 1/8	10	3/8
1501 to 2100	61 to 84	50 x 50 x 3	2 x 2 x 1/8	10	3/8
2101 to 2400	85 to 96	50 x 50 x 6	2 x 2 x 1/4	10	3/8
2400 and over	96 and over	50 x 50 x 6	2 x 2 x 1/4	10	3/8

- .3 Upper hanger attachments:
 - .1 Concrete:
 - .1 Hollow core block concrete: Adhesive material applied with screen tube.
 - .1 Acceptable material: Hilti Hit Adhesive Anchors, HY 70.
 - .2 Coordinate minimum embedment of adhesive anchors with anchor manufacturer.
 - .3 Submit anchor manufacturer's recommendations for anchoring to structural engineer prior to drilling for supports.
 - .2 Solid cast in place concrete or hollow core slabs: Adhesive material fastened into solid base.
 - .1 Acceptable material: Hilti Hit Adhesive Anchors, HY 200 (Safe Set).
 - .2 Coordinate minimum embedment of adhesive anchors with anchor manufacturer.
 - .3 Scan hollow core slabs for locations to install attachments per the manufacturer's written installation instructions.
 - .2 For steel joist: manufactured joist clamp or steel plate washer.
 - .1 Standard of Acceptance: Anvil Int'l. fig.86 for joist clamps, Anvil Int'l. fig.60 for plate washer.
 - .3 For steel beams: manufactured beam clamps.
 - .1 Standard of Acceptance: Anvil Int'l. fig.94.

2.8 SEISMIC RESTRAINTS

- .1 Provide bracing of ducts in accordance with Section 20 05 20 - Seismic Restraints.

Part 3 Execution

3.1 GENERAL

- .1 Do work in accordance with ANSI/NFPA 90A, ASHRAE, CSA B228.1 and SMACNA.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods. Insulate strap hangers 100 mm (4 in.) beyond insulated duct.
- .3 Support risers in accordance with ASHRAE and SMACNA.
- .4 Install breakaway joints in ductwork on each side of fire separation.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths to accommodate installation of acoustic duct lining.
- .7 All open ducts shall be sealed during construction.
- .8 Do not support from metal deck. Provide supplementary steel off roof structure as

required.

3.2 HANGERS

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with SMACNA.
- .4 Rectangular risers shall be supported by angles or channels secured to the sides of the ducts with welds, bolts, sheet metal screws or blind rivets. For ducts over 762 mm (30 in.) wide, fasteners shall allow for expansion of the sheet due to internal pressure. Maximum spacing of risers supports shall be every 3.6 m (11.8 ft.) steel angles and channels shall be of adequate size to support the weight of the duct, given the spans of supports and a safety factor of 4 applied.

3.3 WATERTIGHT DUCT

- .1 Provide watertight duct for:
 - .1 Fresh air intake.
 - .2 As indicated.
- .2 Form of horizontal duct without longitudinal seams. Solder or weld joints of bottom and side sheets. Seal all other joints with duct sealer.
- .3 Slope horizontal branch ductwork down towards hoods served. Slope header ducts down toward risers.
- .4 Fit base of riser with 150 mm (6 in.) deep drain sump and 32 mm (1-¼ in.) drain connected, with deep seal trap discharging to open funnel drain.

3.4 SEALING

- .1 Apply sealant to outside of joint to manufacturer's recommendations.

3.5 DUCT CLEANING

- .1 All ducts shall be thoroughly vacuumed.

3.6 SEISMIC RESTRAINTS

- .1 Provide bracing of ductwork in accordance with Section 20 05 20 – Seismic Restraints.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA B228.1, pipes, ducts and fittings for residential type air conditioning.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with Section 20 05 01 – Mechanical General Requirements.
- .2 Indicate the following:
 - .1 Flexible connections.
 - .2 Duct access doors.

1.3 CERTIFICATION OF RATINGS

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 FLEXIBLE CONNECTIONS

- .1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.
- .2 Material: neoprene.
 - .1 Fire resistant, self-extinguishing, neoprene coated glass fabric, temperature rated at -40°C (-40 °F) to 90°C (194°F), density of 1.3 kg/m² (38 oz./yd²).

2.2 ACCESS DOORS IN DUCTS

- .1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6mm (24 Ga.) thick complete with sheet metal angle frame.
- .2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6mm (24 Ga.) thick complete with sheet metal angle frame and 25mm (1 in.) thick rigid glass fibre insulation.
- .3 Gaskets: neoprene.
- .4 Hardware:
 - .1 Up to 300 X 300mm (12 in. x12 in.): 2 sash locks
 - .2 301 to 450mm (12 in. x 18 in.): 4 sash locks
 - .3 451 to 1000mm (18 in. to 40 in.): piano hinge and minimum 2 sash locks.

Part 3 Execution

3.1 INSTALLATION

- .1 Flexible connections.
 - .1 Install in following locations:
 - .1 Inlets and outlets of supply air, transfer, exhaust and return air fans.
-

- .2 As indicated.
- .2 Length of connection: 150mm (6in.).
- .3 Minimum distance between metal parts when system in operation: 75mm (3in.).
- .4 Install in accordance with recommendations of SMACNA.
- .2 Access doors:
 - .1 Location:
 - .1 At fire dampers.
 - .2 At control dampers.
 - .3 At devices requiring maintenance.
 - .4 At locations required by code.
 - .5 Elsewhere as indicated.
 - .6 Before and after turning vanes.
 - .7 Before and after hydronic and electric coils.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 20 05 01 – Mechanical General Requirements.
- .2 Indicate following:
 - .1 Fan Curves showing point of operation and sound rating data.
 - .2 Dimensions.
 - .3 Voltage and amperage.

1.2 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 – Mechanical General Requirements.

1.3 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with Section 20 05 01 – Mechanical General Requirements.
- .2 Furnish list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing, or replacing, for placement into operating manual.

1.4 CERTIFICATION OF RATINGS

- .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 FANS GENERAL

- .1 Standard of rating: AMCA 201 for Fan Application. AMCA 303 for application of Sound Power Ratings for ducted air moving devices. Performance of fans to AMCA 210 and ANSI/ASHRAE 51. Unit to bear AMCA certified seal. Pwl ratings to comply with AMCA 301, tested to AMCA 300 Unit to bear AMCA certified sound rating seal.
- .2 Maximum loudness: 6 sones.
- .3 Capacity, total static pressure, revolutions per minute, power, model, size and sound power levels: as indicated. Refer to drawings for schedule.

2.2 CENTRIFUGAL INLINE FANS

- .1 Fan wheels:
 - .1 Welded steel or aluminum construction.
 - .2 Maximum operating speed of centrifugal fans not more than 50% of first critical speed.
 - .2 Bearings: heavy duty grease lubricated ball or roller self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 100,000 h in accordance with (Anti-Friction Bearing Manufacturers Association) AFBMA L-10 life standard. Bearings to
-

be rated and selected in accordance with AFBMA 9 and AFBMA 11.

- .3 Housings:
 - .1 Volute with inlet cones: fabricated steel for wheels 300 mm (12 in.) or greater, steel, aluminum, for smaller wheels, braced, and with welded supports.
 - .2 Provide latched airtight access doors with handles.
- .4 Motors:
 - .1 Externally mounted with adjustable drive pulleys.
 - .2 Cabinet mounted factory wired disconnect switch.

2.3 CEILING FANS

- .1 Centrifugal wheels complete with backdraft damper, inlet grille disconnect switch.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Install as per manufacturer's instructions.
- .2 Provide sheaves and belts for final air balance.
- .3 Provide rubber in shear vibration isolation hanging kits for hung fans.
- .4 Provide flexible duct connection on inlet and outlet of fans.
- .5 Provide seismic cable restraint system designed to section 20 05 20 – Seismic Restraints for all suspended fans.

END OF SECTION

Part 1

1.1 REFERENCES

- .1 AMCA 99, Standards Handbook.
- .2 ANSI/AMCA 210, Laboratory Methods of Testing Fans for Rating.
- .3 AMCA 300, Reverberant Room Method for Sound Testing of Fans.
- .4 AMCA 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .5 ANSI/ASHRAE 51, Laboratory Methods of Testing Fans for Rating.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 20 05 01 – Mechanical General Requirements.
- .2 Product data to include fan curves and sound rating data.

1.3 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 20 05 01 – Mechanical General Requirements.

1.4 CERTIFICATION OF RATINGS

- .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards in force.
- .2 Provide confirmation of testing.

Part 2 Products

2.1 FANS GENERAL

- .1 Capacity: as indicated on fan schedule.
- .2 Sound ratings: comply with AMCA 301, tested to AMCA 300.
- .3 Statically and dynamically balanced. Constructed in conformity with AMCA 99.
- .4 Ratings: based on tests performed in accordance with ANSI/AMCA 210, and ANSI/ASHRAE 51.
- .5 Bearings: sealed lifetime of self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 100,000 h in accordance with AFBMA L10 life standard. Bearings to be rated and selected in accordance with AFBMA 9 and AFBMA 11.
- .6 Provide self-flash roof curbs for all roof mounted fans.
- .7 Refer to fan schedule for additional description and options.

2.2 ROOF EXHAUSTERS

- .1 Centrifugal V belt or direct driven as indicated.
 - .1 Housings: spun aluminum housing and complete with resilient mounted motor and fan.
 - .2 Impeller: non-overloading.
 - .3 12 mm (1/2 in.) mesh 2.0 mm (12 Ga.) dia. aluminum birdscreen.
 - .4 Gasketed aluminum backdraft dampers.
 - .5 Weatherproof disconnect switch on fan housing.
 - .6 Continuous curb gaskets, cadmium plated securing bolts and screws.
 - .7 Adjustable motor sheave.
 - .8 Gravity backdraft damper c/w seals and spring assistance.
- .2 Standard of Acceptance: Greenheck model indicated in schedule on drawings.

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Size anchor bolts for exhaust fan base to withstand seismic acceleration and velocity forces for building location.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 20 05 01 – Mechanical General Requirements.

1.2 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 – Mechanical General Requirements.

Part 2 Products

2.1 GENERAL

- .1 Outdoor-mounted, air-cooled, split system outdoor section condensing unit suitable for on-the-ground, rooftop, wall hung, balcony, patio, or under deck installation, or units may be stacked. Unit shall consist of a hermetic compressor(s), an air-cooled coil, propeller-type blow-thru condenser fans, full refrigerant charge, and control box. Unit shall discharge air horizontally as shown on the contract drawings. Units shall function as the outdoor component of an air-to-air cooling system. Each compressor circuit shall include a service valve set for connection of one indoor fan coil units. Indoor; wall-mounted, direct-expansion fan coil to be matched with the condensing unit refrigeration circuit.

2.2 QUALITY ASSURANCE

- .1 Systems shall be rated and certified in accordance with ARI Standards 210/240 and 270. Units shall be listed in the AR directory as a matched set.
- .2 Unit construction shall comply with ANSI/ASHRAE 15 latest revision, and with the NEC.
- .3 Units shall be constructed in accordance with UL standards and shall carry the UL listing label. Units shall have CSA approval.
- .4 Units shall be listed in the CEC directory.
- .5 Unit cabinet shall be capable of withstanding Federal Test Standard No.141 (method 6061) 500-hour salt, spray test.
- .6 Air-cooled condenser coils shall be leak tested at 350 psig air pressure with the coil submerged in water.

2.3 DELIVERY, STORAGE AND HANDLING

- .1 Units shall be shipped in one piece and shall be stored and handled per unit manufacturer's recommendations.

2.4 CONDENSING UNIT

- .1 Factory assembled, single piece, air-cooled condensing outdoor unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, compressor(s), full charge of R-454B refrigerant, and special features required prior to field start-up.
-

- .2 Electrical Requirements
 - .1 Unit shall operate on single-phase, 60 cycle power at 208V/1 phase.
 - .2 Unit electrical power shall be a single point connection.
 - .3 Unit control voltage to the indoor fan coil shall be 24 v.
 - .4 All power and control wiring shall be installed per NEC and all local building codes.
 - .5 Unit shall have low-voltage terminal block connections.
- .3 Special Features (Field Installed)
 - .1 Winter Start Control: Field-installed winter start control shall permit start-up for cooling operation under low-load conditions and at low-ambient temperatures by by-passing the low-pressure switch for a 3-minute delay period.
 - .2 Field-installed crankcase heater shall be a clamp-on compressor oil sump heater.
 - .3 Provide integral condensate pumps where indicated in schedule.

2.5 FAN COIL UNITS

- .1 Indoor, direct-expansion, ceiling-mounted fan coil. Units shall be complete with cooling coil, fan, fan motor, piping connectors, electrical controls, microprocessor control system, and integral temperature sensing. Units shall be furnished with integral ceiling-mounting bracket and mounting hardware.
- .2 Electrical Requirements
 - .1 Unit shall operate on 208V, single phase, 60 Hz power supply. Power and control connections shall have terminal block connections.

2.6 CAPACITY

- .1 Condensing Unit: refer to schedule on drawings.
- .2 Fan Coil Unit: refer to schedule on drawings.

2.7 STANDARD OF ACCEPTANCE

- .1 Condensing Unit: Refer to schedule on drawing.
- .2 Fan Coil Units: Refer to schedule on drawing.

Part 3 Execution

3.1 INSTALLATION

- .1 Install units in accordance with manufacturer's instructions and as indicated.
- .2 Pipe condensate drain on each fan coil to hub drain.
- .3 Install refrigerant piping between outdoor condensing unit and indoor evaporator as per manufacturers instruction and Section 23 23 00 – Copper Tubing & Fittings Refrigerant.
- .4 Provide control wiring between condenser and evaporator as per manufacturers directions. Install wiring in conduit.

END OF SECTION

<u>SECTION NO.</u>	<u>NAME</u>	<u>NO. OF PAGES</u>
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28 31 01	Fire Alarm System	2
33 65 76	Direct Buried Underground Cable Ducts	2

Part 1 General

1.1 GENERAL

- .1 This section covers items common to all Divisions 26 specifications.
- .2 This section supplements the requirements of Division 1.
- .3 The Contractor must obtain and pay for all relevant permits.
- .4 Provide construction occupational health and safety in accordance with Division 1 requirements.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-24, Canadian Electrical Code, Part 1 - Safety Standard for Electrical Installations (29TH Edition)
 - .2 CSA C22.3 No. 7-25, Canadian Electrical Code, Part 3 - Underground systems
 - .3 CSA C235-19 Preferred Voltage Levels for AC Systems, 0-50,000 V.
- .2 Ontario Regulation 332/12: Building Code (Ontario Building Code 2024 as amended).
- .3 National Equipment Manufacturer Association (NEMA).
 - .1 NEMA ICS 6: Enclosures standard.
- .4 Institute of Electrical and Electronics Engineers (IEEE)
 - .1 IEEE SP1122 (current edition), The Authoritative Dictionary of IEEE Standard Terms, 7th Edition
 - .2 IEEE 3001.9 (current edition), Recommended Practice for the Design of Power Systems Supplying Lighting Systems in Commercial and Industrial Facilities, The Authoritative Dictionary of IEEE Standard Terms, 7th Edition

1.3 DEFINITIONS

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications and on drawings are those defined by IEEE SP1122.

1.4 SCOPE OF WORK

- .1 Provide all labour, materials and equipment required to properly complete the work as shown on drawings and as specified in division 26 and 28 specifications for a complete and functional system.
 - .2 Working hours to be coordinated with client and General Contractor, working hours may need to occur outside of building operational hours. Power shutdowns to be coordinated in advance.
 - .3 Include in bid amount allowances for:
 - .1 10 hours of unforeseen demo work
 - .2 10 hours of unforeseen installation work
 - .3 10 hours for miscellaneous work (material handling, testing, etc...)
-

1.5 DESIGN REQUIREMENTS

- .1 Operating voltages: refer to CSA C235-19
- .2 Motors, electric heating, control devices, distribution devices, and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
- .3 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .4 Language operating requirements: provide identification nameplates for control items in English.

1.6 SUBMITTALS

- .1 Provide submittals in accordance with Division 01 requirements.
- .2 Shop drawings:
 - .1 Submit shop drawings in electronic format. Where identified, drawings shall be stamped by a Professional Engineer (P.Eng.) licensed to practice in the province of Ontario.
 - .2 Clearly indicate on shop drawings which models, features, and options will be provided. Ambiguous submissions will be rejected.
 - .3 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a co-ordinated installation.
 - .4 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
 - .5 Indicate required clearances for operation, maintenance and replacement of equipment on drawings.
 - .6 If changes are required, notify Consultant of these changes before they are made.
 - .7 Contractor shall keep a copy of reviewed shop drawings on site at all times for system installation reference.

1.7 QUALITY ASSURANCE

- .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for special approval before delivery to site. Costs related to field inspection comments provided on-site by field inspection service to be borne by Contractor.
 - .3 Electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license.
 - .4 Employees registered in provincial apprenticeship program shall be permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
 - .5 Submit test results of installed electrical systems and instrumentation.
-

1.8 PERMITS, FEES AND INSPECTION

- .1 Consultant to submit to Electrical Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work. Costs for Plan Review to be paid by Owner.
- .2 Contractor to schedule required inspections of electrical work, provide electrician labour to support required inspections, and pay electrical inspection fees associated with the work.
- .3 Notify Consultant and Owner's Representative of changes required by Electrical Inspection Authority prior to making changes.
- .4 Submit to Consultant Certificates of Acceptance from Electrical Inspection Authority and Authorities Having Jurisdiction (AHJ's) on completion of work.
- .5 Certificates are required for partial and final occupancy permits. Allow for testing and inspection of electrical and life safety systems at each stage of occupancy as required by project phasing. Refer to RAAC Replacement and Accessibility Upgrades architectural drawings and specifications for phasing requirements.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Material Delivery Schedule: provide Contractor with schedule within 2 weeks of award of Contract.
- .2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling.
- .3 Packaging Waste Management: remove for reuse and return: pallets, crates, padding, and packaging materials.

1.10 SYSTEM STARTUP

- .1 Ensure circuit protective devices such as overcurrent trips, relays, and fuses are installed and adjusted to required values and settings.
- .2 Instruct Owner's Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.
- .3 Arrange and pay for services of manufacturer's factory service representative to supervise startup of equipment and systems which form part of the Work. System startup shall include the following: check, adjust, balance, and calibrate components.
- .4 Provide these services for such period, and for as many visits as necessary to put equipment in operation and ensure that operating personnel are conversant with all aspects of its care and operation.
- .5 Refer to Section 26 05 02 – Electrical Testing Requirements.

1.11 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure coordination study and arc flash report/labelling is carried out to ensure that circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings and labelling.
-

1.12 FIELD QUALITY CONTROL

- .1 Load Balance: Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .3 Provide upon completion of work, load balance report, phase and neutral currents on panelboards, dry-core transformers and motor control centers, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .4 Arc Flash Study; provide upon completion labelling is carried out to ensure that circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings and labelling.
- .5 Conduct following tests in accordance with Div 0 – Quality Control and Testing in Section 26 05 02 – Testing for
 - .1 Power distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .1 Fire Alarm and Life Safety Systems integration as per ULC-S1001
 - .2 ESA inspection and certification
- .6 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
- .7 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .8 Submit test results for Consultants review.
- .9 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in Division 01 -Quality Assurance.

1.13 MATERIALS AND EQUIPMENT

- .1 Provide material and equipment in accordance with DIV 0.
 - .2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain CSA field inspection before delivery to site.
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Equipment shall arrive on-site bearing CSA approval sticker. ESA field inspection not acceptable except where indicated.

- .3 Factory assemble control panels and component assemblies. Panel builder to obtain CSA field inspection prior to shipping equipment to site.
- .4 Ensure Manufacturer's nameplate and CSA labels are visible and legible after equipment is installed.

1.14 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
- .2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.
- .3 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .4 Clean and prime exposed non-galvanized hangers, supports, racks, and fastenings to prevent rusting.

1.15 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.
- .2 Some conductors for a given ampacity are larger than C22.1 Table 2 values indicate due to derating and voltage drop considerations. Provide alternate lugs for larger conductors or parallel runs of conductors at circuit breakers, disconnect switches, splitters, and other equipment. Where lug kits of sufficient size are not available, provide a junction box located minimum 1.2m from equipment and smaller conductor for final equipment connection.

1.16 ELECTRIC MOTORS, EQUIPMENT, AND CONTROLS

- .1 Control wiring and conduit to be provided by Division 26 Contractor except for conduit, wiring and connections which are related to control systems which is specifically indicated as provided by other trades.

1.17 EQUIPMENT IDENTIFICATION

- .1 Ensure all new equipment is labelled appropriately as per the specifications below. Work that does not include proper labelling will be considered incomplete and will be marked as deficient until labelling is implemented as specified below.
- .2 Labels:
 - .1 All equipment must be labelled.
 - .2 Obtain written approval of identification system from Owner's Representative before starting production of labels.
 - .3 Contractor must NOT label items by name and number on the construction plan unless advised to do so by the Owner's Representative.
 - .4 Allow an average of 25 letters per label.
 - .5 General Label properties:

- .1 All Font must be 'Veranda'.
- .2 All Font style must be 'Regular'.
- .3 All Font colour must be 'White'.
- .4 Normal power system equipment labels must be on black plastic lamacoid 3mm thick plastic engraving sheet with black face, white core.
- .5 Emergency power system equipment shall be red plastic lamacoid 3mm thick plastic engraving sheet with red face, white core.
- .6 Labels shall be permanently attached to equipment with silicone or rivets.
- .7 Labels shall be in English
- .6 Labels shall be sized as follows:

Label Size	Font Size	Number of Lines	Font Size
1	10x50mm	1	3mm
2	12x70mm	1	5mm
3	12x70mm	2	3mm
4	20x90mm	1	8mm
5	20x90mm	2	5mm
6	25x100mm	1	12mm
7	25x100mm	2	6mm

- .3 Terminal cabinet and junction box nameplates:
 - .1 Indicate system and/or voltage characteristics.
- .4 Disconnect switch, starter, and contactor nameplates:
 - .1 Indicate equipment being controlled and location.
- .5 Transformer nameplates:
 - .1 Indicate capacity, primary and secondary voltages and transformer designation name/number.
- .6 Branch circuit type panel board and distribution type panel board nameplates:
 - .1 Indicate panel name/number, voltage, and source panel. (i.e. "Panel A 120/208V-3 ϕ -4W fed from Panel DP-1")
- .7 Distribution type panel board branch circuit breaker nameplates:
 - .1 Indicate the equipment which the circuit breaker is feeding and location of equipment.
- .8 Receptacle and switch nameplates:
 - .1 Identify by panel and circuit number.
 - .2 Receptacle and switch labels need not be lamacoid. Printed adhesive laminate tape acceptable. Black letters on white background. Labels shall be of high

quality type, designed to withstand abrasion, fading, extreme temperatures, chemicals, moisture and other harsh conditions.

1.18 CONDUCTOR IDENTIFICATION

- .1 Identify conductors with permanent identifying markings, coloured heat shrink or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
 - .1 Colour coding: to CSA C22.1-24.
- .3 Identify individual conductors with pre-printed or field-assembled conductor identification tags. Conductor labels to be slip-on type. Handwritten labels not acceptable. Label conductors at both ends and where terminations are made. Labelling of 120/208V branch circuit conductors not required.

1.19 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes, Teck and M.I. cables.
- .2 Code with plastic tape at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals. Paint conduit couplings, connectors and box covers.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

System	PRIME Colour	AUXILIARY Colour
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Fire Alarm	Red	
EMCS	Orange	

- .4 Identify individual cables and conduits with pre-printed or field-assembled cable identification tags. Cable labels to be zip-tied to cable sheath or outside of conduit. Handwritten labels not acceptable. Label cables and conduits at both ends and each point where cable enters wall, ceiling, floor, box, panel, or splitter, and at 15 m intervals. Labelling of 120/208V branch circuit cables and conduits not required.

1.20 WARNING SIGNS

- .1 As specified and as required by OESC and Consultant.
- .2 Decal signs, minimum size 175 x 250mm.

1.21 AS-BUILT DRAWINGS BY CONTRACTOR

- .1 The contractor shall be responsible for a complete set of as-built drawings.
- .2 A set of prints shall be kept up to date as the work progresses. Show all changes and deviations from the original tender documents whether they be issued change orders, site instructions or contractor's changes.

- .3 Record exactly the location of services where concealed or buried or where capped or plugged for future use. Provide dimensions to enable location and modifications of these services in the future.
- .4 Upon completion of the project, the contractor shall turn over a complete set of as-built drawings to the Consultant. 'As-built' drawings shall show conduit sizes and runs, junction boxes, pull boxes, branch circuit numbers. These drawings will be reviewed and will not be accepted until any required corrections are complete and acceptable to the Consultant. Once accepted, as-built drawings shall be completed in AutoCAD format version 2018, by Electrical Contractor.
- .5 Contractor shall update panel schedules to show final room designations.
- .6 In the as-built drawings, electrical contractor shall update drawings to reflect all changes to the contract including change orders and site instructions to reflect site conditions. An amount shall be held back, until these drawings are completed to the entire satisfaction of the Engineer. Before the release of this amount, the Engineer reserves the right to request a number of verifications necessary to prove the exactness of the record drawings.
- .7 Two sets of hard copy drawings and one electronic version to be supplied to electrical contractor for this purpose.
- .8 Contractor to provide the following:
 - .1 1 electronic copy of the AutoCAD record drawings in AutoCAD 2018 file format.
 - .2 1 electronic copy of the AutoCAD record drawings in pdf file format.
 - .3 1 hard copy of the O&M Manual.
 - .4 1 hard copy of the as-built drawings

1.22 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into Operation and Maintenance Manual specified in Division 01.
 - .2 Include in operation and maintenance data:
 - .1 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or the Work.
 - .2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.
 - .3 Wiring and schematic diagrams, control sequences, and performance curves for each principal system and item of equipment.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Safety Instructions.
 - .6 Names and addresses of local suppliers for items included in maintenance manuals.
 - .7 Copy of reviewed shop drawings.
 - .8 Copy of all test results. Include reports for both factory and field testing.
 - .9 ESA Inspection Report and fire alarm system Verification Report (if required) with certificate.
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- .3 Additional data:
 - .1 Prepare and insert into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.
 - .2 The contact information (name, address, contact, telephone number, fax number) of the General Contractor and all suppliers must be included in the manual.
- .4 Operation and Maintenance Manuals must be reviewed and accepted by the Consultant and the Commissioning Agent before the Certificate of Substantial Performance can be issued.
- .5 An amount equal to 2% (minimum) of the electrical construction price must be allocated for Operation and Maintenance (O&M) manuals and as-built drawings. This must be in a line item in the electrical progress billing. Payment will only be released once manuals and as-built drawings have been accepted by the Consultant. Acceptance of the O&M manual by the Commissioning Agent to be included in progress billing line item for commissioning.
- .6 Approvals:
 - .1 Submit 1 copy of draft Operation and Maintenance Manual to Consultant for review. Submission of individual data will not be accepted unless so directed by Consultant. The Maintenance Manual must be compiled in a hard cover, 'D' ring binder complete with inside pockets, index page and index tabs. The name of the project must be clearly visible on the front and spine of each binder.

1.23 LOCATION OF ELECTRICAL DEVICES (if applicable)

- .1 Do not install electrical receptacles back-to-back in wall; allow minimum 150mm (6") horizontal clearance between boxes.
- .2 Change location of electrical receptacles at no extra cost or credit, providing distance does not exceed 3m (10'), and information is provided to contractor before the device is installed.
- .3 Locate light switches on latch side of doors.
- .4 Locate disconnect devices in mechanical and elevator machine rooms on latch side of door.
- .5 Locate emergency stop pushbuttons on path of travel from equipment to nearest exit door, and as required by applicable standards.

1.24 MOUNTING HEIGHTS (if applicable)

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
 - .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
 - .3 Install electrical equipment at heights listed below (to center of outlet box) unless indicated otherwise. Adjust receptacle locations to avoid interference with millwork and office furniture. Coordinate with millwork and furniture drawings prior to roughing in receptacles in or near millwork or behind office furniture.
 - .1 Local switches: 1100mm (44").
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- .2 Wall receptacles, data, telephone, and television outlets:
 - .1 General: 400mm (16").
 - .2 Above top of continuous baseboard heater: 200mm (8").
 - .3 Above top of counters or counter splash backs: 185mm (7½").
 - .4 Wall telephone where telephone handset is mounted on wall over telephone outlet: 1200 mm (47 ¼").
- .3 Doorbell pushbuttons: 1100 mm (44").
- .4 Wall mounted intercom: 1100 mm (44").
- .5 Thermostats: 1200 mm (47 ¼")
- .6 Fire alarm manual pull stations: 1200 mm (47 ¼").
- .7 Fire alarm EOL and control modules: 1525mm (5'-0).
- .8 Fire alarm signalling devices: 2280 mm (7'-6").
- .9 Wall mounted general paging speakers: 2280 mm (7'-6"), or as indicated on millwork drawings.
- .10 Panelboards:
 - .1 In dwelling units: 1.7m (5'-6") to top of uppermost overcurrent device handle.
 - .2 Other locations: as indicated.

1.25 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: sheet metal, sized for free passage of conduit or cable, and protruding 50 mm.
- .2 Install conduits and fittings to be embedded or plastered over, neatly and close to building structure so topping or furring can be kept to minimum.
- .3 Do not encase armoured cables directly in concrete without prior approval.

1.26 FIRE STOPPING & SMOKE SEAL

- .1 Provide fire stopping and smoke sealing of openings made by Division 26 in accordance with Section 07 84 00 Firestopping..
- .2 Cables or conduits passing through a rated assembly, shall be provided with a firestop system in accordance with CAN/ULC-S115:2023, Standard Method of Fire Tests of Firestop Systems.
- .3 Acceptable Materials include:
 - .1 International Protective Coatings "Flamesafe" products appropriate to the application.
 - .2 Dow Corning RTV Foam Sealant System.
 - .3 A/D fire protection systems.
 - .4 Hilti products appropriate to the application.
 - .5 Tremco products appropriate to the application.
 - .6 Approved alternate.

1.27 DEMOLITION

- .1 The full extent of the demolition is not shown on the drawings. All equipment located on the existing walls and ceilings affected in the demolition are to be disconnected and
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removed. All services which have become redundant under the contract shall be removed. All items that are removed during the demolition that are not to be re-used are to be removed from site. The contractor is to make a site visit to familiarize themselves with the site conditions and the extent of the scope of work.

- .2 Working hours to be coordinated with client and General Contractor, working hours may need to occur outside of building operational hours. Power shutdowns to be coordinated in advance.
- .3 Relocate electrical items that do not appear on the drawings that are to remain in service but which interfere with the new construction.
- .4 Reconnect any services which are to remain that have been temporarily disconnected during the demolition or construction.
- .5 Any equipment that is to be re-used must be cleaned of paint, plastic or other marks or debris to the satisfaction of the Engineer.
- .6 Where indicated, panelboards are to be removed. Existing feeders from the upstream overcurrent device are to be maintained to feed the new panels. Provisions are to be made to properly fasten conduit or cables to the new panel enclosure.
- .7 Reconnect existing loads which do not appear on panel details which are to be re-used. These loads are to be identified and recorded for as-built records.
- .8 Remove, store, clean and reinstall existing materials to be re-used.
- .9 Identify and protect any materials or equipment prior to the commencement of demolition that is to be retained in place or reconnected.
- .10 During the demolition process, maintain adequate structural support for equipment and material.
- .11 Maintain electrical services and systems at all times to areas beyond the construction area. Any existing services disrupted during the demolition that are not intended to be removed as part of the contract are to be reinstated immediately.
- .12 Continuity of service of the fire alarm system is to be maintained to all occupied areas of the building throughout the demolition process.

1.28 TEMPORARY ELECTRICAL SERVICES AND LIFE SAFETY

- .1 Provide temporary heat detectors during the demolition work in the existing facility. Quantity of devices per CAN/ULC-S524. Provide verification for the fire alarm devices at the end of each phase of the project. Temporary devices are to be removed after the sprinkler or permanent fire alarm system is commissioned.
 - .2 Remove temporary services when they are redundant (i.e. after the permanent systems are commissioned).
 - .3 Provide temporary lighting at a rate of one (1) fixture per 14m² (150 ft²), and temporary exit lighting in all construction areas. Connect these lights to the temporary electrical panel for normal power and connect the exit lights to an available essential power source or provide battery backup.
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- .4 Provide temporary electrical panels with duplex outlets as necessary for construction power. Connect panel feed to existing hospital distribution panel. Provide breaker as necessary. Obtain facility approval prior to connection to specific panel.

1.29 ACCESS DOORS

- .1 Supply access doors to concealed electrical equipment and/or devices for operating, inspecting, adjusting and servicing.
- .2 Flush mounted 600x600mm 24" x 24" for body entry and 300x300mm 12" x 12" for hand entry unless otherwise noted. Doors to open 180°, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.
- .3 Access doors, hinges, screws, etc. to be tamper proof in areas where tamper proof equipment is called for and/or as specified in drawings.
- .4 Material:
 - .1 Special areas such as tiled or marble surfaces: use stainless steel with brushed satin or polished finish as directed by Consultant.
 - .2 Remaining areas: use prime coated steel.
- .5 Installation:
 - .1 Locate so that concealed items are accessible.
 - .2 Locate so that hand or body entry is achieved.
 - .3 Installation by Division 09.
- .6 Mifab CAD-DW or approved alternate.
- .7 Fire rated access panels: 16 ga. mounting frame, 20 gauge sandwich type insulated self-closing door with concealed hinge, 50mm 2" thickness of fire rated insulation in door, self latching ring pull latch, primer coated, 1½ hour rating.
- .8 Mifab MPFR, Acudor FW-5050, or approved alternate.
- .9 Access doors must maintain fire rating if installed in a fire rated assembly. Refer to RAAC Replacement and Accessibility Upgrades architectural Drawings for locations of fire rated walls and ceilings.

1.30 CUTTING AND PATCHING

- .1 Cutting and patching is by the General Contractor.

1.31 CLEANING

- .1 Daily:
 - .1 Leave work area clean at the end of each day.
 - .2 Final Cleaning:
 - .1 Upon completion of work, remove from site:
 - .1 Waste materials not claimed by OPG.
 - .2 Surplus materials.
 - .3 Rubbish.
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- .4 Tools and equipment which do not form part of the work.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 See Section 26 05 00 for general electrical work requirements.
- .2 The requirements of Division 01 – Quality Control apply to work performed under this Section, with the exception that the cost for this work is to be paid for under base contract, and not the testing allowance provided under Division 01.

1.2 REFERENCES

- .1 International Electrical Testing Association:
 - .1 ANSI/NETA, ATS-2017 Acceptance Testing Specifications for Electrical Power Distribution Equipment & Systems.

Part 2 Pre-Service Testing

2.1 GENERAL

- .1 The following tests shall be made prior to putting the electrical equipment into service to ensure that the distribution equipment has been installed in a satisfactory manner and suitable for placing into service, without endangering personnel or the system.
- .2 Include in Tender amount, all costs and fees incurred for this testing. No additional costs will be accepted by Owner.
- .3 Equipment which fails to meet the specified requirements and performance test shall be corrected and retested until operation is satisfactory without additional cost to Owner.
- .4 The Consultant shall be advised in advance of all tests and shall be given the opportunity to witness any or all tests.
- .5 Submit test reports to Consultant and Owner for review. Select appropriate test equipment in order to facilitate report generation.
- .6 Typed report of test results shall be prepared and submitted for review in accordance with requirements of Division 01 and Section 26 05 00.

2.2 CO-ORDINATION STUDY

- .1 Immediately on award of Contract, prepare a co-ordination and arc fault study and submit for approval. Co-ordination and arc flash study to be completed prior to distribution shop drawing submittals. All distribution change costs associated with not following this sequence to be borne by this trade.
- .2 The co-ordination study data shall be presented in tables and on composite charts and shall include and not be limited to the following:
 - .1 Maximum available short circuit current based on Hydro One Utility primary voltage and 120/208V systems based on MVA available at the utility specified on Hydro One drawings. Verify with consultant. This shall be calculated for every bus down to the lighting panel level.
 - .2 Maximum available ground fault current based on Hydro One Utility primary voltage and 120/208V systems.

- .3 Power supply authority system protective devices with which Owners equipment must co-ordinate.
- .4 Power Supply Authority feeder cables thermal short circuit damage curve.
- .5 Power transformer thermal short circuit damage curve, 3 phase, phase to ground.
- .6 Main and feeder circuit breakers.
- .7 Distribution transformer and generator thermal short circuit damage curves.
- .8 Largest distribution breaker characteristics in each panel.
- .9 Largest branch breaker in each panel.
- .10 Establish the required setting for all ground fault protective devices.
- .11 General damage and decrement curves.
- .12 Cable damage curves.
- .13 Co-ordination charts, each chart shall include single line diagram of the appropriate devices with description and numbering matching that shown on the contract documents. Transformers shall be shown complete with KVA rating, primary and secondary voltages, winding connections, grounding method and impedance.
- .14 A copy of the single-line in Autocad 2024 .DWG format.
- .15 The co-ordination study shall include a list of recommendations to improve co-ordination or protection where possible.
- .16 Selective co-ordination is required to the last branch breaker.

2.3 ELECTRICAL POWER DISTRIBUTION EQUIPMENT (GENERAL)

- .1 Provide infrared thermographic inspection of the major pieces of electrical equipment including switchboards, unit substations, splitter boxes, distribution transformers, motor control centers, switchboards and panel boards after entire system is operation under normal load.
- .2 Verify that each breaker racks in and out correctly and that primary and secondary contacts made correctly.
- .3 With all breakers in operating position and closed and feeder cables disconnected, check insulation resistance of bus at 2.5KV D.C. to ground on each phase with the other two phases grounded.
- .4 By means of current injection test, obtain ratios of all current transformers.
- .5 Test insulation resistance of all secondary breaker wiring and instruments at 1 KV D.C. to ground.
- .6 Test and obtain ohmic values of continuity of all C.T. wiring circuits and of each C.T.
- .7 Test all air circuit breaker functions, i.e. trip, close, recluse etc. Verify that breakers will trip at time and current setting determined by the co-ordination study.
- .8 Verify electric controls and overcurrent trip switch operation.
- .9 Verify all indicating instruments read currently, adjust zero.
- .10 Test ratio and polarity and phase of angle of potential transformers.
- .11 Review factory test results and advise the Consultant in writing of any deficiencies.

2.4 DISTRIBUTION CABLES AND SERVICE CONDUCTORS

- .1 Visually inspect cable jacket, cable sheath and insulation in cables for signs of corrosion, abrasion, mechanical damage and overheating.
- .2 Check for correct cable installation and termination;

- .3 Check feeder for continuity, short circuits, and grounds.
- .4 Confirm phase rotation and proper identification of each phase conductor of each feeder.
- .5 Check feeder for continuity, short circuits, and grounds.
- .6 Ensure resistance to ground of circuits is not less than 100MΩ.
- .7 Megger test with 1000V tester between all phase-to-phase, phase to ground, phase to neutral and neutral to ground, for insulation resistance. Disconnect any devices that should not be subjected to this test voltage prior to testing. Insulation resistance readings shall not be less than 100 MΩ;

2.5 DISTRIBUTION PANELBOARDS AND BRANCH CIRCUIT PANELBOARDS

- .1 Check and test to verify the panel board directory is correct.
- .2 Include the directory in the O&M manual. The directory shall contain size of each breaker and equipment served.
- .3 Check and test the voltage drop is within the specified limit from the service entrance switchboard to the branch panel boards.
- .4 Test branch circuits voltage drop is within the specified requirements.
- .5 Megger test panel feeders with 1000V tester between all phase-to-phase, phase to ground, phase to neutral and neutral to ground, for insulation resistance. Disconnect any devices that should not be subjected to this test voltage prior to testing. Insulation resistance readings shall not be less than 100 MΩ; Provide conductor insulation resistance test report.
- .6 Measure phase and neutral currents on panel board feeder with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes. Provide load balancing report.

2.6 LIGHTING SYSTEMS

- .1 Check and test all lighting fixtures are connected and switched properly
- .2 Check and test all automatic controls are connected and functioning properly
- .3 Check and test the emergency lighting system, including battery lighting system, are connected and functioning properly.
- .4 Check for the voltage drop of the battery lighting system, if the results do not meet OESC requirements, rewire the lighting system to meet OESC requirements.
- .5 Check that time-based lighting control schedule and overrides are functional.

2.7 FIRE ALARM SYSTEM

- .1 The Manufacturer shall carry out the following tests:
 - .1 Perform system verifications and tests according to CAN/ULC-S536 and CAN/ULC-S537.

- .2 Perform life safety testing according ULC-1001:2024 Standard for integrated systems testing of fire protection and life safety systems.
- .3 Confirm, document and verify to Owner's Representative the operation of ancillary functions, including:
 - .1 Release of hold open devices
 - .2 Fan shutdown
 - .3 Annunciation of alarm, trouble, supervisory and status signals
 - .4 Operation under loss of normal power
- .4 Participate in Integrated Systems Commissioning to the extent required by Local AHJ.

2.8 INTEGRATED LIFE SAFETY SYSTEMS

- .1 Contractor shall retain the services of a qualified Integrated Life Safety System Testing Coordinator to develop and execute the required Life Safety System testing as per ULC-S1001. Contractor shall pay all costs associated with completion of this test and assist in facilitating the coordination of the test and testing plan on site.

2.9 MANUFACTURER TESTING

- .1 Manufacturers shall carry out the following tests:
 - .1 Perform system start-up and validation.
 - .2 Check and record nameplate data.
- .2 Manufacturers to provide a full test record showing how each test was carried out, test equipment used, the test results and all the equipment settings.

Part 3 Execution

3.1 PRE-SERVICE TESTING

- .1 Perform Pre-service testing as specified.
- .2 Copies of test reports shall be used to prepare typed test reports and be submitted for review within 5 working days of completion of testing.
- .3 After approval, test reports are to be included in O&M manual.
- .4 Provide arc fault warning labelling on all distribution equipment provided under this contract to CSA-Z462-24 standards.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

1.2 REFERENCES

- .1 CSA C22.2 No .0.3-09 (R2023), Test Methods for Electrical Wires and Cables.

1.3 SUBMITTALS

- .1 Submit product data in accordance with section 26 05 00-Common Work Electrical Section 1.6.

1.4 GENERAL

- .1 Size wires for 3% maximum voltage drop to farthest outlet based a 15A-120V loaded circuit. Maximum suggested home runs to branch panels at 120V/208V for #12 AWG is 13.2m in length, #10 AWG is 22.9m in length, and #8 is 33.5m in length. Refer to drawing for cable specific sizes
- .2 Colour coding shall be as follows for 120/208V:
 - .1 Phase conductors: red, black, blue.
 - .2 Neutral conductors: white.
 - .3 Bonding to ground: green.
- .3 In 120/208 branch circuits supplying power receptacles, the common neutral conductor of each 3 circuits or 2 circuit group shall be 1 size larger than the ungrounded conductors until the first 2 of 3 or 1 of 2 circuits have been dropped off. The grounding conductor within each group shall be of the same ampacity and size as the ungrounded conductors throughout.
- .4 Every 3 circuit group or 2 circuit group of 120/208V, branch circuits must carry a dedicated grounding conductor throughout.
- .5 Size wires for 2% maximum voltage drop for incoming power feed at service entrance switch/panel board.

Part 2 Products

2.1 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
 - .2 "RW90" CSA certified, single copper conductor to CSA C22.2 No. 38, 600/1000 volts, maximum 90°C (194°F) conductor temperature, -40°C (-40°F) minimum installation temperature, X-link polyethylene (XLPE) insulation, colour coded.
 - .3 "RWU90" CSA certified, single copper conductor to CSA C22.2 No. 38, 600/1000 volts, maximum 90°C (194°F) conductor temperature, -40°C (-40°F) minimum installation temperature, extra thickness X-link polyethylene (XLPE) insulation suitable for wet and buried installations, colour coded.
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2.2 ARMoured Cables

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Type: ACWU90 - PVC flame retardant jacket over thermoplastic armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No. 0.3 with maximum flame travel of 1.2 m.

2.3 Control Cables

- .1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket, and armour of closely wound aluminum wire. Jacket colour to be orange.
- .2 Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with PVC insulation type TW -40°C with shielding of braid over each group, over all conductors and overall covering of PVC jackets. Jacket colour to be orange.
- .3 600 V type: 14 AWG stranded annealed copper conductors, sizes as indicated with cross-linked polyethylene type RW90 (x-link) and overall covering of thermoplastic jacket with sheath of aluminum interlocked armour and jacket over sheath of PVC. Armor not required when in cable tray. Jacket colour to be orange.

2.4 Fire Alarm Cables

- .1 Type FAS105-300V Soft Annealed copper conductors 3C#18 or 2C#18 FAS with separate bond wire is acceptable. Flame retardant PVC insulation, outer covering of flame PVC (Red) for initiating circuits. Run in EMT conduit (refer to 26 05 00 2.8).
- .2 Type FAS105-300V Soft Annealed copper conductors 3C#16 or 2C#16 FAS with separate bond wire is acceptable. Flame retardant insulation, outer covering of flame retardant PVC (red) for signaling circuits. Run in EMT conduit (refer to 26 05 00 2.8).

Part 3 Execution

1.1 Installation of Building, Fire Alarm & Control Wires

- 1. Install wiring in conduit systems in accordance with Section 26 05 34.
 - 2. Install all panel feeder circuits without break or splice.
 - 3. Provide dedicated bond for each conduit run.
 - 4. Install F.A.S. data cable from control panels to field devices in separate conduit systems from sounding appliances, door holders and control circuits.
 - 5. Use 1000V insulated conductors for all 600V feeds.
 - 6. Use 600V insulated conductors for all 208V feeds.
 - 7. Use AC90-ISO-BX for drops to devices from main runs of conduit.
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1.2 INSTALLATION OF ARMoured CABLES

1. Group cables wherever possible.
2. Use of armoured cable shall be limited to lighting, switching and outlet drops in stud walls and limited to 20' in ceiling space
3. Armoured cable shall be connected to junction boxes in accessible ceiling space within the room served or adjacent corridor if drywall.
4. Junction boxes shall be appropriately labelled per Section 26 05 00 - Common Work Results - Electrical.

1.3 PROJECT CONDITIONS

1. If identified in documents, verify that field measurements and conditions are as identified.
2. Unless specifically noted, cable routing on drawings is schematic and approximate and not reflective of elevations. Route cable as required to meet project conditions. Determine exact routing and lengths on site.
3. Confirm fire protection ratings of construction to ensure that rooms and paths of conductors are fire rated in accordance with local governing codes requirements. Include fire rated conductors as required to meet local governing codes requirements.

1.4 CO-ORDINATION

1. Co-ordinate work with work provided under other electrical work and work of other trades.
2. Determine required separation between cable and other work.
3. Determine cable routing to avoid interference with other work.
4. Submit any alternative cable routing to Consultant for review prior to proceeding with work.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA Standard C22.2 No. 41-22 - Grounding and Bonding Equipment.
- .2 Local authority having jurisdiction and ESA.
- .3 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
- .4 ANSI/IEEE 837-02, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.
- .5 Canadian Standards Association, (CSA International).

1.3 SUBMITTALS

- .1 Submit in accordance with section 26 05 00-Common Work Electrical Section 1.6 including: manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

Part 2 Products

2.1 EQUIPMENT

- .1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .2 Copper conductor: minimum 6m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as indicated.
- .3 Rod electrodes: copper clad steel 20mm diameter by 3m long.
- .4 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.
- .5 Insulated grounding conductors: green, type RW90 or RWU90.
- .6 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.
- .7 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Thermit welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where PVC, EMT, and flexible conduit is used, run
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ground wire in conduit.

- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, electrodes, using permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

3.2 ELECTRODES

- .1 Make ground connections to continuously conductive underground water pipe on street side of water meter.
- .2 Install water meter shunt.
- .3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.
- .4 Install rod, electrodes and make grounding connections.
- .5 Bond separate, multiple electrodes together.
- .6 Use size 3/0 AWG copper conductors for connections to electrodes.
- .7 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.3 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centers, starters, control panels, building steel work, distribution panels, outdoor lighting.

3.4 COMMUNICATION SYSTEMS (IF APPLICABLE)

- .1 Install grounding connections for telephone, sound, fire alarm, intercommunication systems as follows:
 - .1 Telephones: make telephone grounding system in accordance with telephone company's requirements.
 - .2 Sound, fire alarm, intercommunication systems as indicated.

3.5 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction over

installation.

- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Submit shop drawings and product data for cabinets in accordance with section 26 05 00-Common Work Electrical Section 1.6.

Part 2 Products

2.1 JUNCTION AND PULL BOXES

- .1 Size as needed. Welded steel construction with screw-on flat covers for surface mounting.
- .2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.2 SPLITTERS

- .1 Sized as needed
- .2 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .3 Bus bars to voltage and current rating on drawings and to match required size and number of incoming and outgoing conductors as indicated.
- .4 Lugs to match required conductor sizes.
- .5 Predrilled holes for an additional 3 circuits.

2.3 CABINETS

- .1 Size as needed. Electrical Type: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.
- .2 Communication Systems Type: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm sheet steel backboard for surface mounting.

Part 3 Execution

3.1 JUNCTION, PULL BOXES, SPLITTER AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor.
- .3 Install terminal block as indicated in Type T cabinets.
- .4 Only main terminal & junction boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.2 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
 - .2 Install size 2 identification labels indicating system name voltage and phase.
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END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA C22.1-[24], Canadian Electrical Code (CEC), Part 1 (26th Edition), Safety Standard for Electrical Installations.
- .2 CSA C22.2 No. 18.1-[13(R2022)], Metallic Outlet Boxes (Tri-national Standard, with UL 514A and ANCE NMX- J-023/1).
- .3 CSA C22.2 No. 18.2-[06(R2021)], Nonmetallic Outlet Boxes.
- .5 CSA C22.2 No. 85-[14(R2023)], Rigid PVC Boxes and Fittings.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 100mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices. Identify future use of outlet on back of cover.
- .5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel single and multi-gang flush device boxes for flush installation, minimum size 76 x 50 x 38mm or as indicated. 100mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 100 x 54 x 48mm.
- .3 100mm square or octagonal outlet boxes for lighting fixture outlets.
- .4 100mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 MASONRY BOXES

- .1 Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

- .1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface

wiring of switches and receptacle in mechanical and electrical rooms and unfinished areas.

- .2 Electro-galvanized utility type for indoor surface wiring.

2.6 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit and armoured cable connections. Reducing washers are not allowed.
- .5 Identification in accordance with section 26 05 00.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .2 CSA C22.2 No. 83-M85(R2022), Electrical Metallic Tubing.
- .3 CSA C22.2 No. 211.2:06(R2021), Rigid PVC (Unplasticized) Conduit.

Part 2 Products

2.1 LOCATION OF CONDUIT

- .1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only. Provide all conduits from end point to source point as necessary to form complete system. In these cases provide conduit as indicated. Use armored cable where indicated. Coordinate exact routing with General Contractor.
- .2 All conduit runs within the building are to be above grade. Do not run conduits under the slab unless explicitly indicated on drawings.

2.2 CONDUITS

- .1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .2 Flexible metal conduit: to CSA C22.2 No. 56, aluminum liquid-tight flexible metal.
- .3 Minimum size 20mm 3/4" throughout project.

2.3 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50mm and smaller.
 - .1 Two hole steel straps for conduits larger than 50mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1.5m on center.
- .4 Threaded rods, 6mm diameter, to support suspended channels.
- .5 Do not fasten conduit to roof or floor slabs unless approved by RAAC Replacement and Accessibility Upgrades. Consultant.).

2.4 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "elbows" where 90 degrees bends for 25mm and larger conduits.
- .3 Set-screws connectors and couplings for EMT.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

- .1 Polypropylene.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
 - .2 Conceal conduits except in mechanical and electrical service rooms in unfinished areas.
 - .3 Use electrical metallic tubing (EMT), except in cast concrete, to each corridor, classroom and office for main branch circuit conductor runs. Use from main branch circuit runs for drops to wiring devices in concrete block walls.
 - .4 Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without prewired outlet box, connection to surface or recessed fluorescent fixtures & work in movable metal partitions.
 - .5 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
 - .6 Minimum conduit size for lighting and power circuits: 21mm.
 - .7 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
 - .8 Mechanically bend steel conduit over 21mm diameter.
 - .8 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
 - .10 Install fish cord in empty conduits.
 - .11 Run 2 - 25mm spare conduits up to accessible t-bar ceiling space from each flush panel.
 - .1 Terminate these conduits in 150 x 150 x 100mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.
 - .12 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
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- .13 Dry conduits out before installing wire.
- .14 Conduit wall penetrations to be performed neatly by core holes.
- .15 Do not install conduit in building wall, floor or ceiling control joints.

3.3 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75mm parallel to steam or hot water lines with minimum of 25mm at crossovers.
- .7 Do not fasten conduit to underside of Siporex or steel roof deck.

3.4 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

3.5 CLEANING

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 33 65 76 – Direct Buried Underground Cable Ducts

1.2 REFERENCES

- .1 Canadian Standards Association, (CSA International)
- .2 Insulated Cable Engineers Association, Inc. (ICEA)

Part 2 Products

2.1 MARKERS

- .1 Concrete type cable markers: 600 x 600 x 100 mm with words: cable, joint or conduit impressed in top surface, with arrows to indicate change in direction of cable and duct runs.

Part 3 Execution

3.1 CABLE INSTALLATION IN DUCTS

- .1 Install cables as indicated in ducts.
 - .1 Do not pull spliced cables inside ducts.
- .2 Install multiple cables in duct simultaneously.
- .3 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .4 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.
- .5 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .6 After installation of cables, seal duct ends with duct sealing compound.

3.2 MARKERS

- .1 Mark cable every 50m along cable/duct runs and changes in direction.
- .2 Mark underground splices, if any.
- .3 Where markers are removed to permit installation of additional cables, reinstall existing markers.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
 - .2 Perform tests using qualified personnel. Provide necessary instruments and equipment.
 - .3 Check phase and identify each phase conductor of each feeder.
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- .4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.
- .5 Pre-acceptance tests.
 - .1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.
 - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
- .6 Acceptance Tests
 - .1 Ensure that terminations and accessory equipment are disconnected.
 - .2 Ground shields, ground wires, metallic armour and conductors not under test.
 - .3 High Potential (Hipot) Testing.
 - .1 Conduct hipot testing at % of original factory test voltage in accordance with manufacturer's ICEA recommendations.
- .7 Provide Consultant with list of test results showing location at which each test was made, circuit tested and result of each test.
- .8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Submit descriptive data and shop drawings in accordance with section 26 05 00-Common Work Electrical Section 1.6 including:
- .2 Descriptive Data
 - .1 Catalog cuts or data sheets on vibration isolators and specific restraints detailing compliance with the specification.
 - .2 Detailed schedules of flexibly and rigidly mounted equipment, showing vibration isolators and seismic restraints by referencing numbered descriptive drawings.
- .3 Shop Drawings
 - .1 Submit fabrication details for equipment bases, including dimensions, structural member sizes, and support point locations.
 - .2 Provide all details of suspension and support for equipment hung from the ceiling.
 - .3 Where walls, floors, slabs, or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for cable tray, conduit, and equipment must be included and approved before the condition is accepted for installation. Restraint manufacturers' submittals must include spacing, static loads, and seismic loads at all attachment and support points.
 - .4 Provide specific details of seismic restraints and anchors; include number, size, and locations for each piece of equipment.

1.2 DESIGN REQUIREMENTS

- .1 The contractor shall retain a specialty consultant or equipment manufacturer to develop a seismic restraint system and perform seismic calculations in accordance with the Ontario Building Code and local codes and additional requirements specific in this section. Calculations, restraint selections, and installation details shall be done by a professional engineer experienced in seismic restraint design and installation and licensed in the Province of Ontario.
 - .2 The seismic restraint design, consisting of calculations, restraint selection, installation details, and other documentation, shall be submitted. This submittal shall be signed and sealed by a professional engineer, as stated above.
 - .3 The seismic restraint design shall clearly indicate the attachment points to the building structure and all design forces (in X, Y, and Z direction) at the attachment points. The seismic restraint engineer shall coordinate all attachments with the building's structural engineer of record, who shall verify the attachment methods and the ability of the building structure to accept the loads imposed. The seismic restraint design shall be based on actual equipment data (dimensions, weight, center of gravity, etc.) obtained from submittals or the manufacturers. The equipment manufacturer shall verify that the attachment points on the equipment can accept the combination of seismic, weight, and other loads imposed.
 - .4 Analysis should include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure. Analysis should detail anchoring methods, bolt diameter, embedment, and/or welded length. All seismic restraint devices should be designed to accept, without failure, the forces through
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the equipment or system's center of gravity.

- .5 All seismic restraints and combination isolator/restraints should have verification of their seismic capabilities. Manufacturers may verify their capabilities by testing that is witnessed by an independent professional engineer.
- .6 Engineering Design Criteria
 - .1 Design system in accordance with Ontario Building Code Part 4.
 - .2 Seismic design must be considered for equipment, conduit and cable tray.
 - .3 The building is of high importance category as defined in Table 4.1.2.1.B of the Ontario Building Code, Division B-Part 4.

Part 2 Products

2.1 SPRING MOUNTINGS

- .1 As in the ASHRAE Handbook, Chapter 46, type 3, should be built into a ductile casting or welded steel housing to provide all-directional seismic snubbing. The snubber should be adjustable vertically and allow a maximum of 1/4 in. (6mm) travel in all directions before contacting the resilient snubbing collars.

2.2 SEISMIC CABLE RESTRAINTS

- .1 Should consist of steel cables sized to resist seismic loads with a minimum safety factor of 2 and arranged to provide all-directional restraint. Cables should be pre-stretched to achieve a certified minimum modulus of elasticity. Cable end connections should be steel assemblies that swivel to the final installation angle and utilize two clamping bolts to provide proper cable engagement. Alternatively, 45 degree bent steel plates, with holes for attachment to the structure and for steel cable loops with thimbles and wire rope clamps, are acceptable. A minimum of two wire rope clamps is required at each end of the cable assembly.

2.3 SEISMIC SOLID BRACES

- .1 Should consist of steel angles, channels, or strut channels to resist seismic loads with a minimum safety factor of 2 and arranged to provide all-directional restraint. Seismic solid brace end connectors should be steel assemblies that swivel to final installation angle and utilize two through-bolts to provide proper attachment.

2.4 STEEL ANGLES OR STRUT CHANNELS

- .1 Sized to prevent buckling should be clamped to vertical support rods utilizing a minimum of two clamps at each restraint location when required. Clamp assemblies may be ductile casting or strut channels assemblies.

Part 3 Execution

3.1 GENERAL NOTES

- .1 All seismic restraint systems should be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.

- .2 Installation of seismic restraints should not cause any change of position of equipment, conduit, or cable tray, resulting in stresses or misalignment.
- .3 No rigid connections between equipment and the building structure should be made that degrade the noise and vibration-isolation system specified.
- .4 The contractor shall not install any equipment, cable tray or conduit that makes rigid connections with the building unless isolation is not specified. "Building" includes, but is not limited to, slabs, beams, columns, studs, and walls.
- .5 Coordinate work with other trades to avoid rigid contact with the building.
- .6 Any conflicts with other trades that will result in rigid contact with equipment, conduit or cable tray due to inadequate space or other unforeseen conditions should be brought to the engineer's attention prior to installation.
- .7 Prior to installation, bring to the engineer's attention any discrepancies between the specifications and the field conditions or changes required due to specific equipment selection.
- .8 Overstressing of the building structure should not occur because of overhead support of equipment. Contractor should submit loads to the structural engineer of record for approval. Generally, bracing may occur from:
 - .1 flanges of structural beams,
 - .2 upper truss cords in bar joist construction, and
 - .3 concrete anchors.
- .9 Type 6 cable restraints should be installed slightly slack to avoid short-circuiting the isolated suspended equipment, cable tray or conduit. When cables are installed slack a safety factor of 5 shall be used.
- .10 Type 6 cable assemblies should be installed taut on non-isolated systems. Type 7 seismic solid braces may be used in place of cables on rigidly attached systems only.
- .11 Cables should not be installed over sharp corners.
- .12 At all locations where type 6 or 7 restraints are located, the support rods should be braced when necessary to accept compressive loads with type 8 braces. Welding of compression braces to the vertical support rods is not acceptable.
- .13 The vibration-isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails should not be permitted.
- .14 Post-installed concrete anchors should be approved for seismic restraint systems and suitable for building construction.
- .15 Seismic restraints should be mechanically attached to the system. It is not sufficient to loop restraints around the system.
- .16 Conduit or cable tray crossing building seismic joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the conduit, cable tray, equipment connections, or support connections.
- .17 Do not brace a system to two different structures, such as a wall and a ceiling.

3.2 CERTIFICATION

- .1 At the completion of the installation the seismic specialist shall visit the site and review that the installation of restraint for systems is in accordance with their design. The specialist shall provide written certification that the systems have been correctly restrained. The certification shall be sealed by the engineer responsible for the seismic design. Provide copy of certification to local municipality when required. Include copy of certification in O & M manuals.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for standard and custom breaker type panelboards.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 06 10 00.01 - Rough Carpentry - Short Form: Plywood Backboard.
- .4 Section 26 05 00 - Common Work Results - Electrical.
- .5 Section 26 28 21 - Moulded Case Circuit Breakers.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.29-11, Panelboards and enclosed Panelboards.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Include on drawings:
 - .1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Division 01 Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance and maintenance data for panelboards for incorporation into manual.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
 - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .3 Storage and Handling Requirements:
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- .1 Store materials off ground, indoors or in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect panelboards from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan.

Part 2 Products

2.1 PANELBOARDS

- .1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer, Square D.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand. (Maximum fault current).
- .2 120/208V-3Ø, 120/240V-1Ø or 347/600V-3Ø panelboards: bus and breakers rated for interrupting capacity or as indicated. Designed as lighting panels, power panels, and power conditioned panes.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Two keys for each panelboard and key panelboards alike.
- .6 Copper bus with neutral of same ampere rating as mains.
- .7 Mains: suitable for bolt-on breakers.
- .8 Trim with concealed front bolts and hinges.
- .9 Trim and door finish: baked grey enamel.
- .10 Surface or flushmount as indicated on panel schedules.
- .11 Drip hood on surface panels.

2.2 BREAKERS

- .1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise. All breakers to be bolt-on type.
- .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When

mounted vertically, down position should open breaker.

- .4 Lock-on devices for receptacles, fire alarm clock outlet, emergency, door supervisory, intercom, stairway, exit and night light, public address, telephone, lan, circuits.

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit. (Lighting, power and power conditioned panels).

Part 3 Execution

3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on u-channel. Where practical, group panelboards on common u-channel support system.
- .3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results - Electrical or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.
- .6 Do not enter top of surface mounted panels (drip proof construction for sprinklered buildings).
- .7 Where bottom or side entry into surface panels is not possible, provide liquid tight connectors.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA International
 - .1 CSA C22.2 No.42-10, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CAN/CSA C22.2 No.42.1:13(R2022), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA C22.2 No.55:15 (R2020), Special Use Switches.
 - .4 CSA C22.2 No.111-18, General-Use Snap Switches (Bi-national standard, with UL 20).
 - .5 CAN/CSA-C22.2 No.144-M91(R2020), Ground Fault Circuit Interrupters.
 - .6 NEMA PG 2.2-2014 Application Guide for Ground Fault Protection Devices for Equipment.

Part 2 Products

2.1 SWITCHES

- .1 20A, 120 V, single pole, double pole, three-way, four-way to: CSA-C22.2 No.55 and CSA-C22.2 No.111.
- .2 Manually-operated general purpose ac switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine moulding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 White toggle.
- .3 Toggle operated locking fully rated for tungsten filament and LED lamps, and up to 80% of rated capacity of motor loads.
- .4 Switches of one manufacturer throughout project. (except as noted).
Standard of Acceptance: Hubbell or Leviton Commercial grade.
- .5 Weather proof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles for outdoor rated switches.

2.1 RECEPTACLES

- .1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:
 - .1 Ivory urea moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight back wired entrances, four side wiring screws.
 - .5 Triple wipe contacts and rivetted grounding contacts.
 - .2 Other receptacles with ampacity and voltage as indicated.
 - .3 Receptacles of one manufacturer throughout project.
 - .4 Receptacles to be tamper resistant.
 - .5 Manufacturer: Hubbell or Leviton, white only.
-

2.3 SPECIAL WIRING DEVICES

- .1 Class A GFCI specification grade 15A-125V, U ground.
- .2 CSA Type 5-20RA, 125V, 20A, U ground for the housekeeping receptacles and any receptacle noted as 20A-120V. Ivory urea molding housing.
- .3 CSA Type 5-20RA, 125V, 20A, U ground GFCI with weather proof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles for outdoor rated receptacles.

2.4 CEILING MOUNTED OCCUPANCY SENSOR

1. Dual technologies ceiling mounted occupancy sensor stand-alone control.
 1. Intelligent, continually adapting sensor.
 2. Ultrasonic combined with passive infrared sensing.
 3. Snap lock to ceiling mounted cover plate.
 4. Non-volatile memory.
 5. 93m square coverage.
 6. Operating voltage: as per drawing
 7. Refer to drawing for horsepower rating
 8. Manual mode: 8 to 30 minutes
 9. Test mode: 8 seconds
 10. Red lamp: infrared motion detected.
 11. Green lamp: ultrasonic motion detected.
 12. Housing: rugged, high-impact, injection-molded plastic, color coded leads 15cm
 13. Occupancy suitable for controlled dimming.
 14. Auto-on, auto-off
 15. 2 pole to allow for double switching.
 16. Rated for outdoor used as indicated.
2. Refer to wiring manufacturer for wiring diagrams.
3. Occupancy sensor of one manufacturer throughout the project.
Acceptable materials: Lutron Legrand, Leviton, Current or approved alternate

2.4 COVER PLATES

- .1 Blank plates for boxes with no wiring devices.
- .2 Cover plates for wiring devices to: CSA-C22.2 No.42.1.
- .3 Cover plates from one manufacturer throughout project.
- .4 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .5 Stainless steel, 1 mm thick cover plates for switches, receptacles and other wiring devices mounted in flush-mounted outlet box.
- .6 Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

Part 3 Execution

3.1 INSTALLATION

- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Mount toggle switches at height in accordance with Section 26 05 00 - Common Work Results - Electrical and as indicated.
- .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Mount receptacles at height in accordance with Section 26 05 00 - Common Work Results - Electrical and as indicated.
 - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
 - .4 For GFCI Do not ground neutral on load side of ground fault relay and pass phase conductors including neutral through zero sequence transformers.
- .3 Ceiling Mounted Occupancy and Vacancy Sensor:
 - .1 Self-Adjusting Internal microprocessor continually analyzes, evaluate, and adjusts the sensitivity and time delay.
 - .2 3-wire connection (low voltage) and twist-lock sensor attachment for 360° rotation and flexibility.
 - .3 Ultrasonic technology for small sensitivity.
 - .4 Timer setting: Automatic -30 sec -30 min Test mode -6 sec with auto exit programming.
 - .5 Non-volatile memory.
 - .6 Walk-through 2.5 min.
 - .7 Wide coverage from 500 to 2000 sq.ft.
 - .8 Ambient Light Recognition: lights sensor prevents lights from turning on when the room is adequately lit by natural lights.
 - .9 Ultrasonic Components: U/S transducers and one or two narrow bandwidth receivers each 16mm in diameter. Frequency - Crystal controlled to ±.005%.
 - .10 Device: Rugged, high-impact, injection molded plastic, off-white. Color coded leads 6" (16.24 cm).
 - .11 Indicators: green LED for U/S motion technology and red LED for infrared motion technology.
 - .12 Listings CuL/US Certified, meets ASHRAE Standard 90.1 and CEC Title 24 requirements.
 - .13 Install device as per manufacturer's instruction.
- .4 Cover plates:
 - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
 - .2 Install suitable common cover plates where wiring devices are grouped.
 - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
 - .4 Install stainless steel coverplates for all flush mounted devices.
 - .5 Install cast aluminum coverplates on all exterior devices.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA C22.1-[24], Canadian Electrical Code, Part I (26th Edition), Safety Standard for Electrical Installations.
 - .2 CSA C22.2 No. 5-[16(R2021)], Molded-case circuit breakers, molded-case switches and circuit-breaker enclosures (Tri-national standard with UL 489 and NMX-J-266-ANCE-2016).
 - .3 CSA C22.2 No. 144.1-[16(R2020)], Ground-Fault Circuit-Interrupters (Tri-National standard, with UL 943 and NMX-J-520-ANCE).
 - .4 CSA C22.2 No. 270-[16(R2021)], Arc Fault Protective Devices.

1.2 SUBMITTALS

- .2 Submit shop drawings and product data in accordance with section 26 05 00-Common Work Electrical Section 1.6 including:
 - 1. Product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.
 - 2. Include time-current characteristic curves for breakers with ampacity of 100A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.
 - .2 Shop Drawings:
 - 1. Submit shop drawings for products of this Section.
 - 2. Submit time-current phase protection co-ordination characteristic curves for breakers sized greater than 225 A.
 - 3. Identify types, ratings, trip units and functions/settings.
 - .4 Certificates:
 - .1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit PDF copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.
 - .1 Production certificate of origin must be submitted to Departmental Representative and Consult and for approval.
 - .2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.
 - .3 Any work of manufacturing, assembly or install begin only after acceptance of production certificate of origin by Departmental Representative and Consultant reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.
 - .4 Production certificate of origin must contain:
 - .1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.
-

- .2 Licensed dealer's name and address and distributor responsible for Contractor's account.
- .3 Contractor's name and address and person responsible for project.
- .4 Local manufacturer's representative name address. Local manufacturer's representative must sign and date certificate.
- .5 Name and address of building where circuit breakers will be installed.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURER

- .1 Square D.

2.2 BREAKERS GENERAL

- .1 Size as per drawings.
- .2 Moulded-case circuit breakers, Circuit breakers, and Ground-fault circuit-interrupters: to CSA C22.2 No. 5
- .3 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .4 Common-trip breakers: with single handle for multi-pole applications.
- .5 80% rated.
- .6 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
 - .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .7 Circuit breakers to have minimum symmetrical rms interrupting capacity rating as the panelboard/device they are installed in, as indicated on drawings.

2.3 MAGNETIC BREAKERS DESIGN

- .1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection. (isolation purpose).

Part 3 Execution

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CAN/CSA-C22.2 No.4-16(R2020), Enclosed and Dead-Front Switches
- .2 CSA C22.2 No.39:13 (R2022), Fuseholder Assemblies.

1.2 SUBMITTALS

- .1 Submit shop drawings and product data in accordance with section 26 05 00-Common Work Electrical Section 1.6 including: manufacturer's instructions, printed product literature and data sheets for disconnect switches - fused and non-fused and include product characteristics, performance criteria, physical size, finish and limitations.

Part 2 Products

2.1 DISCONNECT SWITCHES

- .1 Fusible and non-fusible, disconnect switch in CSA Enclosure Type 3, size as indicated on drawing.
- .2 Provision for padlocking in on-off switch position by three locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Fuses: size as indicated.
- .5 Fuseholders: to CSA C22.2 No.39 suitable without adaptors, for type and size of fuse indicated.
- .6 Quick-make, quick-break action.
- .7 ON-OFF switch position indication on switch enclosure cover
- .8 Ensure switch for service entrance is approved for use as service entrance and kA ratings are as indicated on drawings.
- .9 Drip hoods.
- .10 Contact/switch viewing window.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical
- .2 Indicate name of load controlled on size 4 nameplate.

2.3 ISOLATION SWITCHES

- .1 Toggle type.
-

- .2 Hp rated.
- .3 120, 240, 208 or 600V rated or 3 phase to suit motor.
- .4 Padlock provision in off position.
- .5 Surface mount enclosure, CSA type 3

2.4 ACCEPTABLE MANUFACTURER

- .1 Square D

Part 3 Execution

3.1 INSTALLATION

- .1 Install disconnect switches complete with fuses if applicable.
- .2 Install isolation switches at motors as indicated.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 45 00 - Quality Control.

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

1.3 SCOPE OF WORK

- .1 This section shall include the supply of all labour, materials and equipment required for the supply and installation as shown on the drawings and as specified herein.
- .2 No additional costs will be accepted by the Owners for revising fixture types to suit the ceilings indicated in architectural drawing and schedule. Review all ceiling types prior to ordering fixtures.

Part 2 Products

2.1 GENERAL

- .1 Verify the Catalogue Number of all fixtures with the description prior to ordering and check for final ceiling finish in all areas where recessed fixtures are called for in order to purchase correct type of ceiling trim, flanges and mounting brackets to suit the particular construction used where the fixtures are installed.
- .2 Allow for temporary lighting, emergency lighting and exit signs during phased construction.

2.2 LIGHTING ACCESSORIES

- .1 Drivers:
 - .1 Physical Characteristics
 - .1 Driver shall be provided with integral leads color coded per ANSI C82.11.
 - .2 Performance Requirements
 - .1 Driver shall energize compatible LED lamps within 1 second after mains power is applied.
 - .2 Driver shall provide independent lamp operation (ILO) allowing remaining lamps to maintain full light output when one or more lamps fail.
 - .3 Driver shall contain auto restart circuitry in order to restart lamps without resetting power.
 - .4 Driver shall operate from a 50Hz or 60Hz AC input source of 120V through 277V with sustained variations of +/- 10% (voltage and frequency), for interior and exterior wall pack.
 - .5 Driver shall operate from a 50Hz or 60Hz AC input source of 347V with sustained variations of +/- 10% (voltage and frequency), for exterior site lighting.
 - .6 Driver shall be high frequency electronic type and operate lamps at frequencies above 42kHz to avoid interference with infrared devices and eliminate visible flicker.
-

- .7 Driver shall have a power factor of 0.94 or above when operating the maximum rated number of compatible lamps, and .88 or above when operating the minimum rated number of compatible lamps.
- .8 Driver input current shall Total Harmonic Distortion (THD) of 10% or less when operating the maximum rated number of compatible lamps and 15% or less when operating the minimum rated number of compatible lamps.
- .9 Driver shall have a Class A sound rating.
- .10 Driver shall have a minimum starting temperature of -13F/-25C.
- .11 Driver shall tolerate sustained open circuit and short circuit output conditions.
- .12 Driver shall be suitable of operation in up to a 45C ambient temperature.
- .13 Driver shall be replaceable where applicable.
- .3 Regulatory requirements
 - .1 Driver shall not contain any Polychlorinated Biphenyl (PCB).
 - .2 Driver shall be Underwriters Laboratories (UL) Recognized, Class P, and suitable for Damp and Dry conditions; and CSA Certified where applicable.
 - .3 Driver shall comply with ANSI C62.41 Category A transient protection.
 - .4 Driver shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47, CFR part 15, Non-Consumer (class A) for EMI/RFI (conducted and radiated).
 - .5 Driver shall comply with NEMA 410 for in-rush current limits.
- .4 Other
 - .1 Driver shall be manufactured in a factory certified to ISO 9001 Quality System Standards.
 - .2 Driver shall carry a five year warranty from date of manufacture against defects in material and workmanship when operating in a 45C ambient environment or less.

2.3 FINISHES

- .1 Baked enamel finish:
 - .1 Conditioning of metal before painting:
 - .1 For corrosion resistance conversion coating to CGSB 31-GP-103Ma.
 - .2 For paint base, conversion coating to CGSB 31-GP-105Ma, CGSB 31-GP-106M.
 - .2 Metal surfaces of luminaire housing and reflectors finished with high gloss baked enamel to give smooth, uniform appearance, free from pinholes or defects.
 - .3 Reflector and other inside surfaces finished as follows:
 - .1 White, minimum reflection factor 85%.
 - .2 Colour fastness: yellowness factor not above 0.02 and after 250 h exposure in Atlas fade-ometer not to exceed 0.05.
 - .3 Film thickness, not less than .0012" average and in no areas less than .001".
 - .4 Gloss not less than 80 units as measured with Gardner 60° gloss meter.
 - .5 Flexibility: withstand bending over 1/2" mandrel without showing signs of cracking or flaking under 10 times magnification.
 - .6 Adhesion: 1" square lattice made of 1/8" squares cut through film to metal with sharp razor blade. Adhesive cellulose tape applied over lattice and pulled. Adhesion satisfaction if no coating removed.
- .2 Black Alzak Finish:
 - .1 Aluminum sheet fabricated from special aluminum alloys and chemically brightened, subsequently anodically treated to specifications established by Alcoa, to produce:
 - .1 Finish for mild commercial service, minimum density of coating 7.8 g/m², minimum reflectivity 83% for specular, 80.5% for semi-specular and 75%

- for diffuse.
- .2 Finish regular industrial service, minimum density of coating 14.8 g/m², minimum reflectivity 82% for specular and 73% for diffuse.
 - .3 Finish for heavy duty service, minimum density of coating 21.8 g/m², minimum reflectivity 85% for specular, 65% for diffuse.

2.5 LIGHTING FIXTURE

- .1 Type letters for each lighting fixture shown on the drawings are indicated on lighting fixture schedule.

FIXTURE TYPE	WATTS & LAMPS	CAT NO.
A	305x1220mm surface	Day Brite OWL440L-840-UNV
B	610x1220mm	Day Brite 2SBP4060L8CSP-4-UN3-DIM or approved alternate
C	1220mm Wall mount strip	Day Brite CSW48-4740120 or approved alternate
D	10" round downlight	Lightolier S10R-90-40K-22-W or approved alternate
E	Emergency wall pack	Emergi-lite 12ESL/2LJ or approved alternate Complete with duplex receptacle at high level.
X1	LED pictogram Exit sign	Emergi-lite EA1WU or approved alternate
EX	LED combination pictogram exit and emergency light	Emergi-lite EAC-1-W-1250-2-LG or approved alternate

Part 3 Execution

3.1 INSTALLATION

- .1 Install lighting fixtures in accordance with the manufacturer's specified instructions and with details on the drawings, when shown.
- .2 Where light fixtures are to be installed in suspended ceilings, support fixtures independently of ceiling by means of two chain hangers bolted through the fixture housing to form a trapeze at each end, using jack chains and 'S' hooks. Do not secure directly to roof deck. Provide unistrut supports and all hardware as required to install light fixtures.
- .3 Align fixtures mounted in continuous rows to form a straight, uninterrupted line.
- .4 Align individual fixtures parallel or perpendicular to building lines.
- .5 Coordinate outlet locations for suspended fixtures to clear door swings.
- .6 Replace any faulty LED fixtures.
- .7 Fully coordinate with other divisions to avoid interference with ductwork and piping and

other services.

3.2 WIRING

- .1 In corridors:
 - .1 Connect luminaires to lighting circuits through conduit system with drops of armoured cable not exceeding 3m in length.
- .2 In rooms:
 - .1 Connect luminaries to main conduit run junction box in same room with armoured cable.
 - .2 Interconnect luminaires in the same room using armoured cable.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Refer to section 26 05 00 – Common Work Electrical – Reference Standards.
- .2 The system and installation shall conform to the Ontario Building Code, the Ontario Electrical Safety Code and ULC S524 Standard for the installation of fire alarm systems.
- .3 ULC 524-2024 Standard for installation of fire alarm systems
- .4 ULC-525: 2023 Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories
- .5 CAN/ULC-527:2019 Standard for control units for fire alarm systems.
- .6 ULC-S528 :2023 Manual stations for fire alarm systems, including accessories.
- .7 CAN/ULC-S529: 2016 Standard for smoke detectors for fire alarm systems.
- .8 ULC-530:2025 Standard for heat detectors for fire protective signaling systems.
- .9 The system will require to be tested and pass
 - .1 ULC-536:2024 Standard for inspection and testing of fire alarm systems
 - .2 ULC-537:2019 Standard for verification of fire alarm systems
 - .3 ULC-S1001:2024 Standard for integrated systems testing of fire protection and life safety systems

1.2 REGULATORY REQUIREMENTS

- .1 All equipment shall be listed by Underwriter's Laboratory of Canada (ULC).
- .2 All components of the system shall be the product of a single manufacturer.
- .3 The system shall be in accordance with CAN/ULC-S524-24, and shall be subject to the approval of the local authority having jurisdiction.
- .4 The system and installation shall conform to the Ontario Building Code and the Ontario Electrical Safety Code.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Division 01 requirements.
- .2 Shop drawings must be submitted and reviewed before any equipment is shipped to the site.
- .3 Shop drawings to consist of the following:
 - .1 Project title page with project name, engineer, contractor and equipment manufacturers.
 - .2 Project detailed equipment list.
 - .3 Project verification requirements system/device data sheets and typical wiring schematics.
- .4 Contractor shall have a copy of reviewed shop drawings on site at all times for system installation reference.

1.4 OPERATION AND MAINTENANCE MANUALS

- .1 Submit operation and maintenance manuals in accordance with Division 01 requirements.
-

- .2 Include the following:
 - .1 Operation and maintenance instructions for the complete fire alarm system to permit effective operation and maintenance.
 - .2 Recommended spare parts list with parts catalogue numbers.
 - .3 Copy of reviewed shop drawings.
 - .4 Letter of Warranty
 - .5 Copy of ESA certificate
 - .6 Copy of Fire Alarm Verification Report.
 - .7 Copy of Integrated Testing Report.

1.5 MAINTENANCE

- .1 Provide one year's free maintenance with two inspections by manufacturer during the year. Inspection tests to conform to ULC-S536-24. Submit inspection report to Owner.

1.6 TRAINING

- .1 Provide 6 hours on-site lectures and demonstrations by fire alarm equipment manufacturer, to train operational personnel in use and maintenance of the fire alarm system. Refer to paragraph 3.3 – Training for further detail.
- .2 Training shall be in accordance with Division 01 requirements.

1.7 SYSTEM DESCRIPTION

- .1 Provide a fully addressable, micro-processor based, zoned, single-stage, three channel, fire alarm system utilizing automatic/manual addressable devices, and operating at 24 VDC nominal voltage from a rectified 120 VAC power supply.
- .2 System:
 - .1 Subject to Ontario Fire Marshall (OFM) approval.
 - .2 Subject to local Authority Having Jurisdiction (AHJ) inspection for final acceptance.
- .3 Any circuit wiring leaving or entering the building shall be provided with a combination choke, MOV, and gas-discharge transient protection.

1.8 BUILDING DESCRIPTION

- .1 The building is a Group A Division 2 major occupancy with one floor above grade and of non-combustible construction.

Part 2 Tests

2.1 MATERIALS

- .1 Equipment and devices: ULC listed and labeled; standard product of a single manufacturer.
 - .2 Power supply: to CAN/ULC-S524-24 and OBC requirements.
 - .3 Audible signal devices: to ULC-S525-23.
-

- .4 Control unit: to CAN/ULC-S527--19.
- .5 Manual fire alarm stations: to ULC-S528-23.
- .6 Smoke detectors: to CAN/ULC-S529-16
- .7 Thermal detectors: to ULC-530-25.

2.2 ACCEPTABLE MANUFACTURERS

- .1 Chubb Edwards.

2.3 SYSTEM OPERATION

- .1 Actuation of a manual pull station or detector to:
 - .1 Cause on electronic latch to lock-in the alarm state at the control panel.
 - .2 Indicate the zone, room number, room name of alarm at the control panel and remote annunciator.
 - .3 Automatically record the time, date and location of alarm at the control panel.
 - .4 Cause all horns and horn/strobes to sound an evacuation tone throughout the building.
 - .5 Transmit signal to fire department via building security and monitoring system.
 - .6 Cause fire doors and smoke control doors, if normally held open, to close automatically.
- .2 Acknowledging the alarm shall be indicated, and recorded by time and date at the control panel.
- .3 The tones can be silenced by an "alarm silence" switch at the control panel, after the silencing inhibit timer has timed out. This shall be automatically recorded by time and date.
- .4 Any subsequent alarm received after the previous alarm has been silenced, shall re-activate the sequence described in 2.3.1.1 to 2.3.1.2 above.
- .7 Any trouble on the system shall:
 - .1 Indicate the circuit, zone, and device in trouble on the control panel.
 - .2 Be automatically recorded at the control panel.
 - .3 Activate the "system trouble" indication, buzzer and the common trouble sequence. Acknowledging the trouble condition shall silence the audible indication, whereas the visual indication shall remain until the trouble is cleared and the system is back to normal.
- .2 Trouble indications shall not interfere with alarm indications during the process of an alarm.
- .3 A trouble condition on any circuit in the system shall not initiate any alarm conditions.

2.4 CONTROL PANEL

- .1 The control panel shall be modular in construction with solid state, microprocessor-based electronics. All components shall be housed in a CSA enclosure, behind a lockable, concealed hinged door, with a full viewing window, door lock and two keys. Opening of

the panel door shall not expose live components or wiring; these shall only be accessible after removal of a protective cover plate.

- .2 The control panel shall have the following standard indications and controls:
 - .1 "Power on" indication to monitor the primary source of power to the system.
 - .2 "Trouble" indication with acknowledge switch.
 - .3 "Alarm" indication with acknowledge switch.
 - .4 Alarm silence switch.
 - .5 Reset switch.
 - .6 Ground fault indication.
 - .7 Remote annunciator trouble indication.
 - .3 The control panel shall have:
 - .1 Separate alarm and trouble indications for each and every alarm initiating circuit.
 - .2 Separate supervisory alarm and trouble indications for each and every supervisory initiating circuit.
 - .3 Separate trouble indications for each and every signal and supervised control circuit via LCD and L.E.D.
 - .4 Separate alarm and trouble indication for each device via L.C.D. display from each and every zone via L.E.D.
 - .4 The control panel shall have:
 - .1 Digitally coded input/output circuit for initiating, supervisory and control points each individually addressed and wired in a Class A configuration.
 - .2 System shall be provided with no more than 75% of usable address capacity on any one circuit or wiring loop used (ie. 25% spare).
 - .5 The control panel shall have:
 - .1 Alarm output circuits for alarm indicating appliances wired in a class B configuration with end-of-line devices mounted adjacent the main control panel. Each circuit shall be rated at 2A, 24VDC, fuse protected from overload/overcurrent.
 - .2 Auxiliary relay contacts for control functions (fans, door...), as per the system operation requirements.
 - .3 A fire department connection configured to suit the monitoring requirements. Provide ULC listed auto-dialer for connection to monitoring agency.
 - .4 All components and circuit required for two-way voice communication specified here-in.
 - .6 The system stand-by batteries shall be supervised for low voltage/battery disconnection.
 - .7 The system shall be powered from a 120VAC, 60Hz input through a power supply, to provide a 24 VDC output from rectifier, to operate alarm and signal circuits. Standby batteries shall be provided for 24 hours of supervisory operation followed by 30 minutes of full load operation.
 - .8 The control panel shall have the following control switches and indicators.
 - .1 Fire department connection bypass and indicator.
 - .2 Test switch and indicator (to bypass fans and doors).
 - .3 Drill switch.
 - .4 Alarm switch and indicator.
 - .9 All programming functions shall be password protected. Control panel shall also have the capability to password protect any user operation functions throughout a different password.
-

- .10 The control panel shall have the necessary components to maintain in memory a record of its last 300 alarm and 300 trouble events for reviewing purposes.
- .11 The control panel shall be equipped with necessary components to allow silent testing of the system without wiring disconnect.
- .12 The control panel shall have the necessary components to allow any or all circuits to be bypassed for maintenance purposes. Those components shall be accessible to the owner or his authorized personnel. Removing circuit wiring shall not be acceptable.
- .13 The control panel shall supervise all remote annunciators. Any failure in the wiring or visual indication shall be indicated at the main control panel.
- .14 Standard of acceptance: Chubb Edwards EST-3x.

2.5 REMOTE ANNUNCIATORS

- .1 Provide panels as indicated 1.5m above finished floor.
- .2 Panels: duplicate requirements for control panel annunciator, with exception of individual trouble lamps are not required.
- .3 LED type with designation cards to indicate zone.
- .4 LED test button.
- .5 Supervised, including trouble signal for open circuit.
- .5 Standard of acceptance: Chubb Edwards 3LCDANN c/w wallbox.

2.6 PASSIVE GRAPHICS

- .1 Provide passive graphics as indicated. Mount with centerline 1.5m above finished floor.
- .2 Coloured Graphic Display:
 - .1 Provide a coloured graphic display of the passive type, indicating the floor layout and zone identification in a framed enclosure beside the main control panel and remote annunciator as indicated.
 - .2 The graphic depiction shall be put on a piece of clear film approximately 600mm x 600mm. Building zones shall be clearly outlined. The building exterior and zone breaks shall be outlined in black. Lettering shall be black in colour. Label principal rooms and areas.
 - .3 Mount graphic under polycarbonate cover in polished aluminum frame, suitable for screw mounting on wall.
 - .4 Show location of annunciator panels and control panel and have "You Are Here" arrow showing viewer location at each remote annunciator and control panel. Orient building floor plan on graphic to location of person viewing graphic. Direction of viewer is facing toward top of graphic display at each location. Indicate North direction.
 - .5 Submit proposed materials and layout to Consultant for approval.

2.7 AUDIBLE SIGNALLING DEVICES

- .1 Horn :
 - .1 Provide ULC listed devices.
 - .2 Weatherproof electrical horn in exterior spaces or areas with high levels of moisture.
 - .3 Complete with manufacturer's surface mount box.

- .4 Standard of acceptance: Chubb Edwards 757-1A-T c/w 757-WB backbox or approved alternate.

2.8 AUDIBLE/VISUAL SIGNALING DEVICES

- .1 Horn/Strobe:
 - .1 Provide ULC listed devices.
 - .2 Combination electrical Horn and field-adjustable strobe from 15 to 110 candela.
 - .3 Wire on separate circuits. One circuit for Horns and a separate circuit for strobes.
 - .4 Complete with manufacturer's trim plate.
 - .5 Provide wireguard where indicated on plans. Wireguard to mount over device and trim plate.
 - .6 Standard of acceptance Chubb Edwards G1RF-HDVM c/w G1RT or approved alternate.

2.9 VISUAL SIGNALING DEVICES

- .1 Strobe light:
 - .1 Field selectable 15/30/75/110 candela setting.
 - .2 Two or more visible signal devices in corridors or rooms in the same field of view shall flash in synchronization.
 - .3 Complete with manufacturer's trim plate.
 - .4 Standard of acceptance Chubb Edwards G1RF-VM c/w G1RT or approved alternate.

2.10 ALARM INITIATING DEVICES

- .1 Manual fire alarm stations:
 - .1 Single-stage pull lever with break-glass. Unit shall have a tool protected test feature and shall be red enamel finish with aluminum markings. Restoration to require the use of a key. All stations to be keyed alike.
 - .2 Mount device not more than 1.2m above finished floor.
 - .3 Terminal screw type connections.
 - .4 Pull stations shall be of the addressable type.
 - .5 Standard of acceptance: Chubb Edwards SIGC-270 c/w surface mount backbox 27193-11 as indicated.
- .2 Automatic thermal detectors shall be of low silhouette design, finished in flat white paint to blend with ceiling tile. Detector shall have twist lock mounting for ease of maintenance, testing and replacement. Activation of the fixed temperature element in the detector shall cause the centre disk to drop into a vertical position to provide a visible means of determining which detector has initiated the alarm. The automatic thermal detectors shall be:
 - .1 Rated at 135°F fixed temperature and 15°F per minute rate-of-rise. They shall be used where normal temperature fluctuations exist, but ambient temperatures do not exceed 100°F.
 - .2 Rated at 190°F fixed temperature and 15°F per minute rate-of-rise. They shall be used where normal temperature fluctuations exist, but ambient temperature exceeds 100°F, but do not exceed 150°F.
 - .3 Rated at 135°F fixed temperature. They shall be used where violent temperature fluctuations exist, but normal temperatures exceed 100°F.
 - .4 Rated at 190°F fixed temperature. They shall be used where violent temperature fluctuations exist, but normal temperatures exceed 100°F, but do not exceed 150°F.
 - .5 Moisture proof and explosionproof Initiating Devices detectors where indicated on the drawings.

- .6 All automatic alarm initiating devices shall be of the addressable type.
- .7 All automatic alarm initiating devices shall be supplied complete with manufactures ceiling finish trim.
- .3 Photo Electric Smoke Detectors:
 - .1 Detectors shall be of the solid state photo-electronic type and shall operate on the light scattering, photodiode principle.
 - .2 Detectors shall be factory set to detect smoke at a nominal 2.5% light obscuration per foot regardless of the rate of combustion, the distance between the detector and the fire source, the combustible material, the temperature or velocity of the smoke and whether the fire is in a confined or open area. To minimize nuisance alarms, detectors shall be designed to ignore invisible air-borne particles of smoke densities that are below the factory set alarm point. No radioactive material shall be used.
 - .3 Smoke detector light source shall be an LED (Light Emitting Diode).
 - .4 Detector shall be equipped with a pulsed LED power supervisory indicator. An alarm condition shall be indicated by a steady red glow from the LED indicator.
 - .5 A calibrated test feature shall be provided, capable of simulating a maximum acceptable amount of smoke for alarm. The test feature shall provide individual local testing of the detector and shall not required generation of actual smoke within the building.
 - .6 Detectors shall be designed for twist lock mounting to a separate base assembly having screw terminals for external wire connections. Detectors shall have auxiliary contacts to close on detector activation for a nurse call dome light dome light at the door.
 - .7 Each detector base assembly shall be equipped with an optional locking mechanical device to prevent unauthorized removal of the detector.
 - .8 The base assembly shall mount on standard round, square, or octagonal outlet box. Box depth shall be selected on the basis of the number of conductors connected in accordance with the requirements of the Canadian Electrical Code.
 - .9 Terminal screw type connections.
 - .10 Smoke detectors shall of the addressable type.
 - .11 Smoke detectors to be complete with manufacturers ceiling trim units.
 - .12 Standard of acceptance: Chubb Edwards SIGA-PS c/w SIGA-SB4 base/trim or SIGS-RB relay base and SIGA-TS4 trim.

2.11 ALARM INITIATING DEVICE SPACING AND LOCATION

- .1 Detector spacing and location: in accordance with manufacturer's recommendations and requirements of CAN/ULC-S524-24.
- .2 Spacing: not to exceed 9m by 9m per smoke detector, and 12.5 linear meters per detector along corridors.
- .3 Locate detectors minimum 900mm from air discharge of return grille, and not closer than 300mm to lighting fixtures.
- .4 In areas without finished ceilings, mount detectors at underside of deck above unless otherwise indicated.

2.12 ZONE CONTROL AND ZONE MONITORING MODULES

- .1 Addressable Zone Control Modules with 2 NO and 2 NC form 'C' contacts.
- .2 Addressable Zone Monitoring Modules wired in Class "A" 4 wire configuration to field devices such as tamper switches and fire switches.

- .3 Provide finish quality sheet steel enclosures painted red with transparent covers for each module or group of modules.
- .4 Standard of acceptance: Chubb Edwards SIGA-CT1 or SIGA-CT2 monitoring module and SIGA-CR control module.

2.13 END-OF-LINE DEVICES

- .1 End-of-line devices to control supervisory current in signaling circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.
- .2 Mount all EOL devices in common cabinet adjacent point of circuit origin (main fire alarm control panel or remote booster power supply).

2.15 WIRE GUARDS

- .1 Provide the following guards for initiating and signaling devices as indicated.
 - .1 Horns/Strobes: STI-9621
 - .2 Smoke Detectors: STI-9604

2.16 WIRING

- .1 Copper conductors.
- .2 To initiating circuits: as specified in Section 26 05 21 (FAS 105) and installed in conduit.
- .3 To signalling circuits: as specified in Section 26 05 21 (FAS 105) and installed in conduit.

2.17 BATTERIES

- .1 Batteries shall be warranted in accordance with GC24 except for 5 years.

2.18 LINE VOLTAGE SURGE SUPPRESSOR (TVSS)

- .1 Provide line voltage and low voltage surge suppression devices to suppress voltage transients which might damage control panel and transmitter components.
- .2 Mount suppressors in separate enclosure adjacent to control panel and transmitter unless suppressors are specifically UL approved for mounting inside control panel and transmitter provided and approved for such use by control panel and transmitter manufacturer.

2.19 ADDITIONAL MATERIALS

- .1 Provide the additional devices complete with all programming and manufacturers support (engineering, technicians, etc.), as follows:
 - .1 3 Manual Pull Stations.
 - .2 5 Smoke Detectors.
 - .3 5 Zone Control Modules.
 - .4 5 Zone Monitoring Modules.
 - .5 5 Horn/Strobe devices.

- .6 3 Strobe Lights.
- .7 5 STI 1210E Cover.

2.20 SURFACE MOUNTED FIRE ALARM DEVICES

- .1 Where fire alarm devices are surface mounted, manufacturer is to provide backboxes, factory finished to match colour of device, and all required trims for a complete installation.

2.21 AS-BUILT RISER DIAGRAM

- .1 Fire alarm system riser diagram: polished aluminum frame on white sheet, black lettering and designations. Minimum size 600mm x 600mm. Mount adjacent fire alarm control panel in main electrical room.

Part 3 Execution

3.1 INSTALLATION

- .1 Install systems in accordance with ULC-S524-24. Installer shall be company of person specializing in fire alarm system installations with 5 years documented experience approved by manufacturer.
- .2 Provide services of representative or technician from manufacturer of system, experienced in installation and operation of type of system being provided, to supervise installation, adjustment, preliminary testing, and final testing of system and to provide instruction to project personnel.
- .3 Install all equipment as indicated on the drawings. Make all power and communication connections.
- .4 Install all wiring in EMT conduit.
- .5 Terminations to be made at devices only – not in corridor junction boxes.
- .6 Install door releasing devices. Run wiring from door releasing device to local smoke detectors on either side of doors as indicated.
- .7 Run wiring to elevator machine room for termination by others.
- .8 Locate and install relay to control fan shut down via building control system.
- .9 Wire alarm and supervisory switches and connect to addressable loop.
- .10 Provide any additional wiring as required to meet the specified operation, including the 25% spare loop capacity requirement. Loop capacity varies between manufacturers. No fewer wiring loops shall be installed than indicated on the drawings (riser diagrams).
- .11 Beam Type Smoke Detector System Installation:
 - .1 The Detection system - The contractor shall install the system in accordance with the manufacturer's Product Guide.
 - .2 Environmental - The units will have an IP44 rating for the Electronics and IP66 rating for the optics enclosure. The system will be able to operate at an ambient temperature range of at least -10°C to 55°C (14°F to 131°F) at a maximum relative humidity 90% (non-condensing).
 - .3 Alignment - Both Imager and Emitter will be constructed in such that they can be

- simply rotated left, right, up and down and easily aligned and secured by the use of a simple tool, i.e. a laser screwdriver. The adjustment angles will be at a minimum $\pm 60^\circ$ horizontal and $\pm 15^\circ$ vertical.
- .4 It will be possible to install and align Imagers and Emitters by a single person.
- .5 Building Flex - The system will tolerate building flex up to at least 2° in all directions.
- .6 Commissioning
 - 1. After installation and power up, the system will automatically learn the locations of the Emitters and initialise itself. The installation engineer shall not be required to remain at the detector while the initiation is going on.
 - 2. The user interface will indicate when the learning phase is over. At the end of this phase the detector shall be active without any further required action or programming except for a test.
 - 3. The whole initiation phase will not take longer than 10 minutes for a detector with 7 Emitters.
- .7 Maintenance - The system shall be highly resistant to dirt and dust and auto-adjust. Maintenance will be limited to clean the Imager and Emitter front by wiping the optical surface with a dry cloth.
- .8 Optical filters shall be available from acceptable manufacturers that enable a calibrated test to be performed.

3.2 VERIFICATION AND CERTIFICATION

- .1 The system shall be verified by a third party in accordance with CAN/ULC-S537-19 "Verification of Fire Alarm Systems" and Division 01 requirements for Quality Control. Provide services of third party fire alarm technician for the duration of the fire alarm system verification.
- .2 The manufacturer shall make an inspection of the fire alarm equipment, including those components necessary to direct operation of the system. The inspection shall comprise of an examination of such equipment for the following:
 - .1 That the type of equipment installed is that designated by the Consultant's specifications.
 - .2 That the wiring connections to all equipment components show that the installer complied with the applicable ULC and CSA standards.
 - .3 The equipment of the manufacturer's manufacture has been installed in accordance with the manufacturer's recommendations, and that all signaling devices of whatever manufacture have been operated or tested to verify their operation.
 - .4 The supervisory wiring of those items of equipment connected to supervised circuits is operating and that governmental regulations, if any, governing such supervisory wiring, have been met to the satisfaction of the inspecting officials.
- .3 The manufacturer shall supply reasonable amounts of technical assistance with respect to any changes necessary to perform the work. During the period of inspection by the manufacturer, the Electrical Contractor shall make available to the manufacturer an electrician as designated by the manufacturer.
- .4 On completion of the inspection and when all of the above conditions have been complied with, the manufacturer shall issue to the Consultant:
 - .1 A copy of the inspecting technician's report showing the location of each device and certifying the test results of each device.

- .2 A certificate of verification confirming that the inspection has been completed and showing the conditions upon which such inspection and certification have been rendered.
- .3 Proof of liability insurance for the inspection.
- .5 Verification performed from September 1st to June 30th to be scheduled outside of school hours.
- .6 Pay all costs involved in this inspection.
- .7 Manufacturer to verify that the system meets the requirements of this specification.
- .8 Open flame and smoke shall not be used for testing purposes.

3.3 TRAINING

- .1 Provide two hour training sessions on 3 non-consecutive days. First session shall be training to building operational staff on operation and maintenance. Second session to general staff and operational staff on system operation and procedures. The third and session shall be provided one month after the system is in use by the staff and shall be a refresher/question session for both groups.
- .2 Training shall be in accordance with Division 01 requirements.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 31 23 33 – Excavating, Trenching and Backfilling.
- .3 Section 32 11 16 – Granular Sub-Base
- .4 Section 32 11 23 – Aggregate Base Courses.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM International).
 - .1 ASTM D4791-19, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .2 Ontario Provincial Standard Specifications (OPSS):
 - .1 OPSS MUNI 1002-April 2018 – Material Specification for Aggregates – Concrete
 - .2 OPSS MUNI 1004-Nov 2012 – Material Specification for Aggregates – Miscellaneous
 - .3 OPSS MUNI 1010-Nov 2013 – Material Specification for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material

1.3 SOURCE QUALITY CONTROL

- .1 Source of materials to be incorporated into work or stockpiles requires approval.
- .2 Inform Contract Administrator of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing production.
- .3 If, in opinion of Contract Administrator, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.
- .4 Should a change of material source be proposed, advise Contract Administrator 4 weeks in advance of proposed change to allow sampling and testing.
- .5 Acceptance of material at source does not preclude future rejection if it is subsequently found to lack uniformity, or if its field performance is found to be satisfactory.

1.4 SAMPLES

- .1 Aggregate will be subject to continual sampling by Contract Administrator during production.
 - .2 Provide Contract Administrator with access to source and processed material for sampling and testing.
 - .3 Bear the cost of sampling and testing of aggregates which fail to meet specified requirements.
-

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.
- .2 Flat and elongated particles of coarse aggregate: to ASTM D4791-19.
 - .1 Greatest dimension to exceed five times least dimension.
- .3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
 - .1 Natural sand.
 - .2 Manufactured sand.
 - .3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.
- .4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:
 - .1 Crushed rock or slag.
 - .2 Gravel and crushed gravel composed of naturally formed particles of stone.
- .5 Granular 'A' to OPSS MUNI 1010-Nov 2013.
- .6 Granular 'B' top OPSS MUNI 1010-Nov 2013.
- .7 19mm Clear Stone to OPSS MUNI 1004-Nov 2012.
- .8 Clean, crushed, angular stone, nominal size distribution between 19mm to 51mm, as per AASHTO M43 3, 4.

PART 3 EXECUTION

3.1 DEVELOPMENT OF AGGREGATE SOURCE

- .1 Contractor to produce aggregates off site.
- .2 Contractor to develop aggregate source to prevent contamination of aggregates stockpiled.

3.2 PROCESSING

- .1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.
 - .2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified. Use methods and equipment approved by Contract Administrator.
 - .3 Wash aggregates, if required to meet specifications. Use only equipment approved by Contract Administrator.
-

- .4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate.

3.3 HANDLING

- .1 Handle and transport aggregates to avoid segregation, contamination and degradation.

3.4 STOCKPILING

- .1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Contract Administrator. Do not stockpile on completed pavement surfaces.
- .2 Stockpile aggregates in sufficient quantities to meet Project schedules.
- .3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
- .4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into work.
- .5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
- .6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Contract Administrator within two (2) working days of rejection.
- .7 Stockpile materials in uniform layers of thickness as follows:
 - .1 Max 1.0 m for coarse aggregate and base course materials.
 - .2 Max 2.0 m for fine aggregate and sub-base materials.
 - .3 Max 1.5 m for other materials.
- .8 Complete each layer over entire stockpile area before beginning next layer.
- .9 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
- .10 Do not cone piles or spill material over edges of piles.
- .11 Do not use conveying stackers.
- .12 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.5 CLEANING

- .1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water and leave any unused aggregates in neat compact stockpiles as directed by Contract Administrator.

END OF SECTION

PART 1 - **GENERAL**

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 31 05 16 – Aggregate Materials.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM C117-23, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136/C136M-25, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D6913 & ASTM D7928, Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D698-12, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .5 ASTM D1557-12, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .6 ASTM D4318-17e1, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 - .2 Canadian General Standards Board (CGSB).
 - .1 CA/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric
 - .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A3000:23, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3000:23, Cementitious Materials for Use in Concrete.
 - .2 CSA-A23.1:24/A23.2:24, Concrete Materials and Methods of Concrete Construction/ Methods of Test and Standard Practices for Concrete.
 - .4 Ontario Provincial Standard Specifications (OPSS) and Drawings (OPSD)
 - .5 Geotechnical Investigation, prepared by EXP Services Inc. and dated January 22nd, 2020.
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1.3 DEFINITIONS

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
 - .1 Rock excavation: excavation of material from solid masses of igneous, sedimentary or metamorphic rock which, prior to its removal, was integral with its parent mass, and boulders or rock fragments having individual volume in excess of 2 m³. Frozen material not classified as rock. There shall be no compensation for boulder removal for boulders which can be removed by mechanical means with a 1.95 m³ bucket.
 - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Unclassified excavation: excavation of deposits of whatever character encountered in work.
- .3 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .4 Waste material: excavated material unsuitable for use in work or surplus to requirements.
- .5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of work.
- .6 Unsuitable materials:
 - .1 Weak and compressible materials under excavated areas.
 - .2 Frost susceptible materials under excavated areas.
 - .3 Frost susceptible materials:
 - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318-17e1, and gradation within limits specified when tested to ASTM D6913 & ASTM D7928 and ASTM C136/C136M-25: Sieve sizes to CAN/CGSB-8.1-88.

<u>Sieve Designation</u>	<u>%Passing</u>
2.00 mm	100
0.10 mm	45-100
0.02 mm	10-80
<u>0.005 mm</u>	<u>0-45</u>

- .2 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.

- .7 Unshrinkable fill: proportioned and mixed to provide:
 - .1 Maximum compressive strength of 0.4 MPa at 28 days.
 - .2 Maximum Portland cement content of 25 kg/m³.
 - .3 Minimum strength of 0.07 MPa at 24 h.
 - .4 Concrete aggregates: to CSA-A23.1/A23.2,
 - .5 Cement: to CSA A3000, Type GU.
 - .6 Slump: 160 to 200 mm.

1.4 SUBMITTALS

- .1 Inform Contract Administrator at least 4 weeks prior to commencing work, of proposed source of fill materials and provide access for sampling.
- .2 Submit 70 kg samples of type of fill specified including representative samples of excavated material.
- .3 Ship samples as directed by Contract Administrator in tightly closed containers to prevent contamination.

1.5 QUALITY ASSURANCE

- .1 Submit design and supporting data at least 2 weeks prior to commencing work.
- .2 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in the Province of Ontario.
- .3 Keep design and supporting data on site.
- .4 Do not use soil material until written report of soil test results are reviewed and approved by Contract Administrator.

1.6 EXISTING CONDITIONS

- .1 Buried services:
 - .1 Before commencing work verify location of buried services on and adjacent to site.
 - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
 - .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.
 - .4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
-

- .5 Prior to commencing excavation work, notify applicable Owner or authorities having jurisdiction, establish location and state of use of buried utilities and structures. Owners or authorities having jurisdiction to clearly mark such locations to prevent disturbance during work.
- .6 Confirm locations of buried utilities by careful test excavations.
- .7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated.
- .8 Where utility lines or structures exist in area of excavation, obtain direction of Contract Administrator before removing or re-routing.
- .9 Record location of maintained, re-routed and abandoned underground lines.
- .10 Confirm locations of recent excavations adjacent to area of excavation.
- .2 Existing buildings and surface features:
 - .1 Conduct, with Contract Administrator condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by work.
 - .2 Protect existing buildings and surface features from damage while work is in progress. In event of damage, immediately make repair to approval of Contract Administrator.
 - .3 Where required for excavation, cut roots or branches as approved by Contract Administrator.

PART 2

PRODUCTS

2.1 MATERIALS

- .1 Type 1 fill: Granular 'A' as per OPSS 1010 and Section 31 05 16 - Aggregate Materials.
- .2 Type 2 fill: Granular 'B' Type II as per OPSS.MUNI 1010 and Section 31 05 16 – Aggregate Materials.
- .3 Type 3 fill: select subgrade material as per OPSS.MUNI 1010 from excavation or other sources, approved by Contract Administrator for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.
- .4 Geotextile: Type II Non-woven as per OPSS 1860.
- .5 Clear stone per OPSS.MUNI 1004.
- .6 Sand: Mortar sand or uniformly graded sand as per OPSS 1004.

PART 3 **EXECUTION**

3.1 SITE PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

3.2 PREPARATION/PROTECTION

- .1 Keep excavations clean, free of standing water, and loose soil.
- .2 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Contract Administrator's approval.
- .3 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage. Protect buried services that are required to remain undisturbed.
- .4 Protect buried services that are required to remain undisturbed.

3.3 EROSION AND SEDIMENT CONTROL

- .1 As per the requirements of Specification 31 32 25.

3.4 STRIPPING OF TOPSOIL

- .1 Commence topsoil stripping of areas as indicated by Contract Administrator after area has been cleared of brush, weeds and grasses and removed from site.
- .2 Strip topsoil to depths as indicated by Contract Administrator. Do not mix topsoil with subsoil.
- .3 Stockpile in locations as directed by Contract Administrator. Stockpile height not to exceed 2 m.
- .4 Dispose of unused topsoil off-site or as directed by Contract Administrator.

3.5 STOCKPILING

- .1 Stockpile fill materials in areas designated by Contract Administrator. Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.

3.6 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

- .1 Maintain side and slopes of excavations in safe condition by appropriate methods and in accordance with Occupational Health and Safety Act for the Province of Ontario.
-

- .2 Design and construct temporary works to depths, heights and locations as required for new work.
- .3 During backfill operation:
 - .1 Unless otherwise as indicated or as directed by Contract Administrator remove sheeting and shoring from excavations.
 - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
 - .3 Pull sheeting in increments that will ensure compacted backfill is maintained at an elevation at least 500 mm above toe of sheeting.
- .4 When sheeting is required to remain in place, cut off tops at elevations as indicated.
- .5 Upon completion of substructure construction:
 - .1 Remove cofferdams, shoring and bracing.
 - .2 Remove excess materials from site as indicated and as directed from Contract Administrator.

3.7 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while work is in progress.
- .2 Submit for Contract Administrator's review details of proposed dewatering or heave prevention methods, such as dikes, well points, and sheet pile cut-offs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur. Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures and in manner not detrimental to public and private property, or any portion of work completed or under construction.
- .6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, water courses or drainage areas. Maximum allowable concentration of suspended solids in discharge shall be 25 mg/L TSS.

3.8 EXCAVATION

- .1 Excavate to lines, grades, elevations and dimensions as indicated by Contract Administrator.
 - .2 Remove concrete, masonry, paving, walks, demolished foundations and rubble and other obstructions encountered during excavation. Dispose of material off site.
-

- .3 Excavation must not interfere with bearing capacity of adjacent foundations.
- .4 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .5 For trench excavation, unless otherwise authorized by Contract Administrator in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
- .6 Keep excavated and stockpiled materials a safe distance away from edge of trench as directed by Contract Administrator.
- .7 Restrict vehicle operations directly adjacent to open trenches.
- .8 Dispose of surplus and unsuitable excavated material off site.
- .9 Do not obstruct flow of surface drainage or natural watercourses.
- .10 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .11 Notify Contract Administrator when bottom of excavation is reached.
- .12 Obtain Contract Administrator approval of completed excavation.
- .13 Remove unsuitable material from trench bottom to extent and depth as directed by Contract Administrator.
- .14 Correct unauthorized over-excavation as follows:
 - .1 Fill under bearing surfaces and footings with concrete specified for footings.
 - .2 Fill under other areas with Type 2 fill compacted to not less than 95% of corrected maximum dry density.
- .15 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to approval of Contract Administrator.
- .16 Division 31 will complete all required trenching and backfilling required for work of Division 20, 26 and 44.

3.9 FILL TYPES AND COMPACTION

- .1 Use fill of types as indicated or specified below. Compaction densities are percentages of Standard Proctor Maximum Dry Densities (SPMDD) obtained from ASTM D698.
 - .1 Slabs-on-grade:
 - .1 Type 2 fill, thickness as required to raise the floor subgrade, compacted to minimum 98% SPMDD, in maximum 300 mm thick lifts.

- .2 Type 1 fill to underside of slab, minimum compacted thickness of 150 mm, compacted to minimum 98% SMPDD, in maximum 300 mm thick lifts.
- .2 Footings founded on structural fill:
 - .1 Type 2 fill placed over undisturbed native soil, thickness as required to achieve design footing subgrade elevation (minimum compacted thickness of 200 mm), compacted to minimum 100% SPMDD, in maximum 300 mm thick lifts.
 - .2 Type 1 fill to underside of footing, minimum compacted thickness of 150 mm, compacted to minimum of 100% SPMDD, in maximum 300 mm thick lifts.
- .3 Exterior side of perimeter walls:
 - .1 Type 2 fill for 1.0m beyond face of foundation wall, thickness as required to reach subgrade level, compacted to 95% SPMDD.
 - .2 Type 3 fill for other areas, thickness as required to reach subgrade level, compacted to 95% SPMDD.
- .4 Subgrade:
 - .1 Compact existing subgrade under walkways, paving, and sidewalks to same compaction as fill above.
- .5 Under grassed areas:
 - .1 Type 3 fill, thickness as required to reach underside of topsoil, compacted to 95% SPMDD.
- .6 To correct over excavation in trenches:
 - .1 Type 2 fill to underside of Granular "A" bedding, compacted to 95% SPMDD.

3.10 BEDDING AND SURROUND OF UNDERGROUND SERVICES

- .1 Place and compact granular material for bedding and surround of underground services as indicated.
- .2 Place bedding and surround material in unfrozen condition.

3.11 BACKFILLING

- .1 Vibratory compaction equipment: approved by Contract Administrator.
 - .2 Do not proceed with backfilling operations until Contract Administrator has inspected and approved installations.
 - .3 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
-

- .4 Do not use backfill material which is frozen or contains ice, snow or debris.
- .5 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .6 Backfill around installations.
 - .1 Place bedding and surround material as specified elsewhere.
 - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
 - .3 Place layers simultaneously on both sides of installed work to equalize loading. Difference not to exceed 600 mm.
 - .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures.
 - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure, and approval obtained from Contract Administrator, or
 - .2 If approved by Contract Administrator, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Contract Administrator.
- .7 Division 31 will perform required excavation, trenching and backfilling required for all Divisions. General Contractor to coordinate details of all Divisions to determine the extent of work to be provided.

3.12 RESTORATION

- .1 Upon completion of work, remove waste materials and debris, trim slopes, and correct defects as directed by Contract Administrator.
- .2 Replace topsoil as indicated by Contract Administrator.
- .3 Reinstate lawns to elevation which existed before excavation.
- .4 Reinstate pavement and sidewalks distributed by excavation to thickness, structure, and elevation which existed before excavation.
- .5 Clean and reinstate areas affected by work as directed by Contract Administrator.
- .6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 h.
- .7 Protect newly graded areas from traffic and erosion and maintain free of trash and debris.
- .8 Dispose of surplus material and material unsuitable for fill grading or landscaping off site.

3.13 FIELD QUALITY CONTROL

- .1 Testing of materials and compaction of backfill and fill will be carried out by testing laboratory designated by Owner.
- .2 Do not begin backfilling or filling operations until material has been approved for use by Contract Administrator.
- .3 Not later than 48 hours before backfilling or filling with approved material, notify Contract Administrator to allow compaction tests to be carried out by testing agency designated by Owner.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 31 05 16 - Aggregate Materials.
- .2 Section 31 23 33 - Excavating, Trenching and Backfilling.
- .3 Section 32 11 23 - Aggregate Base Courses.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM C117-23, Standard Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136/C136M-25, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D698-12, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .4 ASTM D1557-12, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .5 ASTM D4318-17e1, Standard Test Methods for Liquid Unit, Plastic Unit and Plasticity Index of Soils.
 - .6 Ontario Provincial Standard Specification (OPSS) Division 10.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS MUNI 1010 – Material Specifications for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Granular sub-base material to Section 31 05 16 - Aggregate Materials and following requirements:
 - .1 Granular 'B', Type II as per OPSS.MUNI 1010, maximum aggregate size 65 mm.
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PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verify conditions of subgrade are acceptable for granular sub-base installation.
- .2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 PLACING

- .1 Place granular sub-base after subgrade is inspected and approved by Contract Administrator.
- .2 Construct granular sub-base to depth and grade in areas indicated.
- .3 Ensure no frozen material is placed.
- .4 Place material only on clean unfrozen surface, free from snow or ice.
- .5 Place granular sub-base materials using methods which do not lead to segregation or degradation.
- .6 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Contract Administrator may authorize thicker lifts (layers) if specified compaction can be achieved.
- .7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .8 Remove and replace portion of layer in which material has become segregated during spreading.
- .9 Place material to minimum compacted thickness as shown on drawings, or thicker as required to achieve design base elevation.
- .10 Transition between new and existing pavement structures with a 5 horizontal to 1 vertical taper to match the depths of the granular material exposed in the existing pavement.

3.3 COMPACTION

- .1 Compaction equipment to be capable of obtaining required material densities.
 - .2 Compact to density of not less than 100% of Standard Proctor Maximum Dry Density (SPMDD) to ASTM D698-12.
 - .3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.
-

- .4 Apply water as necessary during compaction to obtain specified density.
- .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Contract Administrator.
- .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.4 PROOF ROLLING

- .1 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
- .2 Where proof rolling reveals areas of defective subgrade:
 - .1 Remove sub-base and subgrade material to depth and extent as directed by the Contract Administrator.
 - .2 Backfill excavated subgrade with Type 3 fill as per Section 31 23 33 – Excavating, Trenching and Backfilling and compact in accordance with this section.
 - .3 Replace sub-base material and compact in accordance with this section.

3.5 SITE TOLERANCES

- .1 Finished sub-base surface to be within 10 mm of elevation as indicated but not uniformly high or low.
- .2 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.6 PROTECTION

- .1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by Contract Administrator.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 31 05 16 - Aggregate Materials.
- .2 Section 32 11 16 – Granular Sub-Base

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM C117-23, Standard Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136/C136M-25, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136/C136M-25, Standard Test Method for Sieve Analysis of Fine and Course Aggregated.
 - .4 ASTM D698-12, Stand Test Methods for Laboratory Compaction Characteristics of Soil Using standard Effort (12,400 ft-lbf/ft³)(600 N m/m³).
 - .5 ASTM D1557-12, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .6 ASTM D4318-17e1, Standard Test Methods for Liquid Unit, Plastic Unit and Plasticity Index of Soils.
 - .7 Ontario Provincial Standard Specifications (OPSS) Division 10.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS MUNI 1010 – Material Specifications for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver and stockpile aggregates in accordance with Section 31 05 16 – Aggregate Materials.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Granular base: material to Section 31 05 16- Aggregate Materials and the following requirements:
 - .1 Granular 'A' to OPSS.MUNI 1010

2.2 SEQUENCE OF OPERATION

- .1 Place granular base after granular sub base surface is inspected and approved by Contract Administrator.
 - .1 Construct granular base to depth and grade in areas indicated.
 - .2 Ensure no frozen material is placed.
 - .3 Place material only on clean unfrozen surface, free from snow and ice.
 - .4 Place material using methods which do not lead to segregation or degradation of aggregate.
 - .5 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.
 - .6 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
 - .7 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .2 Compaction Equipment
 - .1 Compaction equipment to be capable of obtaining required material densities.
- .3 Compacting
 - .1 Compact to no less than 100% of standard proctor maximum dry density (SPMDD).
 - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
 - .3 Apply water as necessary during compacting to obtain specified density.
 - .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Contract Administrator.
 - .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

2.3 SITE TOLERANCES

- .1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

2.4 PROTECTION

- .1 Maintain finished base in condition conforming to this section until succeeding material is applied or until acceptance by Contract Administrator.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 43 – Installation of cables in trenches and ducts

1.2 STANDARDS.

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No. 211.1-06, Rigid Types EBI and DB2/ES2 PVC Conduit.
 - .2 CSA C22.2 No. 211.3-96(R2000), Reinforced Thermosetting Resin Conduit (RTRC) and Fittings (Bi-national standard, with UL 1684).

PART 2 Products

2.1 PVC DUCTS AND FITTINGS

- .1 Rigid PVC duct: to CSA C22.2 No. 211.1, Type DB2/ES2, with fabricated moulded fittings, for direct burial expanded flange ends, Trade size 6 5. Nominal length: 6 3 m plus or minus 12 mm.
- .2 Rigid PVC split ducts.
- .3 Rigid PVC bends, couplings, reducers, bell end fittings, plugs, caps, adaptors same product material as duct, to make complete installation.
- .4 Rigid PVC 90° and 45° bends.
- .5 Rigid PVC 5° angle couplings.
- .6 Expansion joints every m and as required.

2.2 SOLVENT WELD COMPOUND

- .1 Solvent cement for PVC duct joints.

2.3 FIBREGLASS DUCTS

- .1 Fibreglass reinforced thermoset duct: to CSA C22.2 No. 211.3, type AG BG, Tradesize 6 5, watertight self-extinguishing underwater type.
- .2 Couplings, reducers, plugs, caps, adaptors, and supports to make complete installation.
- .3 Expansion joints every m and as required.

2.4 PLASTIC POLYETHYLENE PIPE

- .1 Flexible Rigid plastic polyethylene pipe with approved couplings and fittings required to make complete installation.

2.5 CABLE PULLING EQUIPMENT

- .1 6 mm stranded nylon pull rope tensile strength 5 kN.

2.6 MARKERS

- .1 Concrete type cable markers: as indicated, with words: "Cable", "Joint" or "Conduit" impressed in top surface, with arrows to indicate change in direction of duct runs.
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- .2 Cedar post type markers: 89 x 89 mm square, 1.5 m long, pressure treated with clear coloured, or copper naphthenate or 5% pentachlorophenol solution, water repellent preservative, with nameplate fastened near post top, on side facing duct.
- .1 Nameplate: aluminum anodized 89 x 125mm, 1.5 mm thick mounted on cedar post with mylar label 0.125 mm thick with words "Cable" "Joint" or "Conduit" with arrows to indicate change in direction.

PART 3 Execution

3.1 INSTALLATION

- .1 Install duct pipe in accordance with manufacturer's instructions.
- .2 Clean inside of ducts before laying.
- .3 Ensure full, even support every 1.5 m throughout duct length.
- .4 Slope ducts with 1 to 400 minimum slope.
- .5 During construction, cap ends of ducts to prevent entrance of foreign materials.
- .6 Pull through each duct steel wooden mandrel not less than 300 mm long and of diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Pull stiff bristle brush through each duct immediately before pulling-in cables.
- .7 In each duct install pull rope continuous throughout each duct run with 3 m spare rope at each end.
- .8 Install markers as required.
- .9 Backfill and compaction required as specified on drawings.

END OF SECTION
