

SPECIFICATIONS

For

**Heritage Exhibit
Halifax Citadel**

For

PARKS CANADA AGENCY

ISSUED FOR TENDER

**WSP CANADA INC.
Dartmouth, Nova Scotia**

Heritage Exhibit, Halifax Citadel

SPECIFICATIONS ISSUED FOR TENDER

PARKS CANADA AGENCY



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END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

- .1 In general, the work under this contract consists of, but will not necessarily be limited to, the following:
 - .1 Liaison with a representative Parks Canada (Citadel Hill) throughout the duration of the project.
 - .2 Cleaning and preparation of concrete floors, walls and ceiling including the removal of metal protrusions and rough areas of concrete floor
 - .3 Provide finish carpentry items including counter and screen.
 - .4 Provide mineral thermal sheathing at mechanical mezzanine to fill gaps where existing insulation exists.
 - .5 Provide new fire rated construction as described. Note that asbestos is present in walls surrounding the Boiler Room. Refer to Appendix A for Safe work Practice
 - .6 Provide painting of all new equipment and all walls above 2.4m; equipment tags and identification to be protected. Contractor is not required to paint existing historic stone walls.
 - .7 Removal and disposal of all redundant existing HVAC equipment and associated wiring, piping and all incidentals.
 - .8 Supply and installation of new VRF heat pump system, including but not limited to, condensing unit, fan coil units, duct work, grilles and diffusers, refrigerant piping, condensate drain piping, controls.
 - .9 Supply and installation of one new ERV for ventilation of the room.
 - .10 Supply and installation of two new dehumidifiers, including but not limited to ductwork, grilles and diffusers, condensate drain piping, controls.
 - .11 Supply and installation of duct heaters and other systems as indicated.
 - .12 Supply and installation of new domestic water heater to be connected to existing pipework and sink
 - .13 Start-up and commissioning of new system.
 - .14 Relocation of fire alarm panel and devices, including trenching, and removal of redundant devices, wiring and conduit
 - .15 Removal and disposal of all redundant existing electrical wiring and connections, equipment, junction boxes and all incidentals
 - .16 Provision of base building power distribution for future tenant fit up
 - .17 Provision of communication pathways for future tenant fit up

1.2 IMPLEMENTATION

- .1 This contract shall be planned and implemented by the Contractor, such that all work is carried out within the specified time frame. All measures necessary to meet this deadline including phasing shall be considered when bidding for this project.

1.3 SITE OF WORK

- .1 Work will be carried out at the Heritage Exhibit at Halifax Citadel, Halifax, Nova Scotia in the locations as shown on the accompanying drawings.

1.4 FAMILIARIZATION WITH SITE

- .1 Before submitting a bid, it is recommended that bidders visit the site and its surroundings to review and verify the form, nature and extent of the work, materials necessary for the completion of the works, the means of access to the site, any accommodations they may require, and in general shall obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect their bid. No allowance shall be made subsequently in this connection on account of error or negligence to properly observe and determine the on-site conditions that will apply during the completion of the Works. A meeting will be scheduled with Departmental Representative. Please contact Departmental Representative prior to visiting site. Allow 48 hours' notice for scheduling of site meeting.
- .2 Contractors are to review specification Section 01 35 29.06 - Health and Safety Requirements before visiting site. Take all appropriate safety measures for any visit to site, either before or after acceptance of bid.

1.5 CODES AND STANDARDS

- .1 Perform work in accordance with the following codes and legislative requirements:
 - .1 Environment Act of the Province of Nova Scotia.
 - .2 Waste Material Disposal Act of the Province of Nova Scotia.
 - .3 Canadian Environmental Protection Act.
 - .4 Transportation Dangerous Goods Act.
 - .5 Canada Labour Code Occupational Health and Safety Standards.
 - .6 National Building Code of Canada, latest edition.
 - .7 Canadian Electrical Code, latest edition.
 - .8 National Fire Code of Canada, latest edition.
 - .9 Nova Scotia Occupational Health and Safety Act and Regulations.
 - .10 The Storage and Handling of Gasoline and Associated Products Regulations by the Province of Nova Scotia.
 - .11 Any other Federal, Provincial, Municipal and Local Code, Standard, Regulation, Guideline, By-Law or Ordinance having jurisdiction.
 - .12 Canadian Standards Association (CSA), CSAB52 – Mechanical Refrigeration Code.
- .2 Materials and workmanship must meet or exceed requirements of specified standards, codes and referenced documents.

1.6 TERMS

- .1 Unless specifically stated otherwise, the term "Engineer" as used in the Specifications

and on the Drawings, shall mean the Departmental Representative (DR) as defined in the General Conditions of the Contract.

1.7 COST BREAKDOWN

- .1 Before submitting first progress claim submit breakdown of Contract price in detail as directed by Departmental Representative and aggregating contract price.
- .2 Provide cost breakdown divided into major work components as directed by Departmental Representative.
- .3 Upon approval by Departmental Representative, cost breakdown will be used as basis for progress payment.
- .4 All work items and costs are to be included in the lump sum arrangement, as noted on the Bid and Acceptance Form.

1.8 WORK SCHEDULE

- .1 Submit within five (5) working days of notification of acceptance of bid, a construction schedule showing commencement and completion of all work within the time stated on the bid and acceptance form and the date stated in the bid acceptance letter.
- .2 Provide sufficient details in schedule to clearly illustrate entire implementation plan, depicting efficient coordination of tasks and resources, to achieve completion of work on time and permit effective monitoring of work progress in relation to established milestones.
- .3 As a minimum, work schedule to be prepared and submitted in the form of bar (GANTT) charts, indicating work activities, tasks and other project elements, their anticipated durations and planned dates for achieving key activities and major project milestones provided in sufficient details and supported by narratives to demonstrate a reasonable plan for completion of project within designated time (e.g., show target dates for completion of each work item, if applicable). Breakdown elements to indicate target dates for completion of each element. Generally, bar charts derived from commercially available computerized project management systems are preferred but not mandatory.
- .4 Submit schedule updates on an as-required basis and when requested by Departmental Representative. Provide a narrative explanation of necessary changes and schedule revisions at each update.
- .5 The schedule, including all updates, shall be to the Departmental Representative's approval. Take necessary measures to complete work within approved time. Do not change schedule without Departmental Representative's approval.
- .6 All work on the project will be completed within the time indicated on the Bid and Acceptance Form.

1.9 ABBREVIATIONS

- .1 Following abbreviations of standard specifications have been used in this specification and on the drawings:
 - .1 CGSB - Canadian Government Specifications Board CSA - Canadian Standards Association
 - .2 ASTM - American Society for Testing and Materials DR - Departmental Representative
- .2 Where these abbreviations and standards are used in this project, latest edition in effect on date of bid call will be considered applicable.

1.10 SITE OPERATIONS

- .1 Arrange for sufficient space adjacent to project site for conduct of operations, storage of materials, etc. Exercise care so as not to obstruct or damage public or private property in area. Do not interfere with normal day-to-day operations in progress at site. Vehicle and equipment will not be permitted in the parade square between the hours of 0900 and 1800. All arrangements for space and access will be made by Contractor.

1.11 PROJECT MEETINGS

- .1 Departmental Representative will arrange bi-weekly project meetings and assume responsibility for setting times and recording minutes.
- .2 Project meetings will take place on site of work unless so directed by Departmental Representative.
- .3 Departmental Representative will assume responsibility for recording minutes of meetings and forwarding copies to all parties present at meetings.
- .4 Have a responsible member of firm present at all Project Meetings.

1.12 PROTECTION

- .1 Store all materials and equipment to be incorporated into work to prevent damage by any means.
- .2 Repair and replace all materials or equipment damaged in transit or storage to the satisfaction of the Departmental Representative and at no cost to Parks Canada (PCA).

1.13 EXISTING SERVICES

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

- .2 Before commencing work, establish locations and extent of service lines in area of work and notify Departmental Representative of findings.
- .3 Submit schedule to and obtain approval from Departmental Representative for any shutdown or closure of active service or facility. Adhere to approved schedule and provide notice to affected parties.
- .4 Provide temporary services to maintain critical facility systems.
- .5 Provide adequate bridging over trenches which cross walkways or roads to permit normal traffic.
- .6 Where unknown services or conditions are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .7 Protect, relocate or maintain existing active services as required. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction over service. Record locations of maintained, re-routed and abandoned service lines.

1.14 DOCUMENTS REQUIRED

- .1 Maintain at job site, one (1) copy each of the following:
 - .1 Contract drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed shop drawings.
 - .5 List of outstanding shop drawings.
 - .6 Change Orders.
 - .7 Other modifications to contract.
 - .8 Field test reports.
 - .9 Copy of approved work schedule.
 - .10 Site specific Health and Safety Plan and other safety related documents.
 - .11 Permits and Regulatory Approvals and Requirements.
 - .12 Other documents as stipulated elsewhere in the Contract Documents.

1.15 PERMITS

- .1 Obtain and pay for all permits, certificates and licenses as required by Municipal, Provincial, Federal and other authorities.
- .2 Provide appropriate notifications of project to Municipal and Provincial inspection authorities.
- .3 Obtain compliance certificates as prescribed by legislative and regulatory provisions of municipal, provincial and federal authorities as applicable to the performance of work.

- .4 Submit to Departmental Representative, copy of application submissions and approval documents received for above referenced authorities.
- .5 Comply with all requirements, recommendations and advice by all regulatory authorities unless otherwise agreed in writing by Departmental Representative. Make requests for such deviations to these requirements sufficiently in advance of related work.

1.16 CUTTING, FITTING AND PATCHING

- .1 Execute cutting, including excavation, fitting and patching required to make work fit properly.
- .2 Where new work connects with existing and where existing work is altered, cut, patch and make good to match existing work. This includes patching of openings in existing work resulting from removal of existing services.
- .3 Make cuts with clean, true, smooth edges. Make patches inconspicuous in final assembly.

1.17 EXISTING SUB-SURFACE CONDITIONS

- .1 No information pertaining to the existing sub-surface conditions is available, but is approximate only. Contractor is responsible to confirm all sub-surface conditions prior to construction.

1.18 LOCATION OF EQUIPMENT

- .1 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.
- .2 Inform Departmental Representative when impending installation conflicts with other new or existing components. Follow directives for actual location.
- .3 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.19 ACCEPTANCE

- .1 Prior to the issuance of the Certificate of Substantial Performance, in company with Departmental Representative, make a check of all work. Correct all discrepancies before final inspection and acceptance.

1.20 WORKS COORDINATION

- .1 Contractor to be responsible for coordinating the work of the various trades, where the work of such trades interfaces with each other.
- .2 Convene meetings between trades whose work interfaces and ensure that they are fully aware of the areas and the extent of where interfacing is required. Provide each trade with the plans and specifications of the interfacing trade, as required, to assist them in planning and carrying out their respective work.
- .3 PCA will not be responsible for or held accountable for any extra costs incurred as a result of the failure to carry out coordination work. Disputes between the various trades as a result of their not being informed of the areas and extent of interface work shall be the sole responsibility of the General Contractor and shall be resolved at no extra cost to PCA.

1.21 CONTRACTOR'S USE OF SITE

- .1 Construction operations, including storage of materials, for this contract not to interfere with the operations at this facility. Contractor to note that Citadel Hill will be open to staff and the public during construction and that all equipment, waste and vehicles can not be stored in the parade square.
- .2 All work areas shall be separated from the public with adequate hoarding or barricades. Bilingual signage is to be provided.
- .3 Contractor responsible for arranging the storage of materials on or off site and any materials stored at the site which interfere with any of the day-to-day activities at or near the site will be moved promptly at the Contractor's expense, upon request by the Departmental Representative. Contractor to note that storage is limited outside of the exhibit space
- .4 Vehicle access to site will be limited and restricted to avoid conflicts with site. Vehicles and equipment may be brought onto site before 0900 and may be removed post 1700. The site is open until 1800 in July and August and consultation for deliveries and removals will be assessed by the Owner on a case by case basis with 24 hours' notice.
- .5 The elevator is to remain operational and available to the public during construction. If closure of this space is required, this will need to be scheduled with and approved by the Owner to minimize public impact.
- .6 Exercise care so as not to obstruct or damage public or private property in the area.
- .7 At completion of work, restore area to its original condition. Damage to ground and property will be repaired by Contractor. Remove all construction materials, residue, excess, etc., and leave site in a condition acceptable to Departmental Representative.

1.22 WORK COMMENCEMENT

- .1 Mobilization to project site is to commence immediately after acceptance of bid and submission and approval of site specific Safety Plan and Environmental Plan, unless otherwise agreed by Departmental Representative.
- .2 Project work on site is to commence as soon as possible with a continuous reasonable workforce unless otherwise agreed by Departmental Representative.
- .3 Weather conditions, short construction season, delivery challenges and the location of the work site may require the use of longer working days and additional workforce to complete the project within the specified completion time.
- .4 Make every effort to ensure that sufficient material and equipment is delivered to site at the earliest possible date after acceptance of bid and replenished as required.

1.23 FACILITY SMOKING ENVIRONMENT

- .1 No smoking on federal property.

1.24 INTERPRETATION OF DOCUMENTS

- .1 Supplementary to the General Conditions, the Division 01 sections of the specifications take precedence over technical specification in other divisions of the specifications.

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

Not applicable

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart.

1.2 ACCESS AND EGRESS

- .1 Ensure facility's access and egress routes are maintained in accordance with relevant municipal, provincial and other regulations.
- .2 The only vehicle access to site is limited via an 8 tonne bridge and vehicle size is limited by height and width restrictions surrounding the bridge.

1.3 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Maintain existing services to buildings.
- .3 Where security is reduced by work provide temporary means to maintain security.
- .4 Closures: protect work temporarily until permanent enclosures are completed.
- .5 Contractor able to use site washrooms and facilities

1.4 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

- .1 Execute work with least possible interference or disturbance to building operations and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

1.5 EXISTING SERVICES

- .1 Extreme caution is to be taken during excavation so as not to damage existing buried utilities in any way. Any damage shall be repaired by the Contractor, at no additional cost to the Departmental Representative. Excavation operations shall be coordinated with the Departmental Representative. Locates to be completed prior to starting work and submitted to Departmental Representative.

1.6 SPECIAL REQUIREMENTS

- .1 Submit schedule in accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart.

- .2 Ensure that Contractor personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

Not applicable

END OF SECTION

PART 1 GENERAL

- .1 Unit prices are full compensation for the work necessary to complete each item in the Contract and in combination for all work necessary to complete the Work as a whole.
- .2 Unit prices are full compensation for the contractor to develop and implement a safe work plan and procedure for the Work, including but not limited to Working at Heights including all incidents.
- .3 It is the intention to provide for a finished piece of work, complete in all essentials and details, including all items reasonably inferable from the drawings and specifications.
- .4 The aggregate of all unit prices and lump sum payments shall constitute full compensation for the entire work of the Contract, as shown, specified and intended, regardless of any omission in the tender documents of any items which are necessary for the completion of the work including temporary facilities, safety, etc.
- .5 Should there be any discrepancy regarding measurement between the Measurement and Payment Section and any other section in the specifications, the Measurement and Payment Section shall overrule the other specification section.
- .6 Unless otherwise specified, all materials necessary to complete the items listed in the Unit Price Table and the finished work are to be supplied by the Contractor and the cost of such material is to be included in the Contractor's prices. There will be no measurement for work not authorized, or for work beyond authorized limits as determined by the Departmental Representative.
- .7 All unit prices and lump sums shall include all costs applicable to the items, including labour, materials, equipment, transportation, ancillaries and all other applicable and relevant costs as intended and as required to complete the work to the full satisfaction of the Departmental Representative. The unit prices and lump sums indicated shall exclude HST.
- .8 All work including shoring, protection measures, etc. required to prevent damage/disturbance to existing structures of any areas damaged as a result of work or access are considered incidental to the work.
- .9 Disposal of excess excavated materials will not be measured but will be incidental to the work. All excess materials shall become property of the Contractor and shall be disposed of off-site at an environmentally approved disposal site.
- .10 The intent is to cover a range of required work as determined by the Departmental Representative on the site under established unit rates. Actual quantities may vary widely depending on the final scope of work and the condition of the various structures.
- .11 Removal and disposal of all redundant site materials and equipment associated with this contract.
- .12 All installed above floor equipment including but not limited to drip trays, duct work, heat pumps and pipework to be painted flat black as per architectural specification.

PART 2
HVAC SYSTEM

.1 Heat Pump System

Unit of Measurement: Lump Sum

This item includes: supply and install indoor fan coils, outdoor condensing units, dehumidification units, refrigerant piping, heat pump controllers, fittings, insulation, supports. Includes all incidentals.

.2 Ventilation

Unit of Measurement: Lump Sum

This item includes: supply and install energy recovery unit, ductwork, grilles, diffusers, duct insulation, balancing dampers, fire stops, supports. Includes all incidentals.

.3 Controls

Unit of Measurement: Lump Sum

This item includes: all controls and sensors, associated wiring and thermostats and humidistats. Includes all incidentals.

.4 Plumbing

Unit of Measurement: Lump Sum

This item includes: supply and install hot water heater including all connections (domestic water and power), hot water piping, condensate piping, valves, fittings, pressure testing, and insulation. Includes all incidentals.

.5 Drip Trays

Unit of Measurement: Lump Sum

This item includes: supply and install galvanised drip trays including all hanger and support assembly at 2.4m intervals. Includes all incidentals.

ELECTRICAL SYSTEM

.6 Electrical

Unit of Measurement: Lump Sum

This item includes: supply and installation of wiring, conduits, junction boxes, breakers, pull stations, relocation of existing fixtures, relocation of fire alarm panel, all connections, excavation and reinstatement, all associated hardware. Includes all incidentals.

ARCHITECTURAL

.7 Floor Preparation

Unit of Measurement: Lump Sum

This item includes: patching, modifying and repairing of damaged areas in preparation to receive laminate flooring, removal of steel protruding from concrete, removal of concrete imperfections. Cleaning to be performed at completion of project. Includes all incidentals.

.8 Ceiling Preparation

Unit of Measurement: Lump Sum

This item includes: supply materials and labour to prepare ceiling for painting, final painting including all exposed electrical and mechanical equipment and associated pipework, conduits, ducts and diffusers, drip trays. Includes all incidentals.

.9 Carpentry

Unit of Measurement: Lump Sum

This item includes: supply and install privacy screens, counter, door openers, fire rated walls, repair of redundant penetrations, firestops. Includes all incidentals.

END OF SECTION

PART 2 **PRODUCTS (NOT APPLICABLE)**

PART 3 **EXECUTION (NOT APPLICABLE)**

END OF SECTION

PART 1 - GENERAL

1.1 DEFINITIONS

- .1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2 Bar Chart (Gantt chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.
- .3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.
- .4 Construction Work Week: Monday to Sunday, inclusive, will provide seven (7) day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.
- .5 Duration: number of work periods (not including holidays or other non-working periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.
- .6 Master Plan: summary-level schedule that identifies major activities and key milestones.
- .7 Milestone: significant event in project, usually completion of major deliverable.
- .8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
- .9 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete work in accordance with prescribed milestones and time frame.
- .3 Limit activity durations to maximum of approximately 10 working days, to allow for

progress reporting.

- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Departmental Representative, within 10 days of Award of Contract, Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
- .3 Submit Project Schedule to Departmental Representative within five (5) working days of receipt of acceptance of Master Plan.

1.4 PROJECT MILESTONES

- .1 This contract shall be planned and implemented by the Contractor, such that all work is carried out and completed within the specified time frame. All measures necessary to meet this deadline shall be considered as indicated when bidding this project.

1.5 MASTER PLAN

- .1 Structure schedule to allow orderly planning, organizing and execution of work as Bar Chart (GANTT).
- .2 Departmental Representative will review and return revised schedules with five (5) working days.
- .3 Revise impractical schedule and resubmit within five (5) working days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.6 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
 - .1 Award.
 - .2 Shop Drawings.
 - .3 Permits.
 - .4 Mobilization.

- .5 HVAC Installation.
- .6 Electrical.
- .7 Controls.
- .8 Architecture and Carpentry
- .9 Testing and Commissioning.
- .10 Restoration.

1.7 PROJECT SCHEDULE REPORTING

- .1 Update Project Schedule on weekly basis reflecting activity changes and completions, as well as activities in progress.
- .2 Include as part of Project Schedule, narrative report identifying work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.8 PROJECT MEETINGS

- .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.
- .2 Weather related delays with their remedial measures will be discussed and negotiated.

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

Not applicable

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTAL GENERAL REQUIREMENTS

- .1 Submit to Departmental Representative for review submittals listed, including shop drawings, samples, certificates and other data, as specified in other sections of the Specifications.
- .2 Submit with reasonable promptness and in orderly sequence so as to allow for Departmental Representative's review and not cause delay in Work. Failure to submit in ample time will not be considered sufficient reason for an extension of Contract time and no claim for extension by reason of such default will be allowed.
- .3 Do not proceed with work until relevant submissions are reviewed by Departmental Representative.
- .4 Present shop drawings, product data and samples in SI Metric units.
- .5 Where items or information is not produced in SI Metric units, provide soft converted values.
- .6 Review submittals prior to submission to Departmental Representative. Ensure during review that necessary requirements have been determined and verified, required field measurements or data have been taken, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents.
 - .1 Submittals not stamped, signed, dated and identified as to specific project will be returned unexamined by Departmental Representative and considered rejected.
- .7 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .8 Verify field measurements and affected adjacent work and coordinate.
- .9 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .10 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative's review.
- .11 Submittal format: electronic copies, or alternatively paper originals or clear and fully legible photocopies of originals. Facsimiles are not acceptable, except in special circumstances pre-approved by Departmental Representative. Poorly printed non-legible copies will not be accepted and be returned for resubmission.
- .12 Make changes or revisions to submissions which Departmental Representative may require, consistent with Contract Documents and resubmit as directed by Departmental Representative. When resubmitting, notify Departmental Representative in

writing of any revisions other than those requested.

- .13 Keep one reviewed copy of each submittal document on site for duration of Work.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work that are specific to project requirements.
- .2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed.
- .3 Allow five (5) working days for Departmental Representative's review of each submission.
- .4 Accompany submissions with transmittal letter containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .5 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.

- .10 Relationship to adjacent work.
- .6 After Departmental Representative's review, distribute copies.
- .7 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .8 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .9 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 3 years of date of contract award for project.
- .10 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
- .11 Submit electronic copies of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .12 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .13 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .14 Delete information not applicable to project.
- .15 Supplement standard information to provide details applicable to project.
- .16 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, transparency copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted

copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

- .17 The review of shop drawings by PCA is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that PCA approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
 - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 SCHEDULES, PERMITS AND CERTIFICATES

- .1 Upon acceptance of bid, submit to Departmental Representative copy of Work Schedule and various other schedules, permits, certification documents and project management plans as specified in other sections of the Specifications.
- .2 Submit copy of permits, notices, compliance Certificates received from Regulatory Agencies having jurisdiction and as applicable to the Work.
- .3 Submission of above documents to be in accordance with Submittal General Requirements procedures specified in this section.

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

Not applicable

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Fire Safety Requirements

1.2 RELATED WORK

- .1 Section 01 35 29.06 - Health and Safety Requirements

1.3 REFERENCES

- .1 Fire Protection Standards issued by Fire Protection Services of Human Resources Development Canada as follows:
 - .1 FCC No. 301-June 1982 Standard for Construction Operations (http://www.hrsdc.gc.ca/eng/labour/fire_protection/policies_standards/commissioner/301/page00.shtml).
 - .2 FCC standards, may also be viewed at the Regional Fire Protection Services' office (previously known as the Fire Commissioner of Canada) located at 99 Wyse Road, 8TH Floor, Dartmouth, NS, Tel: (902) 426-6053.

1.4 SUBMITTALS

- .1 Submit in accordance with the Submittal General Requirements specified in Section 01 33 00.

1.5 FIRE SAFETY REQUIREMENTS

- .1 Implement and follow fire safety measures during work. Comply with following:
 - .1 National Fire Code, latest edition
 - .2 Fire Protection Standards FCC 301 and FCC 302.
 - .3 Federal and Provincial Occupational Health and Safety Acts and Regulations as specified in section 01 35 29.06.
- .2 In event of conflict between any provisions of above authorities the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, Departmental Representative will advise on the course of action to be followed.

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

Not applicable

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 35 24: Special Procedures on Fire Safety Requirements.
- .2 Section 02 82 00.02 – Asbestos Abatement
- .3 Appendix A - P-0014718-0-00-200 Englobe Safe Work Practice (November 22, 2017) – Cutting Holes Through Drywall with Asbestos-Containing Joint Compound

1.2 DEFINITIONS

- .1 COSH: Canada Occupational Health and Safety Regulations made under Part II of the Canada Labour Code.
- .2 Competent Person: means a person who is:
 - .1 Qualified by virtue of personal knowledge, training and experience to perform assigned work in a manner that will ensure the health and safety of persons in the workplace, and;
 - .2 Knowledgeable about the provisions of occupational health and safety statutes and regulations that apply to the Work and;
 - .3 Knowledgeable about potential or actual danger to health or safety associated with the Work.
- .3 Medical Aid Injury: any minor injury for which medical treatment was provided and the cost of which is covered by Workers' Compensation Board of the province in which the injury was incurred.
- .4 PPE: personal protective equipment
- .5 Work Site: where used in this section shall mean areas, located at the premises where Work is undertaken, used by Contractor to perform all of the activities associated with the performance of the Work.

1.3 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00.
- .2 Submit site-specific Health and Safety Plan prior to commencement of Work.
 - .1 Submit within 5 work days of notification of Bid Acceptance. Provide 3 copies.
 - .2 Departmental Representative will review Health and Safety Plan and provide comments.
 - .3 Revise the Plan as appropriate and resubmit within 5 work days after receipt of comments.
 - .4 Departmental Representative's review and comments made of the Plan shall not be construed as an endorsement, approval or implied warranty of any kind by

- Canada and does not reduce Contractor's overall responsibility for Occupational Health and Safety of the Work.
- .5 Submit revisions and updates made to the Plan during the course of Work.
- .3 Submit name of designated Health & Safety Site Representative and support documentation specified in the Safety Plan.
- .4 Submit building permit, compliance certificates and other permits obtained.
- .5 Submit copy of Letter in Good Standing from Provincial Workers Compensation or other department of labour organization.
 - .1 Submit update of Letter of Good Standing whenever expiration date occurs during the period of Work.
- .6 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .7 Submit copies of incident reports.
- .8 Submit WHMIS MSDS - Material Safety Data Sheets.

1.4 COMPLIANCE REQUIREMENTS

- .1 Comply with Occupational Health and Safety Act for Province of Nova Scotia, and Occupational Health & Safety Regulations made pursuant to the Act.
- .2 Comply with Canada Labour Code - Part II (entitled Occupational Health and Safety) and the Canada Occupational Health and Safety Regulations (COSH) as well as any other regulations made pursuant to the Act.
 - .1 The Canada Labour Code can be viewed at: [www.http://laws.justice.gc.ca/en/L-2/](http://laws.justice.gc.ca/en/L-2/)
 - .2 COSH can be viewed at: [www.http://laws.justice.gc.ca/eng/SOR-86-304/ne.html](http://laws.justice.gc.ca/eng/SOR-86-304/ne.html)
 - .3 A copy may be obtained at: Canadian Government Publishing Public Works & Government Services Canada Ottawa, Ontario, K1A 0S9 Tel: (819) 956-4800 (1-800-635-7943) Publication No. L31-85/2000 E or F)
- .3 Observe construction safety measures of:
 - .1 Part 8 of National Building Code
 - .2 Municipal by-laws and ordinances.
- .4 In case of conflict or discrepancy between above specified requirements, the more stringent shall apply.
- .5 Maintain Workers Compensation Coverage in good standing for duration of Contract. Provide proof of clearance through submission of Letter in Good Standing.
- .6 Medical Surveillance: Where prescribed by legislation or regulation, obtain and

maintain worker medical surveillance documentation.

1.5 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons and environment adjacent to the site to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by all workers, sub-contractors and other persons granted access to Work Site with safety requirements of Contract Documents, applicable federal, provincial, and local by-laws, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.6 SITE CONTROL AND ACCESS

- .1 Control the Work and entry points to Work Site. Approve and grant access only to workers and authorized persons. Immediately stop and remove non-authorized persons.
 - .1 Departmental Representative will provide names of those persons authorized by Departmental Representative to enter onto Work Site and will ensure that such authorized persons have the required knowledge and training on Health and Safety pertinent to their reason for being at the site, however, Contractor remains responsible for the health and safety of authorized persons while at the Work Site.
- .2 Isolate Work Site from other areas of the premises by use of appropriate means.
 - .1 Erect fences, hoarding, barricades and temporary lighting as required to effectively delineate the Work Site, stop non-authorized entry, and to protect pedestrians and vehicular traffic around and adjacent to the Work and create a safe environment. See Section 01 56 00 for minimum acceptable requirements.
 - .2 Post signage at entry points and other strategic locations indicating restricted access and conditions for access.
 - .3 Use professionally made signs with bilingual message in the 2 official languages or international known graphic symbols.
- .3 Provide safety orientation session to persons granted access to Work Site. Advise of hazards and safety rules to be observed while on site.
- .4 Ensure persons granted site access wear appropriate PPE. Supply PPE to inspection authorities who require access to conduct tests or perform inspections.
- .5 Secure Work Site against entry when inactive or unoccupied and to protect persons against harm.

1.7 PROTECTION

- .1 Give precedence to safety and health of persons and protection of environment over cost and schedule considerations for Work.
- .2 Should unforeseen or peculiar safety related hazard or condition become evident during performance of Work, immediately take measures to rectify situation and prevent damage or harm. Advise Departmental Representative verbally and in writing.

1.8 FILING OF NOTICE

- .1 File Notice of Project with pertinent provincial health and safety authorities prior to beginning of Work.
 - .1 Departmental Representative will assist in locating address if needed.

1.9 PERMITS

- .1 Post permits, licenses and compliance certificates, specified in section 01 10 10, at Work Site.
- .2 Where a particular permit or compliance certificate cannot be obtained, notify Departmental Representative in writing and obtain approval to proceed before carrying out applicable portion of work.

1.10 HAZARD ASSESSMENTS

- .1 Perform site specific health and safety hazard assessment of the Work and its site.
- .2 Carryout initial assessment prior to commencement of Work with further assessments as needed during progress of work.
- .3 Record results and address in Health and Safety Plan.
- .4 Keep documentation on site for entire duration of the Work.

1.11 PROJECT/SITE CONDITIONS

- .1 Following are potential health, environmental and safety hazards at the site for which Work may involve contact with:
 - .1 Known latent site and environmental conditions:
 - .1 Buried utilities.
 - .2 Facility on-going operations:
 - .1 Vehicle traffic from operational parking lot.
 - .3 Construction hazards:
 - .1 Heavy equipment traffic.
- .2 Above items shall not be construed as being complete and inclusive of potential health

and safety hazards encountered during Work.

- .3 Include above items in the hazard assessment of the Work.
- .4 MSDS Data sheets of pertinent hazardous and controlled products stored on site can be obtained from Departmental Representative.

1.12 MEETINGS

- .1 Attend pre-construction health and safety meeting, convened and chaired by Departmental Representative, prior to commencement of Work, at time, date and location determined by Departmental Representative. Ensure attendance of:
 - .1 Superintendent of Work
 - .2 Designated Health & Safety Site Representative
 - .3 Subcontractors
- .2 Conduct regularly scheduled tool box and safety meetings during the Work in conformance with Occupational Health and Safety regulations.
- .3 Keep documents on site.

1.13 HEALTH AND SAFETY PLAN

- .1 Prior to commencement of Work, develop written Health and Safety Plan specific to the Work. Implement, maintain, and enforce Plan for entire duration of Work and until final demobilization from site. Refer to Appendix A for asbestos requirements.
- .2 Health and Safety Plan shall include the following components:
 - .1 List of health risks and safety hazards identified by hazard assessment.
 - .2 Control measures used to mitigate risks and hazards identified.
 - .3 On-site Contingency and Emergency Response Plan as specified below.
 - .4 On-site Communication Plan as specified below.
 - .5 Name of Contractor's designated Health & Safety Site Representative and information showing proof of his/her competence and reporting relationship in Contractor's company.
 - .6 Names, competence and reporting relationship of other supervisory personnel used in the Work for occupational health and safety purposes.
- .3 On-site Contingency and Emergency Response Plan shall include:
 - .1 Operational procedures, evacuation measures and communication process to be implemented in the event of an emergency.
 - .2 Evacuation Plan: site and floor plan layouts showing escape routes, marshalling areas. Details on alarm notification methods, fire drills, location of firefighting equipment and other related data.
 - .3 Name, duties and responsibilities of persons designated as Emergency Warden(s) and deputies.
 - .4 Emergency Contacts: name and telephone number of officials from:
 - .1 General Contractor and subcontractors.

- .2 Pertinent Federal and Provincial Departments and Authorities having jurisdiction.
 - .3 Local emergency resource organizations.
- .5 Harmonize Plan with Facility's Emergency Response and Evacuation Plan. Departmental Representative will provide pertinent data including name of PARKS CANADA (PCA) and Facility Management contacts.
- .4 On-site Communication Plan:
 - .1 Procedures for sharing of work related safety information to workers and subcontractors, including emergency and evacuation measures.
 - .2 List of critical work activities to be communicated with Facility Manager which have a risk of endangering health and safety of Facility users.
- .5 Address all activities of the Work including those of subcontractors.
- .6 Review Health and Safety Plan regularly during the Work. Update as conditions warrant to address emerging risks and hazards, such as whenever new trade or subcontractor arrive at Work Site.
- .7 Departmental Representative will respond in writing, where deficiencies or concerns are noted and may request re-submission of the Plan with correction of deficiencies or concerns.
- .8 Post copy of the Plan, and updates, prominently on Work Site.

1.14 SAFETY SUPERVISION

- .1 Employ Health & Safety Site Representative responsible for daily supervision of health and safety of the Work.
- .2 Health & Safety Site Representative may be the Superintendent of the Work or other person designated by Contractor and shall be assigned the responsibility and authority to:
 - .1 Implement, monitor and enforce daily compliance with health and safety requirements of the Work.
 - .2 Monitor and enforce Contractor's site-specific Health and Safety Plan.
 - .3 Conduct site safety orientation session to persons granted access to Work Site.
 - .4 Ensure that persons allowed site access are knowledgeable and trained in health and safety pertinent to their activities at the site or are escorted by a competent person while on the Work Site.
 - .5 Stop the Work as deemed necessary for reasons of health and safety.
- .3 Health & Safety Site Representative must:
 - .1 Be qualified and competent person in occupational health and safety.
 - .2 Have site-related working experience specific to activities of the Work.
 - .3 Be on Work Site at all times during execution of the Work.
- .4 All supervisory personnel assigned to the Work shall also be competent persons.

- .5 Inspections:
 - .1 Conduct regularly scheduled safety inspections of the Work on a minimum bi-weekly basis. Record deficiencies and remedial action taken.
- .6 Cooperate with Facility's Occupational Health and Safety representative should one be designated by Departmental Representative.
- .7 Keep inspection reports and supervision related documentation on site.

1.15 TRAINING

- .1 Use only skilled workers on Work Site who are effectively trained in occupational health and safety procedures and practices pertinent to their assigned task.
- .2 Maintain employee records and evidence of training received. Make data available to Departmental Representative upon request.
- .3 When unforeseen or peculiar safety-related hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.

1.16 MINIMUM SITE SAFETY RULES

- .1 Notwithstanding requirement to abide by federal and provincial health and safety regulations; ensure the following minimum safety rules are obeyed by persons granted access to Work Site:
 - .1 Wear appropriate PPE pertinent to the Work or assigned task; minimum being hard hat, safety footwear, safety glasses and hearing protection.
 - .2 Immediately report unsafe condition at site, near-miss accident, injury and damage.
 - .3 Maintain site and storage areas in a tidy condition free of hazards causing injury.
 - .4 Obey warning signs and safety tags.
- .2 Brief persons of disciplinary protocols to be taken for non-compliance. Post rules on site.

1.17 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative will stop Work if non-compliance of health and safety

regulations is not corrected in a timely manner.

1.18 INCIDENT REPORTING

- .1 Investigate and report the following incidents to Departmental Representative:
 - .1 Incidents requiring notification to Provincial Department of Occupational Safety and Health, Workers Compensation Board or to other regulatory Agency.
 - .2 Medical aid injuries.
 - .3 Property damage.
 - .4 Interruptions to Facility operations.
- .2 Submit report in writing within five (5) days of incident.

1.19 HAZARDOUS PRODUCTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS).
- .2 Keep MSDS data sheets for all products delivered to site.
 - .1 Post on site.
 - .2 Submit copy to Departmental Representative.
 - .3 For interior work in an occupied Facility, post additional copy in one or more publically accessible locations.

1.20 BLASTING

- .1 Blasting or other use of explosives is not permitted.

1.21 CONFINED SPACES

- .1 Abide by occupational health and safety regulations regarding work in confined spaces.
- .2 Obtain an Entry Permit in accordance with Part XI of the Canada Occupational Health and Safety Regulations for entry into an existing identified confined space located at the Facility or premises of Work.
 - .1 Obtain permit from Facility Manager
 - .2 Keep copy of permit issued.

1.22 SITE RECORDS

- .1 Maintain on Work Site copy of safety related documentation and reports stipulated to be produced in compliance with Acts and Regulations of authorities having jurisdiction and

of those documents specified herein.

- .2 Upon request, make available to Departmental Representative or authorized Safety Officer for inspection.

1.23 POSTING OF DOCUMENTS

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on Work Site in accordance with Acts and Regulations of Province having jurisdiction.
- .2 Post other documents as specified herein, including:
 - .1 Site specific Health and Safety Plan
 - .2 WHMIS data sheets

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.2 DEFINITIONS

- .1 Hazardous Material: Product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to the environment or adversely affect health of persons, animals or plant life when released into the environment.
- .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prior to commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Departmental Representative. Environmental Protection Plan is to present comprehensive overview of known or potential environmental issues which must be addressed during construction.
- .3 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .4 Environmental protection plan: include:
 - .1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
 - .2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.
 - .3 Names and qualifications of persons responsible for training site personnel.
 - .4 Descriptions of environmental protection personnel training program.
 - .5 Erosion and sediment control plan which identifies type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
 - .6 Spill Control Plan: including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
 - .7 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.

- .8 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off project site.
- .9 Contaminant prevention plan that: identifies potentially hazardous substances to be used on job site; identifies intended actions to prevent introduction of such materials into air, water, or ground; and details provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
- .10 Waste water management plan that identifies methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.

1.4 FIRES

- .1 Fires and burning of rubbish on site not permitted.

1.5 DISPOSAL OF WASTES AND HAZARDOUS MATERIALS

- .1 Do not bury rubbish and waste materials on site. Dispose at approved landfill sites as specified in Section 01 74 21.
- .2 Do not dispose of hazardous waste or volatile materials such as mineral spirits, paint thinner, oil or fuel into waterways, storm or sanitary sewers or waste landfill sites.
- .3 Store, handle and dispose of hazardous materials and hazardous waste in accordance with applicable federal and provincial laws, regulations, codes and guidelines.
- .4 Dispose of construction waste materials and demolition debris, resulting from work, at approved landfill sites only. Carry out such disposal in strict accordance with provincial and municipal rules and regulations. Separate out and prevent improper disposal of items banned from landfills.
- .5 Establish methods and undertake construction practices which will minimize waste and optimize use of construction materials. Separate at source all construction waste materials, demolition debris and product packaging and delivery containers into various recycling abilities of various materials and avoid disposal of debris at landfill site(s) in a "mixed state". Where recycling firms specializing in recycling of specific materials exist, transport such materials to the recycling facility and avoid disposal at landfill sites.
- .6 Communicate with landfill operator prior to commencement of work, to determine what specific construction, demolition and renovation waste materials have been banned from disposal at the landfill and at transfer stations.

1.6 DRAINAGE

- .1 Provide temporary drainage and pumping as necessary to keep excavations and site

free from water.

- .2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.
- .3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with governing regulations and requirements.
- .4 Pumped water must meet applicable federal, provincial and municipal standards before it can be discharged to a surface water body. If regulatory guidelines exceedances are noted, the Departmental Representative has the right to issue stop pumping instructions to the Contractor. Contractor will not be compensated for any delays associated with retrofitting equipment to meet guidelines.
- .5 Provide control devices such as filter fabrics, sediment traps and settling ponds to control drainage and prevent erosion of adjacent lands. Maintain in good order for duration of work.

1.7 PERMITS

- .1 All guidelines and instructions stated on permits must be strictly adhered to.

1.8 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this contract.
- .2 Control emissions from equipment and plant to local authorities emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads and around entire construction site.
- .5 Maintain inventory of hazardous materials and hazardous waste stored on site. List items by product name, quantity and date when storage began.
- .6 Have emergency spill response equipment and rapid clean-up kit, appropriate to work, at site. Locate adjacent to work and where hazardous materials are stored. Provide personal protective equipment as required for clean-up.
- .7 Report, to Federal and Provincial Department of the Environment, spills of petroleum and other hazardous materials as well as accidents having potential of polluting the environment. Also notify Departmental Representative and submit a written spill report to Departmental Representative within 24 hours of occurrence.

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

Not applicable

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.

1.2 INSPECTION

- .1 Facilitate Departmental Representative's access to Work. If part of Work is being fabricated at locations other than construction site, make preparations to allow access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection of Work designated for special tests, inspections or approvals by Departmental Representative or by inspection authorities having jurisdiction.
- .3 If Contractor covers or permits to be covered Work designated for special tests, inspections or approvals before such is made, uncover Work until particular inspections or tests have been fully and satisfactorily completed and until such time as Departmental Representative gives permission to proceed. Pay costs to uncover and make good such Work.
- .4 In accordance with the General Conditions, Departmental Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents.

1.3 INDEPENDENT INSPECTION AGENCIES

- .1 Departmental Representative will engage and pay for service of Independent Inspection and Testing Agencies for purpose of inspecting and testing portions of Work except for the following which remain part of Contractor's responsibilities:
 - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
 - .2 Inspection and testing performed exclusively for Contractor's convenience.
 - .3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.
 - .4 Mill tests and certificates of compliance.
 - .5 Tests as specified within various sections designated to be carried out by Contractor under the supervision of Departmental Representative.
 - .6 Additional tests specified in Clause 1.4.2.
- .2 Where tests or inspections by designated Testing Agency reveal work not in accordance with contract requirements, Contractor shall pay costs for additional tests or inspections as Departmental Representative may require to verify acceptability of corrected work.

- .3 Employment of inspection and testing agencies by Departmental Representative does not relax responsibility to perform Work in accordance with Contract Documents.

1.4 ACCESS TO WORK

- .1 Furnish labour and facility to provide access to the work being inspected and tested.
- .2 Cooperate to facilitate such inspections and tests.
- .3 Make good work disturbed by inspections and tests.

1.5 PROCEDURES

- .1 Notify Departmental Representative sufficiently in advance of when work is ready for tests, in order for Departmental Representative to make attendance arrangements with Testing Agency. When directed by Departmental Representative, notify such Agency directly.
- .2 Submit representative samples of materials specified to be tested. Deliver in required quantities to Testing Agency. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.
- .3 Provide labour and facilities to obtain and handle samples on site. Provide sufficient space on site for Testing Agency's exclusive use to store equipment and cure test samples.

1.6 REJECTED WORK

- .1 Remove and replace defective Work, whether result of poor workmanship, use of defective or damaged products and whether incorporated in Work or not, which has been identified by Departmental Representative as failing to conform to Contract Documents.
- .2 Make good damages to existing or new work, including work of other Contracts, resulting from removal or replacement of defective work.

1.7 TESTING BY CONTRACTOR

- .1 Provide all necessary instruments, equipment and qualified personnel to perform tests designated as Contractor's responsibilities herein or elsewhere in the Contract Documents.
- .2 At completion of tests, turn over two (2) copies of fully documented test reports to Departmental Representative. Additionally, obtain other copies in sufficient quantities to enable one (1) complete set of test reports to be placed in each of the maintenance

manuals specified in Section 01 78 00.

1.8 EQUIPMENT AND SYSTEMS

- .1 Submit adjustment balancing reports for electrical and building equipment systems.
- .2 Refer to Section 01 33 00 – Submittal Procedures and Divisions 25 and 26.

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

Not applicable

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 52 00 - Construction Facilities.
- .2 Section 01 56 00 - Temporary Barriers and Enclosures.

1.2 INSTALLATION AND REMOVAL

- .1 Provide temporary utilities controls in order to execute work expeditiously.
- .2 Remove from site all such work after use or as directed by Departmental Representative.

1.3 DEWATERING

- .1 Provide temporary drainage to keep excavations and site free from standing water.
- .2 Ensure discharge is not contaminated with sediment, oil, etc.

1.4 TEMPORARY HEATING AND VENTILATION

- .1 Pay for costs of temporary heat, and pumping used during construction, including costs of supply, installation, fuel, operation, maintenance, and removal of equipment, if applicable.
- .2 Maintain strict supervision of operation of temporary heating and pumping equipment:
 - .1 Conform to applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
- .3 Provide temporary heating and hoarding as required to:
 - .1 Facilitate progress of Work.
 - .2 Protect Work and products against dampness and cold.
 - .3 Prevent moisture condensation on surfaces.
 - .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
 - .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .4 Hoard, heat and provide protection for curing concrete in accordance with Section 03 30 00 – Cast-In Place Concrete.
- .5 Allow Departmental Representative to inspect methods for fire safety.

1.5 TEMPORARY POWER AND LIGHT

- .1 Departmental Representative will not provide or pay for temporary power during construction for temporary lighting and operating of power tools.
- .2 Arrange for connection with appropriate utility company. Pay all costs for supply, installation, maintenance and removal.
- .3 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor.
- .4 Provide and maintain temporary lighting throughout project.
- .5 Coordinate with all PCA Staff.
- .6 Supply and install temporary facilities for power to approval of local power supply authorities.
- .7 Provide and pay for temporary power and lights for use of Departmental Representative site office.

1.6 TEMPORARY COMMUNICATION FACILITIES

- .1 Provide and pay for temporary telephone, fax and data hook up, line(s) and equipment as necessary for own use and use of Departmental Representative.

1.7 FIRE PROTECTION

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.
- .2 Burning rubbish and construction waste materials is not permitted on site.

1.8 SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.9 ACCESS

- .1 Provide and maintain adequate access to project site.

- .2 All surface modifications are restricted to the identified construction corridors. Accurate delineation of these corridors by field survey prior to commencement of construction is required.
- .3 All vehicle traffic is restricted to existing roadways or as indicated in project plans. A field visit will be scheduled with the Contractor for locational confirmation and all areas of proposed construction will be marked in the field with orange flagging tape prior to commencement of work.

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 INSTALLATION AND REMOVAL

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, avenues of ingress/egress to fenced area and details of fence installation.
- .2 Identify areas which have to be graveled to prevent tracking of mud.
- .3 Indicate use of supplemental or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.

1.2 SITE STORAGE/LOADING

- .1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

1.3 CONSTRUCTION PARKING

- .1 No parking will be permitted on site
- .2 Provide and maintain adequate access to project site.

1.4 CONSTRUCTION SIGNS AND NOTICES

- .1 Contractor or sub-contractor advertisement signboards are not permitted on site.
- .2 Only notices of safety or instructions are permitted on site.
- .3 Safety and Instruction Signs and Notices:
 - .1 Signs and notices for safety and instruction shall be in both official languages. Graphic symbols shall conform to CAN/CSA-Z321-96 (R2001).
- .4 Maintenance and Disposal of Site Signs:
 - .1 Maintain approved signs and notices in good condition for duration of project and dispose of off-site on completion of project or earlier if directed by Departmental Representative.

1.5 PROTECTION AND MAINTENANCE OF TRAFFIC

- .1 Provide access and temporary relocated roads as necessary to maintain traffic, including foot traffic.
- .2 Protect travelling public from damage to person and property.
- .3 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .4 Dust control: adequate to ensure safe operation at all times.
- .5 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations.
- .6 Provide snow removal during period of Work.

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

Not applicable

END OF SECTION

PART 1 - GENERAL

1.1 INSTALLATION AND REMOVAL

- .1 Provide temporary controls in order to execute work expeditiously.
- .2 Remove from site all such work after use.

1.2 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around open excavations.
- .2 Provide as required by governing authorities.

1.3 ACCESS TO SITE

- .1 Provide and maintain access roads, crossings, ramps and construct runways as may be required for site access including snow clearing of work areas.

1.4 FIRE ROUTES

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

1.5 PROTECTION OF BUILDING FINISHES

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Confirm with Departmental Representative locations and installation schedule 3 days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

Not applicable

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .2 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .3 Cost for such testing will be borne by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 QUALITY

- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 AVAILABILITY

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or

other remedial action may be authorized in ample time to prevent delay in performance of Work.

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

1.4 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.5 MANUFACTURER'S INSTRUCTIONS

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

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

1.6 QUALITY OF WORK

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.7 CO-ORDINATION

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.8 REMEDIAL WORK

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.9 PROTECTION OF WORK IN PROGRESS

- .1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Departmental Representative.

1.10 EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location

of capped service.

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

Not applicable

END OF SECTION

PART 1 – GENERAL

1.1 EXISTING SERVICES

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.

1.2 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 Departmental Representative of impending installation and obtain approval for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.3 RECORDS

- .1 Maintain a complete, accurate log of work as it progresses.
- .2 On completion of work, prepare record drawings identifying all equipment and systems added or modified as part of this project.

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

Not applicable

END OF SECTION

PART 1 - GENERAL

1.1 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 at end of each working day.
- .3 Prevent accumulation of wastes which create hazardous conditions.
- .4 Provide adequate ventilation during use of volatile or noxious substances.

1.2 MATERIALS

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

1.3 CLEANING DURING CONSTRUCTION

- .1 Maintain project grounds, and public properties in a tidy condition, free from accumulation of waste materials and debris. Clean areas on a daily basis.
- .2 Provide onsite garbage containers for collection of waste materials and debris.
- .3 Remove waste materials and debris from the site or building each day.

1.4 FINAL CLEANING

- .1 In preparation for acceptance of the Work perform final cleaning.
- .2 Inspect finishes, fitments and equipment. Ensure specified workmanship and operation.
- .3 Broom clean exterior paved and concrete surfaces; rake clean other surfaces of grounds.

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

Not applicable

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 35 43 - Environmental Procedures.
- .2 Section 03 30 00 - Cast-in-Place Concrete.

1.2 DISPOSAL REQUIREMENTS

- .1 Burying or burning of rubbish and waste materials is prohibited.
- .2 Disposal of waste, volatile materials, mineral spirits, oil, paint, paint thinner or unused preservative material into waterways, storm, or sanitary sewers is prohibited.
- .3 Do not dispose of preservative treated wood through incineration.
- .4 Do not dispose of preservative treated wood with other materials destined for recycling or reuse.
- .5 Dispose of treated wood, end pieces, wood scraps and sawdust at a sanitary landfill.
- .6 Dispose of waste only at approved waste processing facility or landfill sites approved by authority having jurisdiction.
- .7 Contact the authority having jurisdiction prior to commencement of work, to determine what, if any, demolition and construction waste materials have been banned from disposal in landfills and at transfer stations. Take appropriate action to isolate such banned materials at site of work and dispose in strict accordance with provincial and municipal regulations.
- .8 Transport waste intended for landfill in separated condition, following rules and recommendations of Landfill Operator in support of their effort to divert, recycle and reduce amount of solid waste placed in landfill.
- .9 Collect, bundle and transport salvaged materials to be recycled in separated categories and condition as directed by recycling facility. Ship materials only to approved recycling facilities.
- .10 Sale of salvaged items by Contractor to other parties not permitted on site.

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

Not applicable

END OF SECTION

PART 1 - GENERAL

1.1 INSPECTION AND DECLARATION

- .1 Contractor's Inspection: Contractor and Subcontractors: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
 - .2 Request Departmental Representative Inspection.
- .2 Departmental Representative Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor to correct Work accordingly.
- .3 Completion: submit written certificate that following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
 - .4 Operation of systems have been demonstrated to Departmental Representative.
 - .5 Work is complete and ready for final inspection.
- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.

1.2 CLEANING

- .1 In accordance with Section 01 74 11 - Cleaning.
- .2 Remove waste and surplus materials, rubbish and construction facilities from the site in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

Not applicable

END OF SECTION

PART 1 - GENERAL

1.1 PROJECT RECORD DOCUMENTS

- .1 Departmental Representative will provide two (2) white print sets of contract drawings and two (2) copies of Specifications Manual specifically for “as-built” purposes.
- .2 Maintain at site one (1) set of the contract drawings and specifications to record actual as-built site conditions.
- .3 Maintain up-to-date, real time as-built drawings and specifications in good condition and make available for inspection by the Departmental Representative at any time during construction.
- .4 As-Built Drawings:
 - .1 Record changes in red ink on the prints. Mark only on one (1) set of prints and at completion of project and prior to final inspection, neatly transfer notations to second set (also by use of red ink). Submit both sets to Departmental Representative. All drawings of both sets shall be stamped “As-built Drawings” and be signed and dated by Contractor.
 - .2 Show all modifications, substitutions and deviations from what is shown on the contract drawings or in specifications.
 - .3 Record following information:
 - .1 Horizontal and vertical location of various elements in relation to Geodetic Datum.
 - .2 Field changes of dimension and detail.
 - .3 All design elevations, sections, and details dimensioned and marked-up to consistently report finished installation conditions.
 - .4 Any details produced in the course of the contract by the Departmental Representative to supplement or to change existing design drawings must also be marked-up and dimensioned to reflect final as-built conditions and appended to the as-built drawing document.
 - .5 All change orders issued over the course of the contract must be documented on the finished as-built documents, accurately and consistently depicting the changed condition as it applies to all affected drawing details.
- .5 As-built Specifications: legibly mark in red each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly items substituted from that specified.
 - .2 Changes made by Addenda and Change Orders.
 - .3 Mark up both copies of specifications; stamp “as-built”, sign and date similarly to drawings as per above clause.
- .6 Maintain As-built documents current as the contract progresses. Departmental

Representative will conduct reviews and inspections of the documents on a regular basis.
Frequency of reviews will be subject to Departmental Representative's discretion.

1.2 REVIEWED SHOP DRAWINGS

- .1 Compile two (2) full sets of all reviewed shop drawings.

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

Not applicable

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Comply with requirements of this Section when performing following Work:
 - .1 Removal or disturbance of one square metre or less of friable asbestos containing material during the repair, alteration, maintenance or demolition of all or part of machinery or equipment, or of a building.
 - .2 Enclosure of friable asbestos containing material as indicated .
 - .3 Removing non-friable asbestos containing materials by breaking, cutting, drilling, abrading, grounding, sanding or vibrating at locations indicated on drawings if:
 - .1 The material is not wetted to control the spread of dust or fibres, and
 - .2 The work is done only by means of non-powered hand-held tools.
 - .4 Removing non-friable asbestos containing materials by breaking, cutting, drilling, abrading, grounding, sanding or vibrating at locations indicated on drawings if the work is done by means of power tools that are attached to dust-collecting devices equipped with HEPA filters.
 - .5 Removing more than one square metre of drywall in which joint-filling compounds that are asbestos containing materials have been used.

1.2 REFERENCE STANDARDS

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.205-[94] , Sealer for Application of Asbestos Fibre Releasing Materials.
- .2 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .4 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .5 Underwriters' Laboratories of Canada (ULC)

1.3 DEFINITIONS

- .1 Amended Water: water with non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.
- .2 Asbestos Containing Materials (ACMs): materials that contain 0.5 per cent or more asbestos by dry weight and are identified under Existing Conditions including fallen materials and settled dust.
- .3 Asbestos Work Area: area where work takes place which will, or may disturb ACMs.

- .4 Authorized Visitors: Engineer[s] , or designated representative[s] , and representative[s] of regulatory agencies.
- .5 Competent worker [person] : in relation to specific work, means a worker who:
 - .1 Is qualified because of knowledge, training and experience to perform the work.
 - .2 Is familiar with the provincial laws and with the provisions of the regulations that apply to the work.
 - .3 Has knowledge of all potential or actual danger to health or safety in the work.
- .6 Friable Materials: material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.
- .7 Glove Bag: prefabricated glove bag as follows:
 - .1 Minimum thickness 0.25 mm (10 mil) polyvinyl-chloride bag.
 - .2 Integral 0.25 mm (10 mil) thick polyvinyl-chloride gloves and elastic ports.
 - .3 Equipped with reversible double pull double throw zipper on top and at approximately mid-section of the bag.
 - .4 Straps for sealing ends around pipe.
- .8 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any dimension at 99.97% efficiency.
- .9 Non-Friable Material: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.
- .10 Occupied Area: any area of building or work site that is outside Asbestos Work Area.
- .11 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide protection and isolation.
- .12 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for scope of work.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section [01 33 00- Submittal Procedures] .
- .2 Submit proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of asbestos containing waste in accordance with requirements of authority having jurisdiction.
- .3 Submit Provincial/Territorial and/or local requirements for Notice of Project Form.
- .4 Submit proof of Contractor's Asbestos Liability Insurance.
- .5 Submit to Departmental Representative necessary permits for transportation and disposal of asbestos containing waste and proof that asbestos containing waste has been received and properly disposed.
- .6 Submit proof satisfactory to Departmental Representative that all asbestos workers have received appropriate training and education by a competent person in the hazards of asbestos exposure, good personal hygiene, entry and exit from Asbestos Work Area,

aspects of work procedures and protective measures while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing.

- .7 Submit proof that supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by Departmental Representative. Minimum of one supervisor for every ten workers.
- .8 Submit Worker's Compensation Board status and transcription of insurance.
- .9 Submit documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including:
 - .1 Encapsulants;
 - .2 Amended water;
 - .3 Slow drying sealer.
- .10 Submit proof satisfactory to Departmental Representative that employees have respirator fitting and testing. Workers must be fit tested (irritant smoke test) with respirator that is personally issued.

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to asbestos, provided that in case of conflict among these requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at the time work is performed.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06- Health and Safety Requirements and Appendix A- P-0014718-0-00-200 Englobe Safe Work Practice (November 22, 2017) – Cutting Holes Through Drywall with Asbestos-Containing Joint Compound.
 - .2 Safety Requirements: worker and visitor protection.
 - .1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area include:
 - .1 Air purifying half-mask respirator with N-100, R-100 or P-100 particulate filter, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction. The respirator to be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet. The respirator to be cleaned, disinfected and inspected after use on each shift, or more often if necessary, when issued for the exclusive use of one worker, or after each use when used by more than one worker. The respirator to have damaged or deteriorated parts replaced prior to being used by a worker; and, when not in use, to be stored in a convenient, clean and sanitary location. The employer to establish written procedures regarding the selection, use and care of respirators, and a copy of the procedures to be provided to and

- reviewed with each worker who is required to wear a respirator. A worker not to be assigned to an operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator.
- .2 Disposable type protective clothing that does not readily retain or permit penetration of asbestos fibres. Protective clothing to be provided by the employer and worn by every worker who enters the work area, and the protective clothing to consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing. It includes suitable footwear, and it to be repaired or replaced if torn.
- .3 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.
- .4 Before leaving Asbestos Work Area, the worker can decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing, or, if the protective clothing will not be reused, place it in a container for dust and waste. The container to be dust tight, suitable for asbestos waste, impervious to asbestos, identified as asbestos waste, cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before removal from the work area, and removed from the work area frequently and at regular intervals.
- .5 Ensure workers wash hands and face when leaving Asbestos Work Area.
- .6 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.
- .7 Visitor Protection:
- .1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.
- .2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.
- .3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 74 19- Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal corrugated cardboard, paper, plastic, polystyrene packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Separate for recycling and place in designated containers metal, steel, plastic waste in accordance with Waste Management Plan.
- .5 Place materials defined as hazardous or toxic in designated containers.

- .6 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .7 Fold up metal banding, flatten and place in designated area for recycling.
- .8 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial/Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 mils bags or leak proof drums. Label containers with appropriate warning labels.
- .9 Provide manifests describing and listing waste created. Transport containers by approved means to licenced landfill for burial.

1.7 EXISTING CONDITIONS

- .1 Reports and information pertaining to ACMS to be handled, removed, or otherwise disturbed and disposed of during this Project are referenced in P-0014718-0-00-200 Englobe Safe Work Practice (November 22, 2017) – Cutting Holes Through Drywall with Asbestos-Containing Joint Compound.
- .2 Notify owner or Consultant of friable material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by the owner or Consultant.

1.8 PERSONNEL TRAINING

- .1 Before beginning Work, provide Consultant or owner satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene and work practices, in use of glove bag procedures, and in use, cleaning, and disposal of respirators and protective clothing.
- .2 Instruction and training related to respirators includes, at minimum:
 - .1 Fitting of equipment.
 - .2 Inspection and maintenance of equipment.
 - .3 Disinfecting of equipment.
 - .4 Limitations of equipment.
- .3 Instruction and training must be provided by competent, qualified person.

Part 2 Products

2.1 MATERIALS

- .1 Drop and Enclosure Sheets:
 - .1 Polyethylene: 0.15 mm thick.
 - .2 FR polyethylene: 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.
- .2 Wetting Agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with water in concentration to provide thorough wetting of asbestos containing material.
- .3 Waste Containers: contain waste in two separate containers.

- .1 Inner container: 0.15 mm thick sealable polyethylene bag [or where glove bag method is used, glove bag itself] .
- .2 Outer container: sealable metal or fibre type where there are sharp objects included in waste material; otherwise outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.
- .3 Labelling requirements: affix preprinted cautionary asbestos warning, in both official languages, that is visible when ready for removal to disposal site.
- .4 Glove bag:
 - .1 Acceptable materials: safe-T-Strip products in configuration suitable for Work, or Alternative material approved by addendum during tendering period in accordance with Instructions to Tenderers.
 - .2 The glove bag to be equipped with:
 - .1 Sleeves and gloves that are permanently sealed to the body of the bag to allow the worker to access and deal with the insulation and maintain a sealed enclosure throughout the work period.
 - .2 Valves or openings to allow insertion of a vacuum hose and the nozzle of a water sprayer while maintaining the seal to the pipe, duct or similar structure.
 - .3 A tool pouch with a drain.
 - .4 A seamless bottom and a means of sealing off the lower portion of the bag.
 - .5 A high strength double throw zipper and removable straps, if the bag is to be moved during the removal operation.
- .5 Tape: tape suitable for sealing polyethylene to surfaces under both dry and wet conditions using amended water.
- .6 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.
 - .1 Sealer: flame spread and smoke developed rating less than 50 [and be compatible with new fireproofing] .
- .7 Encapsulant: [penetrating] [surface film forming] type [conforming to CAN/CGSB-1.205] [ULC listed] having following characteristics

Part 3 Execution

3.1 SUPERVISION

- .1 Minimum of one Supervisor for every ten workers is required.
- .2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of asbestos-containing materials.

3.2 PROCEDURES

- .1 Do construction occupational health and safety in accordance with Section [01 35 29.06-Health and Safety Requirements] .
- .2 Before beginning Work, at each access to Asbestos Work Area, install warning signs in both official languages in upper case 'Helvetica Medium' letters reading as follows, where number in parentheses indicates font size to be used: 'CAUTION ASBESTOS HAZARD AREA (25 mm) / NO UNAUTHORIZED ENTRY (19 mm) / WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) / BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)'.
- .3 Before beginning Work remove visible dust from surfaces in work area where dust is likely to be disturbed during course of work.
 - .1 Use HEPA vacuum or damp cloths where damp cleaning does not create hazard and is otherwise appropriate.
 - .2 Do not use compressed air to clean up or remove dust from any surface.
- .4 Prevent spread of dust from Asbestos Work Area using measures appropriate to work to be done.
 - .1 Use FR polyethylene drop sheets over flooring such as carpeting that absorbs dust and over flooring in work areas where dust or contamination cannot otherwise be safely contained.
 - .2 When [and when] [removing asbestos containing material from piping or equipment and "glove bag" method is not used] [removing suspended ceilings and walls themselves do not enclose work area] erect enclosure of polyethylene sheeting around work area, shut off mechanical ventilation system serving work area and seal ventilation ducts to and from work area.
- .5 Before removing suspended ceilings, remove friable material on upper surfaces using HEPA vacuum equipment.
 - .1 Remove and clean surfaces of ceiling panels using HEPA vacuum, wrap clean panels in 0.10 mm thick polyethylene, and store in building as directed by [Consultant] [Departmental Representative] [DCC Representative] .
 - .2 Clean "T" grid suspension system, disconnect, wrap in 0.10 mm thick polyethylene, and store in building as directed by Engineer.
- .6 Remove loose material by HEPA vacuum; thoroughly wet friable material containing asbestos to be removed or disturbed before and during Work unless wetting creates hazard or causes damage.
 - .1 Use garden reservoir type low - velocity sprayer or airless spray equipment capable of producing mist or fine spray.
 - .2 Perform Work in a manner to reduce dust creation to lowest levels practicable.
- .7 Pipe Insulation Removal Using Glove Bag:
 - .1 A glove bag not to be used to remove insulation from a pipe, duct or similar structure if:
 - .1 It may not be possible to maintain a proper seal for any reason including, without limitation:

- .1 The condition of the insulation.
 - .2 The temperature of the pipe, duct or similar structure.
 - .2 The bag could become damaged for any reason including, without limitation.
 - .1 The type of jacketing.
 - .2 The temperature of the pipe, duct or similar structure.
- .2 Upon installation of the glove bag, inspect bag for any damage or defects. If any damage or defects are found, the glove bag is to be repaired or replaced. The glove bag to be inspected at regular intervals for damage and defects, and repair or replaced, as appropriately. The asbestos containing contents of the damaged or defective glove bag found during removal are to be wetted and the glove bag and its contents are to be removed and disposed of in an appropriate waste disposal container. Any damaged or defective glove bags are not be reused.
- .3 Place tools necessary to remove insulation in tool pouch. Wrap bag around pipe and close zippers. Seal bag to pipe with cloth straps.
- .4 Place hands in gloves and use necessary tools to remove insulation. Arrange insulation in bag to obtain full capacity of bag.
- .5 Insert nozzle of garden reservoir type sprayer into bag through valve and wash down pipe and interior of bag thoroughly. Wet surface of insulation in lower section of bag.
- .6 To remove bag after completion of stripping, wash top section and tools thoroughly. Remove air from top section through elasticized valve using a HEPA vacuum. Pull polyethylene waste container over glove bag before removing from pipe. Release one strap and remove freshly washed tools. Place tools in water. Remove second strap and zipper. Fold over into waste container and seal.
- .7 After removal of bag ensure that pipe is free of residue. Remove residue using HEPA vacuum or wet cloths. Ensure that surfaces are free of sludge which after drying could release asbestos dust into atmosphere. Seal exposed surfaces of pipe and ends of insulation with slow drying sealer to seal in any residual fibres.
- .8 Upon completion of Work shift, cover exposed ends of remaining pipe insulation with polyethylene taped in place.
- .8 Work is subject to visual inspection and air monitoring. Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.
- .9 Cleanup:
 - .1 Frequently during Work and immediately after completion of work, clean up dust and asbestos containing waste using HEPA vacuum or by damp mopping.
 - .2 Place dust and asbestos containing waste in sealed dust tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste and wet and fold to contain dust and then place in waste bags.
 - .3 Immediately before their removal from Asbestos Work Area and disposal, clean each filled waste bag using damp cloths or HEPA vacuum and place in second clean waste bag.

- .4 Seal and remove double bagged waste from site. Dispose of in accordance with requirements of Provincial/Territorial and Federal authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of material to be dumped and that guidelines and regulations for asbestos disposal are followed.
- .5 Perform final thorough clean-up of Asbestos Work Areas and adjacent areas affected by Work using HEPA vacuum.

END OF SECTION

The Executed Agreement including General Conditions and Supplementary Conditions, Division 01, applicable drawings and amendments are part of and are to be read in conjunction with this Section.

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Cleaning of concrete floor, walls and ceiling.
- .2 Removal of protruding metal and rough areas from concrete floor.

1.2 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Product descriptions, application procedures, and precautions in use or application of products.

1.3 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submission procedures.

1.4 QUALITY ASSURANCE

- 1.5 Installer Qualifications: Company specializing in performing the work of this section shall have documented experience. The contractor shall have successfully completed projects of similar scope and complexity. When requested, provide a list of the last three comparable jobs including job name and location, specifying authority and project manager.

1.6 MOCK-UP

- .1 Section 01 43 00: Requirements for mock-up.
- .2 Provide mock-up of:
 - .1 Concrete cleaning: 100 sq ft.
 - .1 Determine effectiveness of methods.
 - .2 Ensure that procedures will not discolor or damage existing surfaces.
- .3 Locate where directed by Consultant.
- .4 Approved mock-up may remain as part of the Work.

1.7 DELIVERY, STORAGE, AND PROTECTION

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Protect materials from moisture absorption and damage; reject damaged containers.
- .3 Store sand to prevent inclusion of foreign matter.

1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Section 01 35 26: Environmental conditions affecting products on site.
- .2 Do not apply repair materials during inclement or freezing weather, or if such conditions are anticipated within material curing period.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Concrete Cleaners: mild detergent.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Clean surfaces to be repaired; remove loose and foreign matter on concrete floor, walls, columns and ceiling.

3.2 REPAIR OF SURFACE

- .1 Grind down any protrusion more than ¼" from adjacent concrete floor surface.

3.3 CLEANING

- .1 Close off areas in which work is being performed to pedestrian and vehicular traffic.
- .2 Protect adjacent and underlying surfaces from damage. Prevent overspray of water and detergent on to adjacent heritage stone.
- .3 Install temporary dams and containment devices to collect runoff water.
- .4 Clean existing concrete surfaces to remove dirt, hydrocarbons, grease, oil, environmental pollutants, and residues.
- .5 Sandblasting and use of non-proprietary acids is prohibited.
- .6 Follow manufacturer's instructions and procedures established during preparation of mock-up.
- .7 Do not damage existing surfaces. Leave surfaces uniform in appearance.
- .8 Wet surfaces with clean water.
- .9 Apply cleaning solution by low pressure spray, brush or roller to uniform coverage.
- .10 Allow solution to stand on surfaces as noted in manufacturer instructions.
- .11 Rinse surfaces with low pressure water. Hold nozzle perpendicular to surface; work at uniform rate and uniform distance from surface.

.12 Repeat process if required until concrete is clean.

END OF SECTION

The Executed Agreement including General Conditions and Supplementary Conditions, Division 01, applicable drawings and amendments are part of and are to be read in conjunction with this Section.

PART 1 - GENERAL

1.1 SUMMARY OF SECTION

- .1 As summarized and described but not restricted to the following:
 - .1 Provide Finish Carpentry Items as noted in the schedule.

1.2 REFERENCES

- .1 The standards listed form part of this Specification to the extent of reference. The publications are in the text by the basic designation only.
- .2 American Society for Testing and Materials International (ASTM):
 - .1 ASTM D1761-12, Standard Test Methods for Mechanical Fasteners in Wood.
 - .2 ASTM F1667-17, Driven Fasteners: Nails, Spikes, and Staples
- .3 Canadian Standards Association (CSA):
 - .1 CSA O141-05 (R2014), Softwood Lumber
 - .2 CSA O151-17, Canadian Softwood Plywood

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, including installation instructions, MSDS sheets, specifications and data sheets in accordance with Division 01, Submittal Procedures.
- .2 Samples:
 - .1 Provide samples, if requested, in accordance with Division 01, Submittal Procedures.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Division 01, Submittal Procedures.
 - .2 Indicate details of construction, profiles, jointing, fastening and other related details.
 - .3 Indicate all materials, thicknesses, finishes and hardware as indicated.

1.4 ENVIRONMENTAL REQUIREMENTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of materials.

1.5 WASTE MANAGEMENT

- .1 Separate and recycle waste materials in accordance with Division 01 and local municipality requirements.
- .2 Set aside damaged wood and dimensional lumber off-cuts for acceptable alternative uses (e.g. bracing, blocking, cripples, bridging, finger-joining, or ties). Store this separated reusable wood waste convenient to cutting station and area of work.

1.6 DELIVERY, STORAGE AND PROTECTION OF PRODUCT

- .1 Deliver and store materials in compliance with Division 01, Common Product Requirements.
- .2 Comply with manufacturer's recommendations for handling, storage and protection during installation.
- .3 All finish carpentry items should be shop wrapped and protected, and store indoors.
- .4 Label packages to include material name, production date and/or product code.

1.7 QUALITY ASSURANCE

- .1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood identification: by grade mark in accordance with applicable CSA standards.

1.8 QUALITY CONTROL

- .1 Furnish, at the request of the Consultant, a list of three (3) completed projects of equal or more value than this project completed in the last five years.
- .2 Contractor is responsible for all field dimensions on site that will affect the work.

PART 2 - PRODUCTS

2.1 LUMBER MATERIAL

- .1 Softwood Lumber:
 - .1 Softwood, SPF Species, NLGA (124c) No.2 Structural and better.
 - .2 D4S (dressed four sides).
 - .3 Moisture content 19% or less, in accordance with CSA-O141.
 - .4 NLGA Standard Grading Rules for Canadian Lumber, latest edition.
- .2 Furring, blocking, nailing strips, rough bucks, cants, curbs, fascia backing and sleepers:
 - .1 Softwood, SPF Species, NLGA (122c) Standard Light Framing and better.

- .3 Use pressure treated lumber for when wood is in contact with concrete.

2.2 SOFTWOOD PANEL MATERIALS

- .1 Canadian Softwood Plywood to CSA O151, Standard Construction.

2.3 ACCESSORIES

- .1 Wood screws: to ASTM D1761. Check type and size to suit application.
- .2 Nails and Staples: to ASTM F1667, plain finish.
- .3 Splines: wood, plastic, metal as indicated.
- .4 Adhesive: recommended by manufacturer, be low VOC and contain no urea-formaldehyde.
- .5 Hardware Cloth:
 - .1 ½" spacing
 - .2 19 gauge steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Inspect finish carpentry items for any damage.

3.2 INSTALLATION - GENERAL

- .1 Scribe and cut as required, fit to abutting walls, and surfaces, fit properly into recesses and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects.
- .2 Form joints to conceal shrinkage.
- .3 Fastening:
 - .1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.
 - .2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.
 - .3 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round cleanly cut hole and plug with wood plug to match material being secured.
 - .4 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises

3.3 SCHEDULE

- .1 Plywood Counter:
 - .1 Softwood lumber frame.
 - .2 Softwood lumber blocking.
 - .3 Plywood surround and counter.
 - .4 Paint.
- .2 Screen:
 - .1 Softwood lumber frame.
 - .2 Hardware cloth.
 - .3 Paint frame and screen.

3.4 PROTECTION AFTER WORK COMPLETED

- .1 Do not permit adjacent work to damage hardware or hardware finish.

3.5 CLEANING

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

END OF SECTION

The Executed Agreement including General Conditions and Supplementary Conditions, Division 01, applicable drawings and amendments are part of and are to be read in conjunction with this Section.

PART 1 - GENERAL

1.1 SUMMARY OF SECTION

- .1 As summarized and described, but not restricted to:
 - .1 Provide mineral thermal sheathing at mechanical mezzanine to fill where gaps in existing insulation exists.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM):
 - .1 ASTM C165-07(2017), Standard Test Method for Measuring Compressive Properties of Thermal Insulations
 - .2 ASTM C1104/C1104M-13a, Test Method for Determining the Water Vapour Sorption of Unfaced Mineral Fiber Insulation.
 - .3 ASTM E96/E96M-16, Test Methods for Water Transmission of Materials.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS)
- .3 Canadian Standards Association (CSA):
 - .1 CSA B149.1-15, Natural Gas and Propane Installation Code.
 - .2 CSA B149.2-15, Propane Storage and Handling Code.
- .4 Canadian Standards & Underwriters Laboratories of Canada (ULC):
 - .1 ULC 114, Standard Method of Test for Determination of Non-Combustibility in Building Materials (2005)

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature including installation instructions, MSDS sheets, specifications and data sheets in accordance with Division 01, Submittal Procedures.

1.4 ENVIRONMENTAL REQUIREMENTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of insulation materials.

1.5 WASTE MANAGEMENT

- .1 Contractor to verify that packaging for insulation is collected and sorted for recycling.

- .2 Contractor to take care with the installation of the semi-rigid insulation, use full pieces where possible, any cut areas that cannot be re-used to be kept clean and saved for recycling.
- .3 Separate and recycle waste materials in accordance with Division 01 and local municipality requirements.

1.6 DELIVERY, STORAGE AND PROTECTION OF PRODUCT

- .1 Deliver and store materials in compliance with Division 01. Comply with insulation manufacturer's recommendations for handling, storage and protection during installation.
- .2 Protect insulation from physical damage and from becoming wet, soiled or covered with ice or snow before, during and after installation.
- .3 Store insulation board in original wrapping from the manufacturer at a location where humidity and temperature duplicates those during installation and occupancy in order to stabilize the sheathing. Store in covered area, protected from the weather at all times.
- .4 Label insulation packages to include material name, production date and/or product code.

PART 2 - PRODUCTS

2.1 MATERIALS - GENERAL

- .1 Insulation value thickness based on values listed in the latest edition of NRC-Evaluation listings. Refer to drawings for thickness of material or R-Value or RSI-Value required.

2.2 MINERAL THERMAL SHEATHING

- .1 Mineral Thermal Sheathing:
 - .1 Board Density: to ASTM C165-00, 176 kg/m³ (11 lbs/ft³)
 - .2 Non-Combustible: to CAN4 S114
 - .3 Thermal Resistance: R-Value: 4.2 per inch. RSI-Value: 0.72m² k/w
 - .4 Moisture Resistance: to ASTM C1104, Moisture Absorption: 0.28% volume
 - .5 Water Vapour Permeance: to ASTM E96 (35 perm)
 - .6 Standard of Acceptance: Roxul Inc Comfort Board 110 Thermal Insulating Sheathing or acceptable alternate.
 - .7 Allow for two layers of 1" bond.
 - .8 Quantity Allowance: allow for 200 sq. ft. of patching.

2.3 ACCESSORIES

- .1 Rigid Spindles and Clips:
 - .1 Insulation spindles and clips for semi-rigid board: impale type, perforated 50 mm (2") diameter, cold rolled carbon steel 0.8 mm (0.03") thick,

- spindle of 2.5 mm (0.1") diameter annealed steel, length to suit insulation, self-locking type. Number and spacing clips per manufacturer's recommendation.
- .2 Provide spindle clips adhered to existing wall. Installation as detailed by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine substrates and do not proceed with installation until defects have been corrected. Examine the areas and conditions under which work of this section will be installed. Verify that adjacent materials are dry and ready to receive insulation. Verify mechanical and electrical services within walls have been tested and inspected.
- .2 Provide written report listing conditions detrimental to performance of work in this section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INTERFACE WITH OTHER SYSTEMS

- .1 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.
- .2 Keep insulation minimum 50 mm (2") from sidewalls of ULC 604 and CAN/CSA-B149.1 and CAN/CSA-B149.2 type B and L vents.

3.3 INSTALLATION

- .1 General Notes:
- .1 Install insulation to maintain continuity of thermal protection to building elements and spaces.
 - .2 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use full size board to reduce number of joints.
 - .3 Offset both vertical and horizontal joints in multiple layer applications.
 - .4 Do not enclose insulation until it has been inspected and approved by Consultant.
 - .5 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, and data sheets for insulation products.
- .2 Thermal Sheathing Installation:
- .1 Building substrate to be dry before installing insulation.
 - .2 Install spindle/fastener anchor clips for board by fastening to existing wall as indicated.

3.4 CLEANING

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

END OF SECTION

The Executed Agreement including General Conditions and Supplementary Conditions, Division 01, applicable drawings and amendments are part of and are to be read in conjunction with this Section.

PART 1 - GENERAL

1.1 SUMMARY OF SECTION

- .1 As summarized and described, but not restricted to:
 - .1 Provide firestopping for all rated separations including terminations and penetrations for architectural, structural, mechanical and electrical work.
 - .2 Existing fire separations to be maintained at tie in areas of new and existing building areas.
 - .1 Allow for existing walls with unprotected openings discovered during demolition to be reinstated to maintain rated and unrated separations as required by code and indicated on drawings.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM D2369-10(2015)e1, Standard Test Method for Volatile Content of Coatings.
 - .2 ASTM E2174-14b, Standard Practice for On-Site Inspection of Installed Fire Stops.
 - .3 ASTM E2393-10a(2015), Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
- .2 International Fire stop Council (IFC):
 - .1 Recommended IFC Guidelines for Evaluating Fire stop Systems in Engineering Judgments (EJ's) Perimeter Fire Barrier Systems, latest edition.
- .3 National Building Code of Canada (NBC) 2015.
- .4 South Coast Air Quality Management District (SCAQMD) Rule #1168 VOC Content of Sealants.
- .5 Underwriters' Laboratories of Canada (ULC):
 - .1 ULC 115, Standard Method of Fire Tests of Fire stop Systems (2011).

1.3 SUBMITTALS

- .1 Submit samples in accordance with Division 01, Submittal Procedures.
- .2 Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- .3 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation. Construction details should accurately reflect actual job conditions.

- .4 Shop Drawings: Submit System Design listings, indicating ULC design number and including illustrations, applicable to each firestop configuration. Provide schedule indicating material to be used, building elements to be protected, hourly rating and appropriate references.
- .5 Submit material safety data sheets (MSDS), provided with products delivered to job site.

1.4 ENVIRONMENTAL REQUIREMENTS

- .1 Comply with manufacturer's recommended requirements for temperature, relative humidity and substrate moisture content during application and curing of materials.
- .2 Do not proceed with installation of firestopping materials when temperatures or weather conditions exceed manufacturer's recommendations.
- .3 Ventilate solvent based and moisture-cure firestopping per manufacturer's instructions by natural means or, where inadequate, by forced air circulation.
- .4 VOC Limitations: for all materials supplied by this Section, the total VOC content must be less than or equal to 250 g/L, less water, when tested to ASTM D2369 for all interior sealants applied within the weatherproofing barrier of the exterior wall.

1.5 WASTE MANAGEMENT

- .1 Separate and recycle waste materials in accordance with Division 01, Construction Waste Management and Disposal.

1.6 DESIGN CRITERIA

- .1 Definitions:
 - .1 Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, water and hot gases through penetrations and joints between fire rated wall, floor and roof assemblies.
 - .2 System Design: An assembly of products designed to maintain the integrity of fire-rated construction when tested in accordance with ULC 115, designed by a voting IFC member, certified by an independent ULC licensed testing agency, and ULC Listed.

1.7 PERFORMANCE CRITERIA

- .1 Penetrations: Provide and install firestopping systems produced to resist the spread of fire, and the passage of smoke and other gases according to requirements indicated, including but not limited to the following:
 - .1 Firestop penetrations passing through fire resistance rated wall and floor assemblies and other locations as indicated on the drawings.
 - .2 Provide and install complete penetration firestopping systems that have been tested and approved by third party testing agency.

- .2 Perimeter Fire Containment Systems: As indicated on drawings, provide interior perimeter joint systems with fire-resistance ratings indicated, but not less than the fire-resistance rating of the floor construction.
- .3 Fire-Resistive Joints: Provide joint systems with fire-resistance ratings indicated, but not less than the fire-resistance rating of the construction in which the joint occurs.
- .4 For firestopping exposed to view, traffic, moisture, and physical damage, provide appropriate firestop systems for these conditions.

1.8 DELIVERY, HANDLING AND PROTECTION OF PRODUCT

- .1 Deliver firestopping products in original, unopened containers with labels intact and legible, identifying product and manufacturer.
- .2 Store and handle firestopping materials to manufacturer's instructions.

1.9 QUALITY ASSURANCE

- .1 Engage an experienced Installer who is certified, licensed, or otherwise qualified by the fire stopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements.
 - .1 Installer to be member of FCIA (Firestop Contractors International Association).
 - .2 Installer Qualifications: Company specializing in performing the work shall have successfully completed projects of similar scope and complexity. When requested, provide a list of the last three comparable jobs including job name and location, specifying authority and project manager and certified by the firestop manufacturer.
- .2 Manufacturer to certify firestop materials and methods shall conform to applicable governing codes having local jurisdiction, and certification to be forwarded to the consultant.
- .3 For those firestop applications that exist for which no ULC or ULc tested system is available through a manufacturer, Contractor is to provide a manufacturer's engineering judgment derived from similar ULC or ULc system designs or other tests submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council.
- .4 Firestop installation must meet requirements of ASTM E2174 and ASTM E2393 tested assemblies.

1.10 QUALITY CONTROL

- .1 A manufacturer's direct representative to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

- .2 Conduct conference at Project site. Review methods and procedures related to firestopping including, but not limited to, the following:
 - .1 Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - .2 Review methods and procedures related to firestopping installation.
- .3 Notify Consultant when completed installations are ready for inspection prior to concealing or enclosing area containing fire stopping materials. Allow forty-eight (48) hours for site review.
- .4 Manufacturer's Representative to conduct three site reviews beyond the initial start-up conference. Two during construction and one at substantial performance.
- .5 All written reports to be submitted to Consultant, and these reports will become part of the closeout submittals.

1.11 SEQUENCING AND PHASING

- .1 Do not cover up firestopping installations until receipt of written notice from the Consultant.

1.12 TEST REPORTS

- .1 Inspection: The Owner may retain an independent inspection agency to examine penetration and joint firestopping in accordance with ASTM E2174 and ASTM E2393.
- .2 Testing will be paid by Owner, except where testing reveals non-compliant installation, for which replacement is to be paid by Installer.

1.13 EXTENDED WARRANTY

- .1 Provide manufacturer's standard warranty covering materials and applications warranty covering workmanship, both two (2) years beyond substantial performance.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Firestopping and smoke seal: in accordance with ULC 115.
 - .1 Asbestos -free materials and systems capable of maintaining an effective barrier against flame, smoke, gases and hose steam in compliance with requirements of ULC 115 or cUL and not to exceed opening sizes for which they are intended.
 - .2 See drawings for other locations and fire resistance ratings.
 - .3 Colours: Firestopping (red), Smoke seal (gray).
- .2 Fire-resistance rating of installed fire stopping assembly in accordance with NBC 2015.

- .3 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .4 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .5 Smoke seals are required only at non-rated separations as noted on drawings.
- .6 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .7 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .8 Acceptable Manufacturers:
 - .1 Hilti Systems
 - .2 A/D Fire Protection Systems
 - .3 3M Firestop Solutions
 - .4 Tremco Fire Protection Systems
 - .5 STI Specified Technologies

2.2 ACCESSORIES

- .1 Primer: Type recommended by firestopping manufacturer for specific substrate surfaces.
- .2 Installation Accessories: Clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place, as required by System Design.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verify openings are ready to receive the work of this section.
- .2 Examine substrates and conditions for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping.
- .3 Verify that blocking, anchoring devices, back-up materials, clips, sleeves, supports and other related materials is in place where required by System Design.
- .4 Do not apply firestopping to painted surfaces or surfaces treated with sealers, curing compounds, water repellent or other coatings unless compatibility of materials has been verified.

- .5 Notify the General Contractor of unsatisfactory conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.
- .6 Commencement of Work will be considered acceptance of substrate conditions.

3.2 PREPARATION OF SUBSTRATE

- .1 Prime substrates where recommended by firestopping manufacturer using manufacturer's recommended products and methods. Limit priming to area of bond.
- .2 Use masking tape to prevent firestopping from contacting adjoining surfaces scheduled to remain exposed. Remove tape on completion of installation, without disturbing the firestopping seal with substrates.
- .3 Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material.
- .4 Remove incompatible materials which may affect bond.
- .5 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Substrates and surfaces are to be clean, dry and frost free. A minimum distance of 25 mm (1") is to be maintained around the perimeter of the service line duct etc. to be fire stopped.
- .6 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .7 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.
- .8 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 INSTALLATION

- .1 General Installation:
 - .1 Install permanent warning labels, provided by firestopping manufacturer, adjacent to openings that may be re-penetrated or disturbed. Include following information:
 - .2 Warning that opening has being firestop protected.
 - .3 System Design number.
 - .4 Fire stop products used.
 - .5 Contact person and phone number in case of modification or new penetration of firestop system.
 - .6 Notify Consultant when ready for inspection and prior to concealing or enclosing firestopping materials and service penetration assemblies.
 - .7 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.
- .2 Installation - Penetration Firestops:

- .1 Verify that all building penetrations in rated and non-rated system have been firestopped.
 - .2 Schedule work so partitions and other construction that conceals penetrations are not erected prior to firestop ping.
 - .3 Install forming/damming materials and other accessories in accordance with manufacturers written instructions.
 - .4 Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
 - .5 Provide mock-up of typical cable tray/wiring bundle and ductwork that passes through fire resistance rated separations. Consultant to review and approve mock-up as typical standard of acceptance for wiring and or ductwork that passes through rated wall assemblies.
 - .6 Install materials to contact and adhere to substrates formed by openings and penetrating items.
 - .7 Finish to produce smooth, uniform surfaces for fill materials to remain exposed.
 - .8 Seal holes or voids made by through penetrations, poke-through termination devices, and un-penetrated openings or joints so that continuity and integrity of fire separation is maintained.
 - .9 Firestop caulking is not to be painted. Painting over firestop caulking may void rating / warranty.
- .3 Installation - Mechanical/Electrical Components:
- .1 Firestop all piping, conduit, cable trays, cables and wires, vent pipes and duct work through rated and non-rated penetrations.
 - .2 Coordinate fully with mechanical and electrical trades to seal all vertical/horizontal penetrations of ductwork piping, conduit, wires, etc.
- .4 Installation - Firestop Joint Systems:
- .1 Install joint fillers to provide support of firestop materials during application.
 - .2 Install in full contact with joint substrates.
 - .3 Completely fill recesses provided for joint configuration.
 - .4 Provide uniform, cross-sectional shapes and depths relative to joint width that optimize movement capability.
 - .5 Tool immediately after application and prior to skinning. Form smooth, uniform beads of configuration required to produce fire-resistance rating, eliminate air pockets and verify contact and adhesion with sides of joint.
 - .6 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
 - .7 Tool or trowel exposed surfaces to a neat finish.
 - .8 Remove excess compound promptly as work progresses and upon completion.
 - .9 Apply firestopping material in sufficient thickness to achieve rating.

3.4 PROTECTION DURING WORK

- .1 Where deficiencies are found, repair or replace the firestopping, at no cost to Owner, to comply with requirements of the System Design.

3.5 PROTECTION AFTER WORK COMPLETED

- .1 Protect firestopping during and after curing period from contact with contaminating substances. If damage caused by others, make appropriate repairs at no cost to Owner.
- .2 Protect adjacent surfaces from damage by material installation.

3.6 EXAMINATION

- .1 Prior to covering in, arrange a review by the Manufacturer's Representative and the Consultant of the completed firestop installation to ensure conformance with manufacturer's details and recommendations.

3.7 ADJUSTMENT

- .1 Arrange for inspections by Owner's independent inspection agency, if required.
- .2 Where no deficiencies are found, provide repair of inspected installations, paid by Owner, as required to comply with requirements of the System Design.
- .3 Where deficiencies are found, repair or replace the firestopping, at no cost to Owner, to comply with requirements of the System Design.

3.8 SCHEDULE

- .1 Firestop and smoke seal at:
 - .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions, ceilings and floors.
 - .2 Top of fire-resistance rated masonry and gypsum board partitions.
 - .3 Intersection of fire-resistance rated masonry and gypsum board partitions.
 - .4 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
 - .5 Penetrations through fire-resistance rated floor slabs.
 - .6 Openings and sleeves installed for future use through fire separations.
 - .7 Mechanical and electrical penetrations.

3.9 CLEANING

- .1 Remove excess materials and debris and clean adjacent surfaces immediately after application.
- .2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY OF SECTION

- .1 As summarized but not restricted to:
 - .1 Provide steel doors and frames as indicated on the door and frame schedule and in specifications.

1.2 REFERENCES

- .1 The standards listed form part of this Specification to the extent of reference. The publications are in the text by the basic designation only.
- .2 American Society for Testing and Materials International (ASTM):
 - .1 ASTM A653/A653M-15e1 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - .2 ASTM C578-16, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
 - .3 ASTM C591-16, Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
 - .4 ASTM C1289-16a, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
- .3 Canadian Steel Door Manufacturers Association (CSDMA):
 - .1 CSDMA, Specifications for Commercial Steel Doors and Frames, latest edition.

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, including installation instructions, MSDS sheets, specifications and data sheets in accordance with Division 01, Submittal Procedures.
- .2 Shop Drawings:
 - .1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of fasteners, openings, glazed, louvered.
 - .2 Indicate each type frame material, thickness, reinforcements, glazing stops, location of anchors and fastenings, reinforcing.
 - .3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

1.4 WASTE MANAGEMENT

- .1 Separate and recycle waste materials in accordance with Division 01, Construction Waste Management and Disposal

1.5 DELIVERY, STORAGE AND PROTECTION OF PRODUCT

- .1 Deliver and store materials in compliance with Division 01, Common Product Requirements.
- .2 Store all materials in an interior dry space. All products shall be stored where they will not be exposed to, or come in contact with the elements.
- .3 Do not use non-vented plastic or canvas, which can create blistering and corrosion.
- .4 Store doors and frames in an upright position with heads uppermost.
- .5 Place no more than five doors or welded frames in a group.
- .6 Place all material on planking or blocking at least 100 mm (4") off floor area.
- .7 Provide at least 6.4 mm (1/4") space between all units to permit air circulation.

1.6 EXTENDED WARRANTY

- .1 Provide ten (10) year warranty on steel doors and frames with galvanized finish against perforation from corrosion and rust.

PART 2 - PRODUCTS

2.1 FLUSH TYPE, STEEL DOORS - FABRICATION GENERAL REQUIREMENTS

- .1 Fabricate steel doors as detailed, in accordance with Canadian Steel Door and Frame Manufacturers' Association, "Canadian Manufacturing Specification for Steel Doors and Frames" latest edition.
- .2 Commercial grade steel to ASTM A653 Type B Coating Designation ZF75 (A25) minimum. Minimum thickness (unless noted otherwise) in accordance with Appendix 1 of the CSDMA.
- .3 Mortise, reinforce, drill and tap doors to receive hardware using templates provided by finish hardware supplier.
- .4 All 1/2" diameter holes and larger to be factory prepared, with the exception of mounting holes (site work by installer). Holes less than 1/2" diameter will be factory prepared when they are required for the function of the device such as knob, lever, cylinder or turn holes.
- .5 Reinforcement gauges to meet or exceed CSDFMA specification.
 - .1 Close head and jambs of doors, weld seams typical.
 - .2 Conceal welds where possible.
 - .3 Grind tool marks and surface imperfections and make make surfaces level and free from irregularities.
- .6 Exterior Doors: provide weep holes in bottom closure channel of all exterior doors.

- .7 Provide fire labelled products for all openings requiring fire protection ratings as noted on schedule. All products test in strict accordance with ULC 104, NFPA 252
- .8 Pressure laminate faces to core with adhesive.
- .9 All edge profile to be revealed vertically on locking jamb edge 1/8" .
- .10 After fabrication, clean, sand, fill and grind tool marks and surface imperfections and make face and vertical edges smooth, level and free from irregularities.

2.2 DOOR MATERIALS

- .1 Steel:
 - .1 Commercial grade steel to ASTM A653, CS, Type B, Coating Designation ZF75 (A25) minimum.
 - .2 Minimum steel thicknesses shall be in accordance with Appendix 1 of the CSDMA, "Recommended Specifications for Commercial Steel Door and Frame Products".
 - .3 Interior: 20 Gauge- standard
 - .4 Finish: exterior galvanized, interior galvanealed
- .2 Door Core Materials:
 - .1 Standard Interior: Honeycomb
 - .1 Structural small cell 1" maximum kraft paper 'honeycomb'. Weight: 36.3 kg (80 lb.) per ream minimum, density: 16.5 kg/m3 (1.03 pcf) minimum, sanded to required thickness.
- .3 Accessories:
 - .1 Door silencers: single stud rubber/neoprene type.
 - .2 Exterior top and bottom caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.
 - .3 Fabricate glazing stops as formed channel, minimum 16mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.
 - .4 Metallic paste filler: to manufacturer's standard.

2.3 STEEL FRAMES - FABRICATION GENERAL REQUIREMENTS

- .1 Frames to Canadian Steel Door Manufacturers' Association, "Canadian Manufacturing Specifications for Steel Doors and Frames", latest edition.
- .2 Cut mitres and joints accurately and weld continuously all joints and seams on inside of frame profile.
- .3 Grind welded corners and joints of flat plane, fill with metallic paste filler and sand to uniform smooth finish.
- .4 Touch up frames with primer where finish is damaged during fabrication.
- .5 Provide jamb anchors for fixing at floor.

- .6 Install two bumpers on strike jamb for each single door and two bumpers at head for pair of doors.
- .7 Provide two spreader bars per frame of 16 gauge materials, welded at base of frame to ensure alignment.
- .8 Prepare frames for silencers.
- .9 Frame product shall be mortised, blanked, reinforced, drilled and tapped at the factory for templated hardware only, in accordance with the approved hardware schedule and templates provided by the hardware supplier.
- .10 Provide anchorage appropriate to floor, wall and frame construction. Each wall anchor shall be located immediately above or below each hinge reinforcement on the hinge jamb and directly opposite on the strike jamb.
- .11 Frames in previously placed concrete, masonry or structural steel shall be provided with anchors located not more than 6" from the top and bottom of each jamb, and intermediate anchors at 26" on centre maximum. Fasteners for such anchors shall be provided by others.

2.4 FRAME MATERIALS

- .1 All frames; paintable Galvannealed steel.
 - .1 Interior Frame: 18 gauge - galvannealed.
- .2 Frame Construction:
 - .1 Interior: Continuously welded type

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verify the opening sizes and tolerances are acceptable for anchorage of frame.
- .2 Ensure lintel supports are fully installed before door/frame installation.

3.2 INTERFACE WITH OTHER SYSTEMS

- .1 Coordinate the work with frame opening construction, door, and hardware installation.
- .2 Provide anchoring in accordance with manufacturer's instructions with regards to the type of wall system; masonry, steel studs, etc.
- .3 Sequence installation to ensure power for door hardware is installed in an orderly and expeditious manner. Coordinate with Division 26 Electrical.

- .4 Coordinate installation of glass and glazing. Refer to Section 08 80 00 Glazing.
- .5 Coordinate finish hardware specified in Section 08 71 00 Door Hardware.
- .6 Air/vapour seals at exterior frames to be properly married to the substrate material and air/vapour material adjacent.

3.3 DOOR INSTALLATION

- .1 Install doors and frames to CSDMA.
- .2 Coordinate with wall construction for anchor placement.
- .3 Coordinate installation of doors and frames with installation of hardware specified in Section 08 71 00 Door Hardware.
- .4 Set frames plumb, square, level and at correct elevation.
- .5 Secure anchorages and connections to adjacent construction.
- .6 Make allowance for deflection to ensure structural loads are not transmitted to frame product.
- .7 Install doors, and hardware in accordance with hardware templates and manufacturer's instructions.
- .8 Adjust operable parts for correct clearances and function.
- .9 Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.
- .10 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows:
 - .1 Hinge side: 1/32".
 - .2 Latchside and head: 1/16" .
 - .3 Finished floor: 1/2" .

3.4 FRAME INSTALLATION

- .1 Set frames plumb, square, level and at correct elevation. Refer to the following tolerances:
 - .1 Opening width - measured horizontally from rabbet to rabbet at top, middle and bottom of frame; $\pm 1/32"$.
 - .2 Opening height - measured vertically between the frame head rabbet and top of floor or bottom of frame minus jamb extension at each jamb and across the head; $\pm 1/16"$.
 - .3 Squareness - measured at rabbet on a line from jamb, perpendicular to frame head; not to exceed 1/16".
- .2 Secure anchorages and connections to adjacent construction.

- .3 Make allowance for deflection so that structural loads are not transmitted to frame product.
- .4 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 1220 mm (4'-0") wide. Remove temporary spreaders after frames are built-in.
- .5 Caulk perimeter of frames between frame and adjacent material.
- .6 All exterior door frames are to be sealed and all voids within the frames filled with foamed insulation.

3.5 FINISH REPAIRS

- .1 Touch up with primer finishes damaged during installation.

3.6 ADJUSTMENT

- .1 Adjust doors and frames for smooth and balanced movement.
- .2 Adjust closers for full closure.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTION**

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 61 00 - Common Product Requirements
- .3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal
- .4 Section 01 78 00 - Closeout Submittals
- .5 Section 09 21 16 - Gypsum Board Assemblies

1.2 **SHOP DRAWINGS**

- .1 Submit catalogue details for each type of door illustrating profiles, dimensions and methods of assembly.

1.3 **SAMPLES**

- .1 Submit one sample of each type of hand entry access door.
- .2 Submit one 300 x 300 mm corner sample of each type of body entry door.

1.4 **CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for cleaning and maintenance of stainless steel finishes for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 **WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal, and with the Waste Reduction Workplan.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

- .4 Divert unused metal materials from landfill to metal recycling facility as approved by Owner's Representative.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Apply temporary protective coating to finished surfaces. Remove coating after erection. Do not use coatings that will become hard to remove or leave residue.
- .3 Leave protective covering in place until final cleaning of building.

PART 2 PRODUCTS

2.1 ACCESS DOORS

- .1 Sizes: Except as indicated otherwise, to be minimum sizes as follows:
 - .1 For body entry: 600 x 600 mm.
 - .2 For hand entry: 300 x 300 mm.
- .2 Construction: Rounded safety corners, concealed hinges, screwdriver latch, anchor straps, able to open 180°.
- .3 Materials
 - .1 Tiled or marble surfaces and other special areas: Stainless steel with brushed satin or polished finish as directed by Owner's Representative.
 - .2 Other areas: Prime coated steel.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Installation:
 - .1 Drywall surfaces: to Section 09 21 16 - Gypsum Board Assemblies.

3.2 LOCATION

- .1 Location: Ensure that equipment is within view and accessible for operating, inspecting, adjusting, servicing without using special tools.

END OF SECTION

The Executed Agreement including General Conditions and Supplementary Conditions, Division 01, applicable drawings and amendments are part of and are to be read in conjunction with this Section.

PART 1 GENERAL

1.1 SUMMARY OF SECTION

- .1 As summarized and described, but not restricted to:
 - .1 Hinges.
 - .2 Locksets and Deadbolts.
 - .3 Keying.
 - .4 Surface Door Closers.
 - .5 Supply and Install of Automatic Operators, Low Energy.
 - .6 Miscellaneous Trim.

1.2 RELATED SECTIONS

- 1. Section - Structural Metal Framing: Door Frames.
- 2. Section - Rough Carpentry: Door Frames.
- 3. Section - Fire Seals: Fire rated gaskets at perimeter of doors.
- 4. Section - Metal Doors and Frames.
- 5. Section - Electrical.

1.3 REFERENCES

- 1. ANSI A117.1 - American National Standard for Accessible and Useable Buildings and Facilities.
- 2. ANSI/BHMA A156.1, "Butts and Hinges" (copyrighted by BHMA, ANSI approved).
- 3. ANSI/BHMA A156.2 - American National Standard for Bored and Preamsembled Locks & Latches.
- 4. ANSI/BHMA A156.4 - American National Standard for Door Controls - Closers.
- 5. ANSI/BHMA A156.6, "Architectural Door Trim" (copyrighted by BHMA, ANSI approved).
- 6. ANSI/BHMA A156.7, "Template Hinge Dimensions" (copyrighted by BHMA, ANSI approved).
- 7. ANSI/BHMA A156.8, "Door Controls - Overhead Holders" (copyrighted by BHMA, ANSI approved).

8. ANSI/BHMA A156.13 - American National Standard for Mortise Locks and Latches Series 1000.
9. ANSI/BHMA A156.15 - Life Safety Closer/Holder/Release Devices.
10. ANSI/BHMA A156.16 - Auxiliary Hardware.
11. ANSI/BHMA A156.18 - Materials and Finishes.
12. ANSI A156.28 - American National Standard for Keying Systems
13. NFPA 80 - Standard for Fire Doors, Fire Windows.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.
15. Underwriters Laboratories (UL). - Fire Resistance Directory.
16. ANSI/UL 10C - Standard for Safety for Positive Pressure Fire Tests of Door Assemblies.
17. NBC - National Building Codes or Canada

1.4 PERFORMANCE REQUIREMENTS

1. Fire Rated Openings: Provide door hardware listed by UL or Intertek Testing Services (Warnock Hersey Listed), or other testing laboratory approved by applicable authorities.
 1. Comply with NFPA 80 for fire ratings indicated, based on testing according to NFPA 252.
 2. Comply with UL10C, Positive Pressure Fire Tests of Door Assemblies.
2. Accessibility Requirements: Comply with requirements of Local building code, and Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities.

1.5 SUBMITTALS

1. Submit under provisions of Section 01 00 00.
2. Product Data: Manufacturer's catalog cuts on each product to be used.
3. Shop Drawings: Indicate locations and mounting heights of each type of hardware, schedules, electrical characteristics and connection requirements.
4. Schedule:
 1. Submit schedule indicating each type of hardware for each door.
 2. List manufacturer's name with each manufacturer's hardware number together with finishes.
 3. Show door number/location, handing, door and frame material, manufacture and catalog numbers, all finishes and keying information. Explain fully all abbreviations.

5. Shop Drawings:
 1. Indicate locations and mounting heights of each type of hardware.
 2. Supply templates to door and frame manufacturer(s) to enable proper and accurate sizing and locations of cut-outs for hardware.
 3. Detail any conditions requiring custom extended lip strikes, or any other special or custom conditions.
 4. Wiring diagrams including point to point and riser diagrams, function statements and system descriptions for all electrical hardware
6. Verification Samples: For each finish product specified.
 1. If required by the Architect, submit one sample of each type of typical hardware required illustrating style, color, and finish.
 2. Approved samples may be incorporated into Work.
7. Closeout Submittals:
 1. Project Record Documents: Schedule showing actual locations of installed cylinders and their master key code.
 2. Parts lists and maintenance instructions including data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.6 QUALITY ASSURANCE

1. Manufacturer Qualifications: A manufacturer with a minimum of ten years' experience manufacturing door hardware.
2. Supplier Qualifications: A supplier with demonstrated experience in the sale and distribution of builders' hardware for commercial projects and who has successfully completed at least three projects of similar complexity to the project specified.
3. Hardware Supplier Personnel: Employ Architectural Hardware Consultant (AHC) or equally qualified person to supervise and prepare all schedules, details, and services required for the project.
4. Hardware Supplier: to provide 3 job site visits for inspection of the hardware. One is before the hardware is installed, the second one is during the install and the last one is on completion of the install. Each inspection is to have a certified AHC complete the inspection and report any issues at the time of inspection.
5. Automatic operator to be supplied, installed and commissioned by AAADM certified personnel.

1.7 DELIVERY, STORAGE, AND HANDLING

1. Package hardware items individually with necessary fasteners and installation templates when necessary; label and identify each package with door opening code to match hardware schedule.
2. Store products in manufacturer's unopened packaging until ready for installation.

3. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.
4. Store materials in a dry, warm, ventilated weathertight location.

1.8 PROJECT CONDITIONS

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

1.9 WARRANTY

1. Provide factory warranty against defects in material and workmanship as follows:
 1. Overhead Surface Closers, Grade 1, 25 Year Warranty.
 2. Mortise locks, Grade 1, 10 Year Warranty.
 3. Supply and Install Automatic Operators, 1 Year Warranty.

1.10 MAINTENANCE MATERIALS

1. Provide special wrenches and tools applicable to each different or special hardware component.
2. Provide manufactures data sheets and contact information along with any maintenance manuals as well as a copy of the door hardware shop drawings.

1.11 COORDINATION

1. Coordinate work with other directly affected components involving manufacture or fabrication of internal reinforcement for door hardware and recessed items.
2. Coordinate work with other directly affected components involving electrical wiring and components.

PART 2 PRODUCTS

2.1 MANUFACTURERS

1. Acceptable Manufacturer:
2. Hinges: PBB, MH Hinge
3. Locksets: Dorma
4. Exit Devices: Dorma
5. Auto Operators: Dorma
6. Miscellaneous Hardware: CBH, Draftseal, ABH

2.2 HINGES

1. Hinges: ANSI A156.1, full mortise template type complying with following general requirements unless otherwise scheduled.
 1. Widths: Sufficient to clear trim projection when door swings 180 degrees.
 2. Number: Furnish minimum three hinges to 90 inches (2 286 mm) high, four

hinges to 120 inches (3 048 mm) high for each door leaf.

1. Fire Rated Doors to 86 inches (2 184 mm) high: Minimum three ball bearing hinges.
2. Residential Wood Doors: Furnish minimum two hinges.
3. Size and Weight: 4-1/2 inch (114 mm) heavy weight typical for 1-3/4 inch (44 mm) doors.
 1. Doors over 40 inches (1 016 mm) wide: Extra heavy weight ball bearing hinges.
 2. Doors over 48 inches (1 220 mm) wide: 5 inch (125 mm) extra heavy weight ball bearing.
4. Pins: Furnish nonferrous hinges with non-removable pins (NRP) at exterior and locked out swinging doors, non-rising pins at interior doors.

2.3 MORTISE LOCKSETS

1. Lockset: ML9000 Series.
 1. Standards:
 1. ANSI Conformance - ANSI A156.13, Operational Grade 1, Security Grade 1.
 2. U.L. and C.U.L. listed for use on 3-hour fire-rated doors and for all positive pressure applications.
 3. U.L. and C.U.L. listed for UL 10B/10C.
 4. Lever trim meets A117.1 and ADA requirements.
 2. Features:
 1. Stainless steel latch.
 2. Stainless steel dead bolt.
 3. Hardened steel rollers in dead bolt.
 4. Security spacer between inside and outside lever.
 5. Steel lock case and internal components.
 6. Full length face plate.
 7. All trim through-bolted through the lock case.
 8. Accepts interchangeable core cylinders.
 3. Function:
 1. As noted on the hardware schedule attached to this section.

2.4 KEYING

1. Keying:
 1. Keying: Provide master keyed Dorma series as directed by architect.
2. Keys:
 1. Supply keys in the following quantities:
 1. 8 keys for every core

2.5 EXIT DEVICES

1. Exit devices are listed by U.L.C under their continuing re-inspection programs and conform to standards U.L. 10C and U.B.C. 7-2 (1997) positive pressure testing. They are BHMA certified to the requirements of ANSI A156.3 for Grade 1 exit devices.
 1. Heavy Duty Exit Device: ANSI A156.3, Grade 1, heavy duty exit devices.

Heavy duty RIM devices shall maintain a minimum latch bolt static load rating of 3,000 lbs.

2. Use fire exit hardware where exit devices are scheduled for fire door assemblies. Where lever handle trim is specified, match lever trim on locksets. Furnish freewheeling lever trim as standard. Construct device touch bar, rail and cover assemblies of heavy gauge solid wrought materials for true architectural finishes. Provide cylinder dogging on all non-rated devices. Furnish all devices with stainless 3/4 inch (19 mm) throw deadlocking latch bolts.

2.6 SURFACE DOOR CLOSERS

1. Closers used in conjunction with overhead stops and holders shall be templated and coordinated to function properly. Properly detail closers to meet application requirements by providing drop plates, brackets, etc. to meet application and installation requirements as indicated.
2. 8900/8600 Series: ANSI A156.4, Grade 1, heavy duty surface door closer.
 1. Model 8916 for interior and exterior applications features adjustable spring sizes from 1 to 6 and meets ANSI A117.1 and ADA for barrier-free accessibility.
 2. Compliant with UL10C for positive pressure.
Certified to 10 million cycles by a recognized test lab.
 3. Non-handed.
 4. Featuring full range spring power adjustment and backcheck, with a narrow projection full cover and flat form style arm.
 5. Door control also features a backcheck positioning adjustment for parallel arm applications, to maintain an ANSI backcheck range similar to regular and top jamb applications.
 6. Independent sweep and latch non-critical closing speed adjustment.

2.7 AUTOMATIC OPERATORS

1. Power operator pedestrian doors: to CAN/CGSB-69.26
 1. Low Energy Operators: CAN/CGSB-69.26 / ANSI A156.19, Grade 1,
 2. surface applied power assist and low energy power operated doors.
 3. Operators shall be supplied and installed completed with all components.
 4. Controls shall include adjustable time delay and safe-swing circuit.
 5. All wiring shall be of the shielded type with proper number of conductor wire to install all components specified.
 6. Compliant with UL10C for positive pressure.
 7. Power requirements: 120 VAC, 50/60 Hz, 2 amps (single dedicated line).
 8. Installation of all Automatic Operators items to be performed by AAADM certified and Manufacturer authorized personnel including connection to hardware products installed by others.
 9. Hardware groups lists the intent and function of the opening however supplier is to include for any and all additional components required to properly operate the doors as required. In the event additional components are required they shall be added at no additional cost to the owner.

2.8 MISCELLANEOUS HARDWARE

1. Kickplates, Mop Plate, Armor Plates: ANSI A156.6, metal; height indicated in Schedule by 1 inch (25 mm) less than door width:
 1. Provide as indicated on the Schedule.

PART 3 EXECUTION

3.1 EXAMINATION

1. Do not begin installation until substrates have been properly prepared.
2. Verify doors and frames are ready to receive door hardware and dimensions are as indicated on shop drawings.
3. Verify electric power is available to power operated devices and is of correct characteristics.
4. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
5. Hardware groups lists the intent and function of the openings however supplier is to include for any and all additional components required to properly operate the doors as required under all code requirements. In the event additional components are required they shall be added at no additional cost to the owner.

3.2 INSTALLATION

1. Install in accordance with manufacturer's instructions.
2. Coordinate mounting heights with door and frame manufacturers. Use templates provided by hardware item manufacturer.
3. Install with fasteners provided by hardware item manufacturer.
4. Adjust hardware for smooth operation.

3.3 PROTECTION

1. Protect installed products until completion of project.
2. Touch-up, repair or replace damaged products before Substantial Completion.

3.4 DOOR HARDWARE SCHEDULE

Hardware Group 1 (Exterior Entry/ Vestibule Doorways, E101A/E101B)

2-Auto Operators Dorma ED100 Dark Bronze Anodized (LHR exterior, LHR vestibule)

3-Wireless Push Buttons Dorma DX3339-030 (exterior, inner vestibule, outer vestibule)

1-Wireless Receiver Dorma DX3335-000

1-Wiring Diagram

Theory of operation: Locking devices to be unlocked and dogged down, auto operator (sequenced operation) can be activated by push buttons (exterior, inner vestibule, outer vestibule) for entry or exiting.

Note: Requires 120VAC conduit/wiring for each auto operator to header box/frame.

Note: Requires 24VDC conduit/wiring to/from set of sequenced operators.

Note: 24VDC/120VAC Electrical Wiring and Conduit by Division 26.

Note: Install, final termination, hook up and commissioning by hardware supplier.

Hardware Group 2 (Exterior Exiting/Vestibule Doorways, E102A/E102B)

2-Auto Operators Dorma ED100 Dark Bronze Anodized (LHR exterior, LHR vestibule)

2-Wireless Push Buttons Dorma DX3339-030 (exterior, inner vestibule, outer vestibule)

1-Wireless Receiver Dorma DX3335-000

1-Wiring Diagram

Theory of operation: Locking devices to be unlocked and dogged down, auto operator (sequenced operation) can be activated by push buttons (inner vestibule, outer vestibule) for exiting only.

Note: Requires 120VAC conduit/wiring for each auto operator to header box/frame.

Note: Requires 24VDC conduit/wiring to/from set of sequenced operators.

Note: 24VDC/120VAC Electrical Wiring and Conduit by Division 26.

Note: Install, final termination, hook up and commissioning by hardware supplier.

Hardware Group 3 (Boiler Room, D100)

3-Hinges PBB BB51 4-1/2x4 US10B

1-Lockset Dorma C880 LTA 613PVD (Dorma GA Keyway)

1-Door Closer Dorma 8616 SISJ 695

1-Smokeseal Draftseal DS44 (sized to suit)

1-Kickplate CBH 903 C10B (12in x sized to suit)

Hardware Group 4 (Back Boiler Room Area, D101)

3-Hinges PBB BB51 4-1/2x4 630

1-Exit Device Dorma F9300 YT08 630 (Dorma GA Keyway)

1-Door Closer Dorma 8616 SISJ 689

1-Smokeseal Draftseal DS44 (sized to suit)

1-Kickplate CBH 903 C32D (12in x sized to suit)

Door Number and Hardware Group Schedule

Door #	HG#
D100	3
D101	4
E101A / E101B	1
E102A / E102A	2

END OF SECTION

The Executed Agreement including General Conditions and Supplementary Conditions, Division 01, applicable drawings and amendments are part of and are to be read in conjunction with this Section.

PART 1 - GENERAL

1.1 SUMMARY OF SECTION

- .1 As summarized and described but not restricted to the following:
 - .1 Provide interior gypsum board for wall assemblies.
 - .2 Provide accessories as indicated.
 - .3 Provide installation of access panels. Refer to Mechanical for access panel specification.
 - .4 Provide shaft wall assemblies.

1.2 REFERENCES

- .1 The standards listed form part of this Specification to the extent of reference. The publications are in the text by the basic designation only.
- .2 American Society for Testing and Materials International (ASTM):
 - .1 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - .2 ASTM C475/ C475M-15, Joint Compound and Joint Tape for Finishing Gypsum Board
 - .3 ASTM C840-17, Application and Finishing of Gypsum Board
 - .4 ASTM C1002-14, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
 - .5 ASTM C1047-14a , Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base
 - .6 ASTM C1177/C1177M-13, Glass Mat Gypsum Substrate for Use as Sheathing
 - .7 ASTM C1178/C1178M-13 Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel
 - .8 ASTM C1280-13a, Application of Exterior Gypsum Panel Products for Use as Sheathing
 - .9 ASTM C1396/C1396M-14a, Standard Specification for Gypsum Board
 - .10 ASTM C1658/C1658M-13, Glass Mat Gypsum Panels
 - .11 ASTM E136-16a, Standard Test Method for Behaviour of Materials in a Vertical Tube Furnace at 750 degrees Celsius
- .3 Gypsum Association:
 - .1 GA-214-15 Recommended Levels of Gypsum Board Finish
 - .2 GA-216-16 Application and Finishing Of Gypsum Panel Products
 - .3 GA-600-15 Fire Resistance Design Manual
 - .4 GA-801-07 Handling and Storage of Gypsum Panel Products: A Guide for Distributors, Retailers, and Contractors

- .4 Underwriters Laboratories of Canada (ULC)
- .5 National Building Code of Canada (NBCC), 2015.

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, including installation instructions, MSDS sheets, specifications and data sheets in accordance with Division 01, Submittal Procedures.

1.4 ENVIRONMENTAL REQUIREMENTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of materials.
- .2 Maintain temperature minimum 50°F (10°C), maximum 70°F (21°C) for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.
- .3 Apply board and joint treatment to dry, frost free surfaces.

1.5 WASTE MANAGEMENT

- .1 Separate and recycle waste materials in accordance with Division 01.

1.6 PERFORMANCE CRITERIA

- .1 Conform to applicable code for fire rated assemblies in conjunction with Section 09 22 16 Non Structural Metal Stud Framing as follows:
 - .1 Shaft Wall: 1 hour rating to ULC 415.

1.7 DELIVERY, STORAGE AND PROTECTION OF PRODUCT

- .1 Deliver and store materials in compliance with Division 01, Common Product Requirements.
- .2 Comply with manufacturer's recommendations for handling, storage and protection during installation.
- .3 Protect and store materials off the ground, away from physical damage and from becoming wet, soiled or covered with ice or snow before, during and after installation.
- .4 Label packages to include material name, production date and/or product code.

1.8 QUALITY ASSURANCE

- .1 Installer Qualifications: Company specializing in performing the work of this section shall have successfully completed projects of similar scope and complexity. When requested, provide a list of the last three comparable jobs including job name and location and project manager.

1.9 QUALITY CONTROL

- .1 Perform Work in accordance with ASTM C840, GA-214, GA-216, and GA-600. Maintain one (1) copy on site.
- .2 Handling and Storage of Gypsum Board: Comply with GA-801.

PART 2 - PRODUCTS

2.1 MATERIALS - GYPSUM BOARD

- .1 All gypsum board products:
 - .1 To meet standard ASTM C1396/C1396M.
- .2 Fire Rated Gypsum Board:
 - .1 ULC rated board
 - .2 Fire resistive
 - .3 Thickness: as indicated
 - .4 Edges: tapered
 - .5 Recycled Content: 20%
 - .6 Approved Manufacturers:
 - .7 Certainteed
 - .8 CGC
 - .9 Georgia Pacific
 - .10 Cabot Gypsum Board
- .3 Gypsum Liner Board: ASTM C1396/C1396M, paper faced liner, 1 inch thick, ends square cut.

2.2 ACCESSORIES

- .1 Gypsum Board Fasteners: ASTM C1002, type S12. Corrosion Resistant in exterior applications.
- .2 Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.
- .3 Acoustic Sealant and Firestop Sealant: See Section 07 92 00 Joint Sealants
- .4 Corner Beads: GA-216, metal corner bead. Use "pull away" beads adjacent to window frames.

- .5 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, Zinc metal, 0.5 mm (1/32") base thickness, perforated flanges, one piece length per location.
- .6 Stud adhesive: as per manufacturer's recommendations
- .7 Edge Trim: GA-216
- .8 Joint Materials: ASTM C475.
 - .1 Reinforcing tape, adhesive, and water.
 - .2 Joint compound for interior gypsum board:
 - .3 Prefilling: At open joints, panel edges, and damaged surface areas, use setting-type taping compound.
 - .4 Embedding and first coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - .5 Fill coat: For second coat, use setting-type, sandable topping compound.
 - .6 Finish coat: For third coat, use setting-type, sandable topping compound.
 - .7 Joint compound for exterior applications:
 - .8 Use setting-type taping compound and setting-type, sandable topping compound.
 - .9 Joint compound for tile backing panels:
 - .10 Use setting-type taping compound and setting-type, sandable topping compound.
 - .11 Mesh tape only where required by ULC design.
- .9 Access Panels: installed by this Section, supplied by mechanical.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verify that site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.
- .2 Do not apply gypsum board until bucks, anchors, blocking, sound attenuation, electrical and mechanical work are reviewed and accepted by Consultant.

3.2 GYPSUM BOARD INSTALLATION

- .1 Install gypsum board in accordance with ASTM C840, GA-216 and GA-600 and manufacturer's written instructions.
- .2 Apply single and/or double layer gypsum board to metal furring or framing using screw fasteners for first layer, screw fasteners for second layer. Maximum spacing of screws 305 mm (12") o.c.
- .3 Remove all debris from partition cavities and clean dust from bottom tracks with [Hepa] vacuum prior to installation of board.
- .4 Install single layer board in most economical direction, with ends and edges occurring over firm bearing.

- .5 Use screws when fastening gypsum board to metal furring or framing. Use wafer-head screws for attachment of backer board.
 - .1 Install board so as edges terminate on the centerline of the studs
- .6 Provide acoustic sealant and sound batts at all mechanical and electrical penetrations or partitions required to have STC rating. Coordinate with Section 07 84 00 Fire Stopping for all rated partitions.
- .7 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 (6") o.c.
- .8 Apply 12.7 mm (1/2") diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board / structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, and similar penetrations, in partitions where perimeter sealed with acoustic sealant.
- .9 Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.
- .10 Bottom of boards to be 12.7 mm (1/2") above floor.
- .11 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.
- .12 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.
- .13 Splice corners and intersections together and secure to each member with 3 screws.
- .14 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.
- .15 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.
- .16 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.
- .17 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .18 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

3.3 APPLICATION FOR FIRE RATED ASSEMBLIES

- .1 Label fire rated assemblies with sign consisting of the following information:
 - .1 Hour Rating (ie; 1 hour)
 - .2 Type: Fire Resistance Rating or Fire Separation without a Rating

- .3 "Protect All Openings and Penetrations"
- .2 Sign to be painted on wall or vinyl sign permanently adhered to wall, locate above ceiling. Minimum size: 280 mm x 380 mm (11" x 15") with brightly colored letters.
- .3 Construct fire-rated assemblies in accordance with Drawings.
- .4 Fire separations shall be clearly identified on both sides above ceilings. Labeling should be visible from any point in the space above the ceiling. There should be at least one label every 3 m on straight runs and additional labels as needed around corners to meet visibility requirement.

3.4 JOINT TREATMENT

- .1 Mix joint compound slightly thinner than for joint taping.
- .2 Finish in accordance with GA-214 and as follows.
 - .1 Level 1: Above Ceilings (non-fire rated partitions): Embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable.
 - .2 Level 2: Above Ceilings (1 HR fire rated partitions): Embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fasteners heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.
 - .3 NOTE: For fire separations greater than 1 HR, apply two coats of joint compound over, joints, angles, fastener heads and accessories.
 - .4 Level 4: All Finished Areas below Ceilings: 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.
 - .5 Level 5: For all exposed gypsum board surfaces: 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; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges and ready to receive primer. If required to achieve smooth and ridge free surface at wall boards, apply a thin skim coat of joint compound trowel applied (or a material manufactured especially for this purpose) to the entire surface.

3.5 TOLERANCES

- .1 Maximum Variation of Finished Gypsum Board Surface from True Flatness: 3 mm in 3 m (1/8 inch in 10 ft) in any direction.
- .2 Feather coats on to adjoining surfaces so that camber is maximum 0.76 mm (0.03 inches).

3.6 SCHEDULE

- .1 Schedule:

- .1 Standard Gypsum Board, unless otherwise noted on drawings.

END OF SECTION

The Executed Agreement including General Conditions and Supplementary Conditions, Division 01, applicable drawings and amendments are part of and are to be read in conjunction with this Section.

PART 1 - GENERAL

1.1 SUMMARY OF SECTION

- .1 As summarized and described but not restricted to the following:
 - .1 Provide non-load bearing metal stud framing for all gypsum board walls, and shaft walls.
 - .2 Provide all necessary accessories.

1.2 REFERENCES

- .1 The standards listed form part of this Specification to the extent of reference. The publications are in the text by the basic designation only.
- .2 American Society for Testing and Materials International (ASTM):
 - .1 ASTM C645-14e1, Non Structural Steel Framing Members.
 - .2 ASTM C754-17, Installation of Steel Framing Members to Receive Screw Attached Gypsum Panel Products.
 - .3 ASTM C1002-16, Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS)
- .4 Gypsum Association:
 - .1 GA-216-16, Application and Finishing of Gypsum Panel Products
 - .2 GA-600, Fire Resistance Design Manual

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, including installation instructions, MSDS sheets, specifications and data sheets in accordance with Division 01, Submittal Procedures.
 - .2 Provide data describing standard framing member materials and finish, product criteria, load charts, limitations, and recycled content.
- .2 Shop Drawings:
 - .1 Indicate prefabricated work component details, stud layout, framed openings, anchorage to structure, type and location of fasteners and accessories or items required of other related work.
 - .2 Describe method for securing studs to tracks, splicing and for blocking and reinforcement to framing connections.

1.4 ENVIRONMENTAL REQUIREMENTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of materials.

1.5 WASTE MANAGEMENT

- .1 Separate and recycle waste materials in accordance with Division 01.
- .2 Divert steel scraps from landfill by disposal into the on-site metal recycling bin at nearest metal recycling facility.

1.6 DELIVERY, STORAGE AND PROTECTION OF PRODUCT

- .1 Deliver and store materials in compliance with Division 01, Common Product Requirements.
- .2 Comply with manufacturer's recommendations for handling, storage and protection during installation.
- .3 Protect and store materials off the ground, away from physical damage and from becoming wet, soiled or covered with ice or snow before, during and after installation.
- .4 Label packages to include material name, production date and/or product code.

1.7 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this Section shall have relevant experience.
- .2 Installer Qualifications: Company specializing in performing the work of this Section shall have successfully completed projects of similar scope and complexity. When requested, provide a list of the last three comparable jobs including job name and location and project manager.

1.8 QUALITY CONTROL

- .1 Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the province where the Work is being done.
- .2 Perform Work to ASTM C754.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Non-load bearing channel stud framing, to ASTM C645, galvanized sheet steel:
 - .1 25 gauge thick unless noted otherwise
 - .2 20 gauge required at door openings larger than 1067 mm (42") and at walls with heights as recommended by manufacturer
 - .3 Knock-out service holes at 460 mm (18") centers
 - .4 Top tracks with 50 mm (2") extended legs
 - .5 Shaft Wall: CH shape
- .2 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 32 mm (1 1/4") flange height. Galvanized to ASTM A653/A653M, Z180 zinc coating
- .3 Metal channel stiffener: size to suit framing, 1.4 mm (0.06") thick cold rolled steel, coated with rust inhibitive coating.
- .4 Insulating strip: rubberized, moisture resistant 3 mm (1/8") thick foam strip, width of track, with self-sticking adhesive on one face, lengths as required.
- .5 Furring, framing and accessories: ASTM C645 and GA-216.
- .6 Fasteners: ASTM C1002 exterior finish to be corrosion resistant.
- .7 Anchorage to substrate: tie wire, nails, screws and other metal supports, of type and size to suit application, to rigidly secure materials in place.

PART 3 - EXECUTION

3.1 FRAMING INSTALLATION

- .1 Install studs in accordance with ASTM C754 and manufacturer's instructions. Install shaft wall framing in accordance with GA-600.
- .2 Align partition tracks at floor and ceiling and secure at 610 mm (2'-0") o.c. maximum.
- .3 Install insulating strip under stud shoe tracks of partitions on slabs on grade.
- .4 Place studs vertically at 405 mm (16") and 610 mm (2'-0") o.c. and not more than 50 mm (2") 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.
- .5 Erect metal studding to tolerance of 1:1000.
- .6 Coordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

- .7 Coordinate 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 centres specified. Secure studs together, 50 mm (2") 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 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .12 Provide concealed bracing as required to construct rigid installation. Provide bracing to building structure for partitions extended above ceilings.
- .13 Provide extra length top track flanges to maintain clearance between structure and top of studs, to avoid transmission of structural loads to studs.
- .14 Screw attach studs to top and bottom tracks of partitions less than ceiling height.
- .15 Extend partitions to underside of steel deck except where noted otherwise on drawings.
- .16 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use double track slip joint using a 50 mm (2") leg or ensure studs are of correct length to allow for deflection if not screw fastened to tracks. Track to have minimum 50 mm (2") leg.
- .17 Provide 38 mm (1½") stiffener channels at one third segments in height from floor to u/s deck.

END OF SECTION

The Executed Agreement including General Conditions and Supplementary Conditions, Division 01, applicable drawings and amendments are part of and are to be read in conjunction with this Section.

PART 1 - GENERAL

1.1 SUMMARY OF SECTION

- .1 As summarized and described but not restricted to the following:
 - .1 Provide interior paint as indicated.

1.2 REFERENCES

- .1 The standards listed form part of this Specification to the extent of reference. The publications are in the text by the basic designation only.
 - .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .2 Material Safety Data Sheets (MSDS)
 - .3 Environmental Protection Agency (EPA):
 - .4 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24, (for Surface Coatings).
 - .5 National Fire Code of Canada, latest edition.
 - .6 Master Painters Institute (MPI):
 - .7 MPI Architectural Painting Specifications Manual, latest edition.

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, including installation instructions, MSDS sheets, specifications and data sheets in accordance with Division 01, Submittal Procedures.
 - .2 Submit maintenance materials in accordance with Division 01, Closeout Submittals.
 - .3 Lead, cadmium and chromium: presence of and amounts.
 - .4 Mercury: presence of and amounts.
 - .5 Organochlorines and PCBs: presence of and amounts.
- .2 Samples:
 - .1 Submit duplicate 150 mm (6") x 200 mm (8") swatches of each paint, special finish with specified primer.
 - .2 When approved, paint swatches will become acceptable standard of quality and retained on-site for reference.
- .3 Closeout Submittals: submit maintenance data for incorporation into manual specified in Division 01, Closeout Submittals include following:
 - .1 Product name, type and use.
 - .2 Manufacturer's product number.
 - .3 Colour numbers.
- .4 Extra Materials:

- .1 Provide one - four litre (1 gallon) can of each type and colour of paint. Identify colour and paint type.
- .2 Deliver to Owner's representative and store where directed.

1.4 ENVIRONMENTAL 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 twenty-four (24) hours before, during and after paint application until paint has cured sufficiently.
 - .2 Where required, provide continuous ventilation for seven (7) days after completion of application of paint.
 - .3 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.
 - .4 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted.
- .2 Temperature, Humidity Levels:
 - .1 Perform no painting when ambient air and substrate temperatures are below 50°F (10°C.) for interior or exterior work.
 - .2 Paint application must meet environmental conditions required by MPI and paint manufacturer. Where required, suitable weatherproof covering and sufficient heating facilities shall be in place to maintain minimum ambient air and substrate temperatures for 24 hours before, during and after paint application.
 - .3 Maximum moisture content of Substrates:
 - .4 12% concrete and masonry, clay and concrete brick or block.
 - .5 15% for wood.
 - .6 12% for plaster and gypsum board.
 - .7 Test concrete, masonry and plaster surfaces for alkalinity as required.
 - .8 Concrete and masonry surfaces must be installed at least 28 days prior to painting and decorating work and must be visually dry on both sides.
- .3 Surface and Environmental Conditions:
 - .1 Apply paint only to dry, clean, properly cured and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect the quality of finished surfaces.
- .4 Additional Interior Application Requirements:
 - .1 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.
- .5 Provide paint products meeting MPI Green Performance Standard GPS-01 ratings based on VOC EPA Method 24 content levels.

1.5 MOCK-UP

- .1 Locate where directed by Consultant.

- .2 Prepare and paint designated areas to specified requirements, with specified paint or coating showing selected colours, gloss/sheen, textures.
- .3 Mock-up will be used to judge workmanship, substrate preparation, operation of equipment and material application and workmanship to MPI Architectural Painting Specification Manual standards.
- .4 Allow 48 hours for field review of mock-up by Consultant.
- .5 Contractor to proceed once the testing is complete and written approval has been received by the Consultant.
- .6 When accepted, mock-up will demonstrate minimum standard for this work. Approved mock-up may remain as part of the Work.

1.6 WASTE MANAGEMENT

- .1 Separate and recycle waste materials in accordance with requirements of Workplace Hazardous Materials Information System (WHMIS), Division 01 and local municipality requirements.
- .2 Paint, stain and wood preservative finishes and related materials (thinners, solvents, caulking, empty paint cans, cleaning rags, etc.,) are regarded as hazardous products. Recycle and dispose of same subject to regulations of applicable authorities having jurisdiction.
- .3 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
- .4 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground the following procedures shall be strictly adhered to:
 - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
 - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
 - .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
 - .4 Empty paint cans are to be dry prior to disposal or recycling (where available).
- .5 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

1.7 DELIVERY, STORAGE AND PROTECTION OF PRODUCT

- .1 Comply with manufacturer's recommendations for handling, storage and protection during installation.
- .2 Deliver and store all painting materials in sealed, original labeled can indicating:
 - .1 Manufacturer's name and address.
 - .2 Brand name

- .3 Type of paint or coating.
- .4 Compliance with applicable standard.
- .5 Material content
- .6 Mixing and reducing and application requirements
- .7 Colour number in accordance with established colour schedule.

- .3 Observe manufacturer's recommendations for storage and handling.

1.8 QUALITY ASSURANCE

- .1 Contractor must have proven satisfactory experience. When requested, provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager. Contractor shall maintain a qualified crew of painters throughout the duration of the Work.
- .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.

1.9 QUALITY CONTROL

- .1 All materials, preparation and workmanship to conform to requirements of the latest edition of the Architectural Painting Specification Manual by the Master Painters Institute (MPI)

1.10 FIRE WATCH

- .1 Fire Safety Requirements:
 - .1 Provide one 9 kg (20 lb) dry chemical 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 the National Fire Code of Canada.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 PAINT - GENERAL:
 - .1 Conform to latest MPI requirements for painting work including preparation and priming.
 - .2 Provide paint products meeting MPI Green Performance Standard GPS-01 ratings based on VOC (EPA Method 24) content levels.
 - .3 Paint materials for paint systems shall be products of a single manufacturer.

- .4 Other materials such as linseed oil, shellac, thinners, solvents, etc. shall be the highest quality product of an MPI listed manufacturer and shall be compatible with paint materials being used as required.
- .5 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .6 Flash point: 61.0 °C or greater for water-borne surface coatings and recycled water-borne surface coatings.
- .7 Ensure manufacture and process of both water-borne surface coatings and recycled water-borne surface coatings does not release:
- .8 Matter in undiluted production plant effluent generating 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to natural watercourse or sewage treatment facility lacking secondary treatment.
- .9 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15mg/L to natural watercourse or a sewage treatment facility lacking secondary treatment.
- .2 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, shall:
 - .1 Be water-based water soluble water clean-up.
 - .2 Be non-flammable biodegradable.
 - .3 Be manufactured without compounds which contribute to ozone depletion in the upper atmosphere.
 - .4 Do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.

2.2 COLOURS

- .1 Second coat in a three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.
- .2 Paint Colours:
 - .1 PT1: Benjamin Moore; Black Satin; 2131-10
 - .2 PT2: Benjamin Moore; Baby Seal Black; 2119-30.

2.3 MIXING AND TINTING

- .1 Unless otherwise specified herein or pre-approved, all paint shall be ready-mixed and pre-tinted. Re-mix all paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and color and gloss uniformity. Where thinner is used, addition shall not exceed paint manufacturer's recommendation.
- .2 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 Consultant.

2.4 GLOSS/SHEEN RATING

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

.2	Gloss Level Category	Units @ 60°	Units @ 85°
	G1-matte or flat 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	20 to 35	min. 35
	G5-semi-gloss finish	35 to 70	
	G6-gloss finish	70 to 85	
	G7-high gloss finish	> 85	

2.5 PAINTING SYSTEMS

- .1 Concrete vertical surfaces: including horizontal soffits:
 - .1 INT 3.1M - Institutional low odour/low VOC gloss level G1 finish.
- .2 Steel and metal fabrications:
 - .1 INT 5.1K – Epoxy Modified Latex Finish gloss level G1 finish.
- .3 Exposed ceiling structure-painted: columns, beams, joists, deck, mechanical & electrical:
 - .1 INT 5.1C Water Based Dry Fall Finish gloss level G1 finish.
- .4 Steel high heat: (boilers, furnaces, heat exchangers, breeching, pipes, flues, stacks, etc., with temperature range as noted):
 - .1 INT 5.2D - High heat resistant coating, maximum 1100 °F (593°C.) Gloss level G1 finish.
- .5 Aluminum: un-anodized:
 - .1 INT 5.4D - Aluminum paint finish (for exposed aluminum). Gloss level G1 finish.
- .6 Gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:
 - .1 INT 9.2M (Typical walls) - Institutional low odour/low VOC.
 - .2 Gloss level 1 finish.
- .7 Plywood backboards for mechanical and electrical equipment
 - .1 INT-64 fire resistant latex-low odor/low VOC gloss level G1 finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verify existing substrates are suitably prepared to be painted. Report to Consultant unsatisfactory conditions before proceeding with work.
- .2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test".

- .3 Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

3.2 PREPARATION OF SUBSTRATE

- .1 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
 - .1 Sand, clean, dry, etch, neutralize and test all surfaces under adequate illumination, ventilation and temperature requirements.
 - .2 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths.
 - .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.
 - .8 Many water based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water based paints.
- .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 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 (39").
- .4 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 brushing with clean brushes or vacuum cleaning. Confirm preparation and primer used with fabricator of steel items.
- .5 Paint finish shall continue behind all wall mounted items.
- .6 Touch up of shop primers with primer as specified.
- .7 For steel to receive finish painting on site:
 - .1 Clean all members of loose mill scale, rust, oil, dirt and other foreign matter, prepare and prime to CISC/CPMA 2-75. Grey primer to be used
 - .2 Apply one coat of primer in shop to all steel surfaces.
 - .3 Primer: to MPI #79 Primer, Alkyd, Anti-Corrosive for Metal.

3.3 MECHANICAL AND 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.
- .2 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .3 Do not paint over nameplates.
- .4 Keep sprinkler heads free of paint.
- .5 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.
- .6 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.
- .7 Do not paint interior transformers and substation equipment.
- .8 Paint all interior and exterior natural gas piping yellow.

3.4 APPLICATION

- .1 Apply paint in accordance with MPI Painting Manual Custom Grade finish requirements.
- .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 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple unless approved by Consultant.
 - .4 Remove runs, sags and brush marks from finished work and repaint.
- .3 Spray application:
 - .1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
 - .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
 - .3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.
 - .4 Brush out immediately all runs and sags.
 - .5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.
- .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 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.
- .7 Finish closets and alcoves as specified for adjoining rooms.
- .8 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.5 PROTECTION DURING WORK

- .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 surfaces as directed by Consultant.
- .2 Make good all damage caused by failure to protect above listed items.
- .3 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .4 Protect factory finished products and equipment.
- .5 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. Items shall be securely stored, cleaned and re-installed after painting is completed. Remove doors before painting to paint bottom and top edges and then rehang.
- .6 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
- .7 Remove all absorbent materials, including furniture and ceiling tiles to carry out painting operations. Replace once paint has dried completely.
- .8 As painting operations progress, place "WET PAINT" signs in occupied areas or provide sufficient barriers to protect Work.

3.6 SCHEDULE:

- .1 Paint ceiling and exposed equipment:
 - .1 Colour: PT1
- .2 Paint base building concrete walls, concrete columns and gypsum wall board:
 - .1 Colour: PT1
 - .2 Paint from 2.3m AFF to ceiling only
 - .3 Protect all existing stone from overspray
- .3 Paint mechanical loft insulation, ceiling and equipment:
 - .1 Colour: PT1

- .4 Paint screen frame and metal screen:
 - .1 Colour: PT2
- .5 Plywood counter:
 - .1 Colour: PT2
- .6 Screen structure:
 - .1 Colour: PT1
- .7 Shaft wall in Boiler Room:
 - .1 Colour: PT3: Flat White

3.7 SITE TOLERANCES

- .1 Painted surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:
 - .1 Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 1000 mm (39") .
 - .2 Visible defects are evident on ceiling, soffit, and other overhead surfaces when viewed at normal viewing angles.
 - .3 When the final coat on any surface exhibits a lack of uniformity of color, sheen, texture, and hiding across full surface area.
- .2 Painted surfaces deemed unacceptable shall be made good at the expense of the Contractor. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags of damaged paint shall be removed by scraper or by sanding prior to application of paint.

3.8 CLEANING

- .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 approval of Consultant. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Consultant.

END OF SECTION

PART 1 – GENERAL

1.1 RELATED SECTIONS

- .1 Division 01 - General Requirements.

1.2 SUBMITTALS

- .1 Site Records:
 - .1 Parks Canada will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .2 As-built Drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Engineer for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
 - .6 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Management System.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Waste management and disposal to be in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

PART 2 – PRODUCTS

2.1 MATERIALS

- .1 Do verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's verification.

2.2 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") 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") above other floors. For equipment room floors, terminate 100mm (4") 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 Future-use sleeves shall be fire stopped as a blank opening listed system in order to provide the same fire rating as the assembly.
 - .5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CGSB 1-GP-181M+Amdt.
 - .6 One step cast-in-place sleeve and fire stop assemblies are an acceptable alternate to steel sleeving systems.
 - .1 Standard of Acceptance: Hilti CP680.

2.3 ACCESS DOORS

- .1 Supply access doors to concealed mechanical equipment for operating, inspecting, adjusting and servicing.
- .2 For drywall surfaces, access doors shall be flush type. For ceramic tile, wood, solid composite panels, or other surfaces other than drywall, access doors shall be recess type.
- .3 Flush mounted 750 x 750mm (30" x 30") for body entry and 300 x 300mm (12" x 12") for hand entry unless otherwise noted. Doors to open 180°, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps. Access doors for reheat coils/VAV boxes above drywall ceilings shall be 750 x 750mm (30" x 30") minimum.
 - .1 Material:
 - .1 Prime coated steel.
 - .2 Standard of Acceptance: Acudor UF-5000
 - .1 Alternate: Mifab UA.

- .4 Recessed, 300 x 300mm (12" x 12") minimum for hand entry unless otherwise noted. Recessed 16mm (5/8") door panel to allow insertion of various types of material. Outer frame as required to receive adjacent material. Concealed pivot rod hinge. Flush mounted, screwdriver operated cam latch.
 - .1 Use prime coated steel, with a primed white finish.
 - .2 Standard of Acceptance: mifab CAD-DW.
 - .1 Alternate: Acudor.
- .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 Fire rated access panels: 16 ga. mounting frame, 20 ga. sandwich type insulated self-closing door with concealed hinge, 50mm 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.

2.4 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 DN 50 (NPS 2) and under: isolating unions.
- .3 Pipes DN 65 (NPS 2 1/2) and over: isolating flanges.

2.5 PREPARATION FOR FIRESTOPPING

- .1 All firestopping under this contract is to be carried out by a single sub-contractor. Refer to Section 07 84 00 for further applicable requirements.
- .2 When penetration element pass through a fire rated separation floor or wall; maintain fire rating integrity.
- .3 Provide free annular space according to the corresponding listed system to be used.
- .4 Apply fire stop material according to the installation procedure corresponding to the selected listed systems used.
- .5 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.

- .6 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.
- .7 Ensure no metal to metal contact where pipe passes through sleeve.
- .8 Always submit specific firestop details of all penetration types as a shop drawing for review by the Consultant prior to construction, showing approval number and installation details.
- .9 For those firestop applications that exist for which no ULC or cUL tested system is available through a manufacturer; a manufacturer's engineering judgment derived from similar ULC or cUL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council (February 2007).
- .10 A manufacturer's direct representative (not distributor or agent) to be on site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

2.6 FIRESTOP 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 requirement and fire-rating involved for each separate instance.
- .2 Cast-in place firestop devices are installed prior to concrete placement for use with non-combustible and combustible plastic pipe (closed and open piping systems) penetrating concrete floors. The following products are acceptable:
 - .1 Hilti CP 680 Cast-In Place Firestop Device.
 - .2 Equivalent products listed in the U.L.C. Fire Resistance Directory - Volume III or UL Products Certified for Canada (cUL) Directory).
- .3 The following products are acceptable for sealants or caulking materials for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT).
 - .1 Hilti FS-ONE Intumescent Firestop Sealant.
 - .2 Hilti CP 604 Self Leveling Firestop Sealant.
 - .3 Hilti CP 620 Fire Foam.
 - .4 3M Fire Stop Sealant 2000.
 - .5 3M Fire Barrier CP25 WB.
 - .6 Tremco Tremstop Fyre-Sil Sealant.
 - .7 Equivalent products listed in the U.L.C. Fire Resistance Directory - Volume III or UL Products Certified for Canada (cUL) Directory.
- .4 Sealants or caulking materials for use with sheet metal ducts:
 - .1 Hilti CP 601s Elastomeric Firestop Sealant.

- .2 Hilti CP 606 Flexible Firestop Sealant.
- .3 Hilti FS-ONE Intumescent Firestop Sealant.
- .4 Hilti CP 604 Self Leveling Firestop Sealant.
- .5 Equivalent products listed in the U.L.C. Fire Resistance Directory - Volume III or UL Products Certified for Canada (cUL) Directory.
- .5 Intumescent sealants or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe:
 - .1 Hilti FS-ONE Intumescent Firestop Sealant.
 - .2 Hilti CP 620 Fire Foam.
 - .3 3M Fire Barrier CP25 WB.
 - .4 Tremco Tremstop WBM Intumescent Firestop Sealant.
 - .5 Equivalent products listed in the U.L.C. Fire Resistance Directory - Volume III or UL Products Certified for Canada (cUL) Directory.
- .6 Intumescent sealant, caulking or putty materials for use with flexible cable or cable bundles:
 - .1 Hilti FS-ONE Intumescent Firestop Sealant.
 - .2 Hilti CP 618 Firestop Putty Stick.
 - .3 Hilti CP 620 Fire Foam.
 - .4 3M Fire Barrier CP25 WB.
 - .5 Tremco Tremstop WBM Intumescent Firestop Sealant.
 - .6 Equivalent products listed in the U.L.C. Fire Resistance Directory - Volume III or UL Products Certified for Canada (cUL) Directory.
- .7 Non curing, re-penetrable intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles.
 - .1 Hilti CP 618 Firestop Putty Stick.
 - .2 Equivalent products listed in the U.L.C. Fire Resistance Directory - Volume III or UL Products Certified for Canada (cUL) Directory.
- .8 Wall opening protective materials for use with U.L.C. listed metallic and specified nonmetallic outlet boxes:
 - .1 Hilti CP 617 Firestop Putty Pad.
 - .2 Equivalent products listed in the U.L.C. Fire Resistance Directory - Volume III or UL Products Certified for Canada (cUL) Directory.
- .9 Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems) tested to 0.20" differential:
 - .1 Hilti CP 642 Firestop Collar.
 - .2 Hilti CP 643 Firestop Collar.
 - .3 Hilti CP 645 Wrap Strips.
 - .4 3M Fire Barrier PPD Plastic Pipe Device.
 - .5 Equivalent products listed in the U.L.C. Fire Resistance Directory - Volume III or UL Products Certified for Canada (cUL) Directory.
- .10 Materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways:
 - .1 Hilti FS 635 Trowelable Firestop Compound.

- .2 Hilti FS 657 FIREBLOCK.
 - .3 Hilti CP 620 Fire Foam.
 - .4 3M Firestop Foam 2001.
 - .5 3M Fire Barrier CS-195 Composite Sheet.
 - .6 Equivalent products listed in the U.L.C. Fire Resistance Directory - Volume III or UL Products Certified for Canada (cUL) Directory.
- .11 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:
- .1 Hilti FS 657 FIREBLOCK.
 - .2 Equivalent products listed in the U.L.C. Fire Resistance Directory - Volume III or UL Products Certified for Canada (cUL) Directory.

2.7 ACCEPTABLE FIRE STOP MANUFACTURERS

- .1 Submit to compliance with through penetration firestop systems listed in U.L.C. Fire Resistance Directory - Volume III or UL Products Certified for Canada (cUL) Directory, provide products of the following manufacturers as identified below:
- .1 Hilti (Canada) Limited.
 - .2 Tremco Sealants & Coatings.
 - .3 3M Fire Protection Products.
 - .4 Other manufacturers listed in the U.L.C. Fire Resistance Directory - Volume III or UL Products Certified for Canada (cUL) Directory.
- .2 Firestop Field Quality Control
- .1 Examine sealed penetration areas with both visual inspection combined with a small proportion of destructible test (destructible tests consist of removing the fire stop material on a small surface to ensure the proper thickness of fire stop material and proper thickness/compression of backing material plus verification of all limitations of listed system used to fire stop penetration) to ensure proper installation before concealing or enclosing areas.
 - .2 Keep areas of work accessible until inspection by authorities having jurisdiction.
 - .3 Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.
 - .4 Install a warning card that is clearly visible adjacent to all large and medium openings that may be re-penetrated. This card should contain the following information:
 - .1 Warning that the opening has been fire stop protected.
 - .2 Indicate the fire stop system used (ULC or cUL).
 - .3 F rating FT rating.
 - .4 Fire stop product(s) used.
- .3 Person to contact and phone number in case of modification or new penetration of fire stop system.

2.8 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.

PART 3 - EXECUTION

3.1 CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.2 FIELD QUALITY CONTROL

- .1 Site Tests: conduct tests in accordance with Section 01 45 00 – Quality Management.
- .2 Provide 4 days written notice to Parks Canada.

3.3 DEMONSTRATION

- .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 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .3 Instruction duration time requirements as specified in appropriate sections.

3.4 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

PART 1 – GENERAL

1.1 SECTION INCLUDES

- .1 This section includes specifications for all piping insulation requirements.

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE Standard 90.1-2013 (SI Edition), Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI Approved; IESNA Co-sponsored).
- .2 American Society for Testing and Materials (ASTM International)
 - .1 ASTM B209M-10, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
 - .2 ASTM C335-10ae1, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C411-05, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449-07, Standard Specification for Mineral Fiber-Hydraulic- Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C533-07, Specification for Calcium Silicate Block and Pipe Thermal Insulation.
 - .6 ASTM C534/C534M-08, Standard Specification for Preformed Flexible Cellular Thermal Insulation in Sheet and Tubular Form.
 - .7 ASTM C547-07e1, Specification for Mineral Fibre Pipe Insulation.
 - .8 ASTM C553-08, Specification for Mineral Fibre Blanket Insulation for Commercial and Industrial Applications.
 - .9 ASTM C612-04e1, Specification for Mineral Fibre Block and Board Thermal Insulation.
 - .10 ASTM C795-08, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .11 ASTM C921-09, Standard Specification for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.12-M86, Cement, Thermal Insulating and Finishing.
 - .2 CGSB 51-GP-52MA-89, Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .3 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.
- .4 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.
- .5 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-07, Method of Test for Surface Burning Characteristics of

Building Materials and Assemblies.

- .2 CAN/ULC S702-09, Thermal Insulation, Mineral Fibre, for Buildings.
- .3 CAN/ULC S702.2-10, Mineral Fibre Thermal Insulation for Buildings, Part 2: Application Guidelines

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves and jointing recommendations.

1.4 SAMPLES

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

1.5 INSTALLATION INSTRUCTIONS

- .1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.6 QUALIFICATIONS

- .1 Installer to be specialist in performing work of this section, and have successful experience in this size and type of project, qualified to standards of TIAC. When requested, provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather, construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions required by manufacturer.

1.8 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces provided the mechanical service is not visible from floor level.
 - .2 "EXPOSED" - will mean "not concealed" as defined herein.

1.9 WASTE MANAGEMENT AND DISPOSAL

- .1 Waste management and disposal to be in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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 specified values at 24 C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-1: Rigid moulded mineral fibre without factory applied vapour retarder jacket.
 - .1 Mineral fibre: to ASTM C547.
 - .2 Maximum "k" factor: to ASTM C547.
- .4 TIAC Code A.6: Flexible unicellular tubular elastomer.
 - .1 Insulation: to ASTM C534 with vapour retarder jacket.
 - .2 Jacket: to CGSB 51-GP-52 Ma.
 - .3 Maximum "k" factor: to ASTM C534.
 - .4 To be certified by manufacturer to be free of potential stress corrosion cracking corrodants.

2.3 INSULATION SECUREMENT

- .1 Tape: self-adhesive, aluminum, plain reinforced, 50 mm wide minimum.
- .2 Contact adhesive: quick-setting.
- .3 Canvas adhesive: washable.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

2.4 CEMENT

- .1 Thermal insulating and finishing cement:

- .1 To CAN/CGSB-51.12.
- .2 Hydraulic setting or Air drying on mineral wool, to ASTM C449/C449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

- .1 Water-based, fire-retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 JACKETS

- .1 Jacketing on Pipe Insulation: PVC Jacketing.

PART 3 - EXECUTION

3.1 PRE-INSTALLATION REQUIREMENT

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed, and certified.
- .2 Surfaces to be clean, dry, free from foreign material.

3.2 INSTALLATION

- .1 Install in accordance with TIAC 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 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes, including fire separations.
 - .1 Hangers, supports to be outside vapour retarder jacket.
- .5 Supports, Hangers:
 - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.3 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.

3.4 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-1.
 - .1 Securements: Tape @ 300 mm oc.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code 1501-H.
- .3 TIAC Code: A-3.
 - .1 Securements: Tape @ 300 mm oc.
 - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .4 TIAC Code: A-6.
 - .1 Insulation securements: SS wire.
 - .2 Seals: lap seal adhesive, lagging adhesive.
- .5 TIAC Code: C-2 with vapour retarder jacket.
 - .1 Insulation securements: Tape @ 300 mm oc.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .6 TIAC Code: A-2.
 - .1 Insulation securements: SS bands.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-H.
- .7 Thickness of insulation to be as listed in following table.
 - .1 ** Run-outs to individual units and equipment not exceeding 4000 mm long.
 - .2 ** Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.
- .8 Finishes:
 - .1 Exposed indoors: PVC Jacket.
 - .3 Use vapor retarder jacket on TIAC code A-3 insulation compatible with insulation.
 - .4 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.5 PIPING INSULATION SCHEDULES

Application	Temp °C	TIAC Code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	To 1	1 ¼ 2	2 ½ 4	5 6	8 & over
Condensate draining		A-1	25	38	38	38	38	38
Refrigerant hot gas liquid suction	4 - 13	A-6	25	25	25	25	25	25

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 This section includes specifications for all piping and fittings for drainage systems.

1.2 RELATED SECTIONS

- .1 Division 01 - General Requirements.
- .2 Section 22 05 00 - Common Work Results for Plumbing.
- .3 Section 22 07 20 - Thermal Insulation for Piping.
- .4 Section 23 05 05 - Installation of Pipework.

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM International).
 - .1 ASTM B32-08, Specification for Solder Metal.
 - .2 ASTM B306-09, Specification for Copper Drainage Tube (DWV).
 - .3 ASTM C564-09a, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .2 Canadian Standards Association (CSA International).
 - .1 CSA B67-1972(R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
 - .2 CAN/CSA B70-06, Cast Iron Soil Pipe, Fittings, and Means of Joining.
 - .3 CAN/CSA-B125.1-05, Plumbing Supply Fittings.
 - .4 CSA B242-05, Groove- and Shoulder-Type Mechanical Pipe Couplings.
- .3 National Research Council (NRC)/Institute for Research in Construction.
 - .1 NRCC 47688, National Plumbing Code of Canada – 2015.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Waste management and disposal to be in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- .1 Aboveground sanitary, storm, vent and indirect drains from mechanical equipment up to NPS 4, Type DWV to: ASTM B306.
 - .1 Fittings.
 - .1 Cast brass: to CAN/CSA-B125.1.
 - .2 Wrought copper: to CAN/CSA-B125.1.
 - .2 Solder: to ASTM B32.

PART 3 – EXECUTION

3.1 INSTALLATION

- .1 In accordance with Section 23 05 05 - Installation of Pipework.
- .2 Install in accordance with National Plumbing Code of Canada and local authority having jurisdiction.
- .3 Install buried pipe on 150 mm bed of clean washed sand, shaped to accommodate hubs and fittings, to line and grade as indicated. Backfill with 150 mm of clean washed sand.
- .4 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.
- .5 For threaded joints, use teflon tape applied to male thread only.

3.2 TESTING

- .1 Pressure test sanitary, vent and rain water leader piping in accordance with the National Plumbing Code of Canada.
 - .1 Pressure test buried systems before backfilling in accordance with the National Plumbing Code of Canada.
 - .2 Hydraulically test to verify grades and freedom from obstructions.
 - .3 Pressure test systems (with air or water) in accordance with the National Plumbing Code of Canada.
 - .4 Final test systems (with air or smoke) to a pressure of 25 mm water column in accordance with the National Plumbing Code of Canada.
 - .5 Test durations: minimum 1 hour for water systems; 2 hours for air systems.

3.3 PERFORMANCE VERIFICATION

- .1 Cleanouts:
 - .1 Ensure accessible and that access doors are correctly located.
 - .2 Open, cover with linseed oil and re-seal.
 - .3 Verify that cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Storm water drainage:
 - .1 Verify domes are secure.
 - .2 Verify provisions for movement of roof system.
- .4 Ensure that fixtures are properly anchored, connected to system and effectively vented.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 This section includes regulations and circumstances where mechanical systems may be used during construction.

1.2 RELATED SECTIONS

- .1 Division 01 - General Requirements.

1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings: submit drawings stamped where required, and signed by professional engineer registered or licensed in Province of Nova Scotia, Canada.
- .3 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .4 Shop drawings and product data 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 current model production.
 - .5 Certification of compliance to applicable codes.
- .5 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Parks Canada Representative before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .4 Maintenance data to 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.
 - .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

- .2 Equipment performance verification test results.
- .3 Special performance data as specified.
- .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Engineer for approval. Submission of individual data will not be accepted unless directed by Engineer.
 - .2 Make changes as required and re-submit as directed by Engineer.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 Parks Canada Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .9 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Engineer for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
 - .6 Submit copies of as-built drawings for inclusion in final TAB report.

1.4 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 – Quality Management System.

1.5 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:
 - .1 One glass for each gauge glass.
 - .2 One set of filter media for each filter.
 - .3 One set of fan belts for each belt driven equipment.

- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 DRAIN PANS

- .1 Design and construct drain pans to allow for easy cleaning. Pans to be 18 gauge stainless steel. Pans to be a minimum of 100mm wide with a minimum depth of 50mm. Pans shall be leak free.

PART 3 - EXECUTION

3.1 PAINTING, REPAIRS AND RESTORATION

- .1 Do painting in accordance with Section 09 91 00 - Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.3 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 – Quality Management System.
- .2 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 QUALITY ASSURANCE.

3.4 DEMONSTRATION

- .1 Parks Canada Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 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.
- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.

3.5 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 This section includes specifications for pipe installation.

1.2 RELATED SECTIONS

- .1 Division 01 - General Requirements.
- .2 Section 22 07 20 - Thermal Insulation for Piping.
- .3 Section 23 05 00 - Common Work Results for Mechanical.
- .4 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.3 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Waste management and disposal to be in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 CONNECTIONS TO EQUIPMENT

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.2 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.3 DRAINS

- .1 Install piping with grade in direction of flow except as indicated.
- .2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.

3.4 DIELECTRIC COUPLINGS

- .1 General: compatible with system, to suit pressure rating of system.
- .2 Locations: where dissimilar metals are joined.
- .3 NPS 2 and under: isolating unions or bronze valves.
- .4 Over NPS 2: isolating flanges.

3.5 PIPEWORK INSTALLATION

- .1 Screwed fittings jointed with Teflon tape.
- .2 Protect openings against entry of foreign material.
- .3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .4 Assemble piping using fittings manufactured to ANSI standards.
- .5 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .6 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .7 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .8 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .9 Group piping wherever possible and as indicated.
- .10 Ream pipes, remove scale and other foreign material before assembly.
- .11 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

3.6 SLEEVES

- .1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.
- .2 Material: Schedule 40 black steel pipe.
- .3 Construction: foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.
- .4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Installation:
 - .1 Concrete, masonry walls, concrete floors on grade: Terminate flush with finished surface.
 - .2 Other floors: terminate 25 mm above finished floor.
- .6 Sealing:
 - .1 Foundation walls and below grade floors: Fire retardant, waterproof non-hardening mastic.
 - .2 Elsewhere: Provide space for firestopping. Maintain fire rating integrity.

3.7 ESCUTCHEONS

- .1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.
- .2 Construction: One piece type with set screws. Chrome or nickel plated brass or type 302 stainless steel.
- .3 Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

3.8 FLUSHING OUT OF PIPING SYSTEMS

- .1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
- .2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11 - Cleaning supplemented as specified in relevant sections of Division 15.
- .3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.9 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

- .1 Advise Parks Canada Representative 4 work days minimum prior to performance of

pressure tests.

- .2 Pipework: test as specified in relevant sections of Divisions 22 and 23.
- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant sections of Divisions 22 and 23.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
- .5 Conduct tests in presence of Parks Canada Representative.
- .6 Pay costs for repairs or replacement, retesting, and making good.
- .7 Insulate or conceal work only after approval and certification of tests by Parks Canada Representative.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 This section includes specifications regarding electrical motors for HVAC equipment.

1.2 RELATED SECTIONS

- .1 Division 01 - General Requirements.

1.3 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE).
 - .1 ANSI/ASHRAE 90.1-2013 (SI), Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings, SI Edition.
- .2 Electrical Equipment Manufacturer's Association Council (EEMAC)
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

1.4 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Quality Control: in accordance with Section 01 45 00 - Quality Management System.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Closeout Submittals:
 - .1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements: work to be performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial /Territorial regulations.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety.

1.6 DELIVERY, STORAGE AND HANDLING

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

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Waste management and disposal to be in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 GENERAL

- .1 Motors: high efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

2.2 MOTORS

- .1 Provide motors for mechanical equipment as specified. Motors to be suitable for variable speed operation, where required.
- .2 Motors under 373 W: speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.
- .3 Motors 373 W and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 degrees C, 3 phase, unless otherwise indicated.

2.3 BELT DRIVES

- .1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.
- .2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.
- .3 For motors under 7.5 kW: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.
- .4 For motors 7.5 kW and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.
- .5 Correct size of sheave determined during commissioning.

- .6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
- .7 Motor slide rail adjustment plates to allow for centre line adjustment.
- .8 Supply one set of spare belts for each set installed in accordance with Section 01 78 00 - Closeout Submittals.

2.4 DRIVE GUARDS

- .1 Provide guards for unprotected drives.
- .2 Guards for belt drives:
 - .1 Expanded metal screen welded to steel frame.
 - .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
 - .3 38 mm dia holes on both shaft centres for insertion of tachometer.
 - .4 Removable for servicing.
- .3 Provide means to permit lubrication and use of test instruments with guards in place.
- .4 Install belt guards to allow movement of motors for adjusting belt tension.
- .5 Guard for flexible coupling:
 - .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
 - .2 Securely fasten in place.
 - .3 Removable for servicing.
- .6 Unprotected fan inlets or outlets:
 - .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
 - .2 Net free area of guard: not less than 80% of fan openings.
 - .3 Securely fasten in place.
 - .4 Removable for servicing.

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 datasheet.

3.2 INSTALLATION

- .1 Fasten securely in place.
- .2 Make removable for servicing, easily returned into, and positively in position.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 This section includes specifications for hangers and support for piping and valves as referenced in Sections 22 11 18 – Domestic Water Piping Copper, 23 21 15 – Hydronic Systems: Copper, 23 21 16 (Hydronic Systems: Water Piping Copper, Steel, and 23 23 00 - Refrigerant Piping.

1.2 RELATED SECTIONS

- .1 Division 01 - General Requirements.
- .2 Section 22 07 20 - Thermal Insulation for Piping.
- .3 Section 23 23 00 – Refrigerant Piping.

1.3 REFERENCES

- .1 National Fire Protection Association (NFPA)
 - .1 NFPA (Fire) 13, Standard for the Installation of Sprinkler Systems, 2010 Edition.
- .2 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.1-2010, Power Piping
- .3 American Society for Testing and Materials (ASTM International)
 - .1 ASTM A125-96(2007), Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307-07b, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A563-07a, Specification for Carbon and Alloy Steel Nuts.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA G40.20-04/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA G164-M92(R2003), Hot-Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CAN/CSA W59-03(R2008), Welded Steel Construction.
- .5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP-58-2002, Pipe Hangers and Supports – Materials, Design and Manufacture.
 - .2 ANSI/MSS SP-69-2003, Pipe Hangers and Supports – Selection and Application.
 - .3 MSS SP-89-2003, Pipe Hangers and Supports – Fabrication and Installation Practices.
- .6 Underwriter's Laboratories of Canada (ULC)
- .7 National Plumbing Code of Canada - 2015.

1.4 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
 - .2 Base maximum load ratings on allowable stresses prescribed by MSS SP58 and ASME B31.1.
 - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
 - .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
 - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

1.5 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Nova Scotia, Canada.
- .3 Submit shop drawings and product data for following items:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.
- .4 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .1 Parks Canada Representative will make available 1 copy of systems supplier's installation instructions.
- .5 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Waste management and disposal to be in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 – PRODUCTS

2.1 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

- .1 Finishes:
 - .1 Ensure steel hangers in contact with copper piping are copper plated.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
 - .1 Rod: 9 mm UL listed, 13 mm FM approved for sprinkler systems.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, to MSS-SP58 and MSS-SP69.
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, to MSS SP69.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut.
- .4 Upper attachment to concrete:
 - .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
 - .2 Concrete inserts: wedge shaped body with knockout protector plate to MSS SP69.
- .5 Shop and field-fabricated assemblies:
 - .1 Trapeze hanger assemblies.
 - .2 Steel brackets.
 - .3 Sway braces for restraint systems: to Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

- .6 Hanger rods: threaded rod material to MSS SP58:
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
 - .3 Do not use 22 mm or 28 mm rod.
- .7 Pipe attachments: material to MSS SP58:
 - .1 Attachments for steel piping: carbon steel black.
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 Use insulation shields for hot pipework.
 - .4 Oversize pipe hangers and supports.
- .8 Adjustable clevis: material to MSS SP69, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.
- .9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.
- .10 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
 - .1 Finishes for steel pipework: black.
 - .2 Finishes for copper, glass, brass or aluminum pipework: black, with formed portion plastic or epoxy coated.
- .11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

2.3 RISER CLAMPS

- .1 Steel or cast iron pipe: black carbon steel to MSS SP58, type 42.
- .2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.
- .3 Bolts: to ASTM A307.
- .4 Nuts: to ASTM A563.

2.4 INSULATION PROTECTION SHIELDS

- .1 Insulated cold piping:
 - .1 64 kg/m³ density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.
- .2 Insulated hot piping:
 - .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.

2.5 CONSTANT SUPPORT SPRING HANGERS

- .1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).

- .2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.
- .3 Provide upper and lower factory set travel stops.
- .4 Provide load adjustment scale for field adjustments.
- .5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.
- .6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.6 EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel.

2.7 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

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 datasheet.

3.2 INSTALLATION

- .1 Install in accordance with:
 - .1 Manufacturer's instructions and recommendations.
- .2 Clamps on riser piping:
 - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
 - .2 Bolt-tightening torques to industry standards.
 - .3 Steel pipes: install below coupling or shear lugs welded to pipe.
- .3 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .4 Support from structural members. Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

- .5 Use approved constant support type hangers where:
 - .1 vertical movement of pipework is 13 mm or more,
 - .2 transfer of load to adjacent hangers or connected equipment is not permitted.

3.3 HANGER SPACING

- .1 Plumbing piping: to most stringent requirements of National Plumbing Code of Canada, Provincial Code or authority having jurisdiction.
- .2 Fire protection: to applicable fire code.
- .3 Copper piping: up to NPS 1/2: every 1.5 m.
- .4 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.
- .5 Within 300 mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.1 m	1.8 m
1-1/2	2.7 m	2.4 m
2	3.0 m	2.7 m

3.4 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.

3.5 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
 - .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.

- .2 Adjustable clevis:
 - .1 Tighten hanger load nut securely to ensure proper hanger performance.
 - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 This section includes specifications for identification of all mechanical systems and equipment.

1.2 RELATED SECTIONS

- .1 Division 01 - General Requirements.

1.3 REFERENCES

- .1 Canadian Gas Association (CGA)
 - .1 CSA/CSA B139-10, Installation Code for Oil Burning Equipment.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.
 - .2 CAN/CGSB-24.3-92, Identification of Piping Systems.
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA (Fire) 13, Standard for the Installation of Sprinkler Systems, 2010 Edition.

1.4 SUBMITTALS

- .1 Product Data: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submittals: in accordance with Section 01 33 00 – Submittal Procedures.
- .3 Product data to include paint colour chips, other products specified in this section.
- .4 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.5 QUALITY ASSURANCE

- .1 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety.

1.6 DELIVERY, STORAGE, AND HANDLING

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

- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Waste management and disposal to be in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers raised or recessed.
- .3 Information to include, as appropriate:
 - .1 Equipment: manufacturer's name, model, size, serial number, capacity.
 - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

- .1 Colours:
 - .1 Hazardous: red letters, white background.
 - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
 - .1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
 - .1 Conform to following table:

Size # (mm)	Sizes (mm) of	No. of Lines	Height letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

- .2 Use maximum of 25 letters/numbers per line.

- .4 Locations:
 - .1 Terminal cabinets, control panels: use size # 5.
 - .2 Equipment in Mechanical Rooms: use size #9.

2.3 PIPING SYSTEMS GOVERNED BY CODES

- .1 Identification:
 - .1 Sprinklers: to NFPA 13.

2.4 IDENTIFICATION OF PIPING SYSTEMS

- .1 Medium in piping to be identified as indicated below showing name and service, including temperature and pressure as indicated below, and directional flow arrows where relevant.
 - .1 Material shall be vinyl/plastic coated cloth with protective over coating and waterproof contact adhesive undercoating, suitable for continuous operating temperature of 150°C and intermittent temperature of 200°F.
 - .2 Tape shall be 50mm wide single wrap around pipe or pipe covering with ends overlapping not less than 25mm. Tape is to be cut, not torn.
 - .3 Block capital letters 50mm high for pipes of 75mm nominal and larger o.d. including insulation and not less than ¾" high for smaller diameters shall be used.
 - .4 Direction arrows 6" long by 2" wide for piping of 3" nominal or large o.d. including insulation and 4" long by 20mm wide for smaller diameters to be used. Double headed arrows to be used where direction of flow is reversible.
 - .5 Waterproof and heat resistant plastic marker tags to be used for pipes and tubing of 20mm nominal and smaller o.d.
 - .6 Use black pipe marker letters and direction arrows. Use white on red background for fire protection pipe markers.
 - .7 Stenciled identification if used shall be from a first quality low VOC paint, with letters a minimum of 50mm. Use stenciling on all purpose or canvas insulation jackets only.
 - .8 A high quality pre-manufactured identification system may be used in lieu of the identification noted above. Submit proposed product(s) to Parks Canada and do not proceed until written approval received.
- .2 Location of Identification
 - .1 Markers and classifying colours on piping systems to be located so they can be seen from floor or platform.
 - .2 Piping runs to be identified at least once in each room, regardless of whether concealed or in open areas.
 - .3 Do not exceed 15m between identification, regardless of whether concealed or in open areas.
 - .4 In addition, where piping is concealed in pipe chase or other confined space, point of entry and leaving, and each access Opening to be identified.
 - .5 Both sides where piping passes through walls, partitions and floors to be identified.
 - .6 Piping to be identified at starting and ending points of runs and at each piece of

- equipment.
- .7 Identify branch, equipment or building served after each valve. (ie. Heating zones are to be identified in boiler rooms)
 - .8 Provide primary and secondary colour banding.
 - .9 Identification and colour coding shall be as per the following:

Pipe Marker	Valve Tag	Primary Colour	Second Colour
Condensate drain	COND	Green	Black
Refrigerant suction (include Refrig No.)	REF.S (No.)	Yellow	Black
Refrigerant liquid (include Refrig No.)	REF.L (No.)	Yellow	Black
Refrigerant hot gas (include Refrig No.)	REF.H.G. (No.)	Yellow	Black

2.5 IDENTIFICATION DUCTWORK SYSTEMS

- .1 50 mm high stenciled letters and directional arrows 150 mm long x 50 mm high.
- .2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

2.6 VALVES, CONTROLLERS

- .1 Brass tags with 12 mm 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 LANGUAGE

- .1 Identification in English.
- .2 Use one nameplate and label for each language.

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 datasheet.

3.2 INSTALLATION

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC or CSA registration plates as required by respective agency.
- .3 Identify systems, equipment to conform to PWGSC PMSS.

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.

3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

- .1 On long straight runs, equipment runs in open areas in boiler rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification easily and accurately readable from usual operating areas and from access points.
 - .1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.5 CONTROLLERS

- .1 Operating controllers: Secure tags with non-ferrous chains or closed "S" hooks.

3.6 FIELD QUALITY CONTROL

- .1 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

3.7 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

PART 1 – GENERAL

1.1 SECTION INCLUDES

- .1 This section includes specifications for testing, adjusting and balancing (TAB) for ventilation distribution and fan coils units.

1.2 RELATED SECTIONS

- .1 Division 01 - General Requirements.

1.3 SUMMARY

- .1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.
- .2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.4 QUALIFICATIONS OF TAB PERSONNEL

- .1 Submit names of personnel to perform TAB to Engineer within 90 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
 - .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.
 - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.
 - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.
- .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

- .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
- .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.5 PURPOSE OF TAB

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.
- .2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.6 EXCEPTIONS

- .1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.7 CO-ORDINATION

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.8 PRE-TAB REVIEW

- .1 Review contract documents before project construction is started and confirm in writing to Parks Canada Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to Engineer in writing proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.9 START-UP

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

- .2 Follow special start-up procedures specified elsewhere in Division 22 and Division 23.

1.10 OPERATION OF SYSTEMS DURING TAB

- .1 Operate systems for length of time required for TAB and as required by Parks Canada Representative for verification of TAB reports.

1.11 START OF TAB

- .1 Notify Parks Canada Representative 5 days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:
 - .1 Installation of ceilings, doors, windows, other construction affecting TAB.
 - .2 Application of weather stripping, sealing, and caulking.
- .3 Pressure, leakage, other tests specified elsewhere in Division 22 and Division 23.
- .4 Provisions for TAB installed and operational.
- .5 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Air systems:
 - .1 Filters in place, clean.
 - .2 Duct systems clean.
 - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
 - .4 Correct fan rotation.
 - .5 Volume control dampers installed and open.
 - .6 Coil fins combed, clean.
 - .7 Access doors, installed, closed.
 - .8 Outlets installed, volume control dampers open.

1.12 APPLICATION TOLERANCES

- .1 Do TAB to following tolerances of design values:
 - .1 HVAC systems: plus or minus 10%.

1.13 ACCURACY TOLERANCES

- .1 Measured values accurate to within plus or minus 2% of actual values.

1.14 INSTRUMENTS

- .1 Prior to TAB, submit to Engineer list of instruments used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for

either applicable system or HVAC system.

- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Parks Canada Representative.

1.15 SUBMITTALS

- .1 Submit, prior to commencement of TAB:
 - .1 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.16 PRELIMINARY TAB REPORT

- .1 Submit for checking and approval of Engineer, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
 - .1 Details of instruments used.
 - .2 Details of TAB procedures employed.
 - .3 Calculations procedures.
 - .4 Summaries.

1.17 TAB REPORT

- .1 TAB report to show results in SI units and to include:
 - .1 Project record drawings.
 - .2 System schematics.
- .2 Submit an electronic copy of TAB Report to Parks Canada Representative for verification and approval.

1.18 VERIFICATION

- .1 Reported results subject to verification by Parks Canada Representative.
- .2 Provide personnel and instrumentation to verify up to 30% of reported results.
- .3 Number and location of verified results as directed by Parks Canada Representative.
- .4 Pay costs to repeat TAB as required to satisfaction of Parks Canada Representative.

1.19 SETTINGS

- .1 After TAB is completed to satisfaction of Parks Canada Representative, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.
- .2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.20 COMPLETION OF TAB

- .1 TAB considered complete when final TAB Report received and approved by Engineer.

1.21 AIR SYSTEMS

- .1 Standard: TAB to most stringent of this section or TAB standards of AABC NEBB SMACNA ASHRAE.
- .2 Do TAB of systems, equipment, components, controls specified Division 23.
- .3 Qualifications: personnel performing TAB current member in good standing of AABC or NEBB qualified to standards of AABC or NEBB.
- .4 Quality assurance: perform TAB under direction of supervisor qualified by standards of AABC or NEBB.
- .5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dew point), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
- .6 Locations of equipment measurements: to include as appropriate:
 - .1 Inlet and outlet of dampers, filter, coil, fan, other equipment causing changes in conditions.
 - .2 At controllers, controlled device.
- .7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 NOT USED

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 This section includes specifications for all ventilation duct insulation requirements.

1.2 RELATED SECTIONS

- .1 Division 01 - General Requirements.

1.3 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE 90.1-2007, Energy Standard for Buildings Except Low-Rise Residential Buildings, SI Edition. Includes Addenda a, b, c, g, h, i, j, k, l, m, n, p, q, s, t, u, w, y, ad, and aw, and errata (2009).
- .2 American Society for Testing and Materials (ASTM International)
 - .1 ASTM B209M-07, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
 - .2 ASTM C335-05ae1, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C411-05, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449-07, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C547-07e1, Standard Specification for Mineral Fiber Pipe Insulation.
 - .6 ASTM C553-08, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .7 ASTM C612-09, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .8 ASTM C795-08, Standard Specification for Thermal Insulation Stainless Steel.
 - .9 ASTM C921-09, for Use with Austenitic Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 1-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.
- .5 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-07, Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701-05, Thermal Insulation Polystyrene, Boards and Pipe Covering.
 - .3 CAN/ULC-S702-09, Thermal Insulation, Mineral Fibre, for Buildings.
 - .4 CAN/ULC-S702.2-10, Mineral Fibre Thermal Insulation for Buildings, Part 2: Application Guidelines.

1.4 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 provided the mechanical service is not visible from floor level.
 - .2 "EXPOSED" - will mean "not concealed" as defined herein.
 - .3 Insulation systems – insulation material, fasteners, jackets, and other accessories.
- .2 TIAC Codes:
 - .1 CRD: Code Round Ductwork,
 - .2 CRF: Code Rectangular Finish.

1.5 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

1.6 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

1.7 MANUFACTURERS' INSTRUCTIONS

- .1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Installation instructions to include procedures used, and installation standards achieved.

1.8 QUALIFICATIONS

- .1 Installer: specialist in performing work of this section, and have successful experience in this size and type of project, qualified to standards. When requested, provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.

1.9 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 temperatures and conditions recommended by manufacturer.

1.10 WASTE MANAGEMENT AND DISPOSAL

- .1 Waste management and disposal to be in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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 includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24° C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with or without factory-applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).
- .4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with or without factory-applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
 - .1 Mineral fibre: to ASTM C553.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to ASTM C553.

2.3 JACKETS

- .1 Canvas:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921
 - .2 Rectangle ductwork should come with corner beads were covered with canvas jacket were exposed.
- .2 Lagging adhesive: compatible with insulation.
- .3 Aluminum:
 - .1 To ASTM B209 with and without moisture barrier as scheduled in PART 3 of

- this section.
- .2 Thickness: 0.50 mm sheet.
- .3 Finish: stucco embossed.
- .4 Jacket banding and mechanical seals: 19 mm wide, 0.5 mm thick stainless steel.

2.4 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 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .5 Outdoor vapour retarder mastic:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
 - .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m².
- .6 Tape: self-adhesive, aluminum, plain, 75 mm wide minimum.
- .7 Contact adhesive: quick-setting
- .8 Canvas adhesive: washable.
- .9 Tie wire: 1.5 mm stainless steel.
- .10 Banding: 19 mm wide, 0.5 mm thick stainless steel.
- .11 Fasteners: 4 mm diameter pins with 35 mm square clips, length to suit thickness of insulation.

PART 3 - EXECUTION

3.1 PRE-INSTALLATION REQUIREMENTS

- .1 Pressure testing of ductwork systems complete, witnessed and certified.
- .2 Surfaces clean, dry, 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 as indicated.
- .3 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Hangers, supports to be outside vapour retarder jacket.
- .5 Supports, hangers in accordance with Section 23 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.
- .6 Fasteners: at 300 mm oc in horizontal and vertical directions, minimum two rows each side.
- .7 Blank off sections of louvres to be insulated with 100 mm thick insulation sandwiched between 2 galvanized sheets of metal.

3.3 DUCTWORK INSULATION SCHEDULE

- .1 Insulation types and thicknesses: Conform to following table:

	TIAC CODE	VAPOUR RETARDER	THICKNESS (MM)
Rectangular cold and dual temperature supply air ducts	C-1	Yes	25
Round cold and dual temperature supply air ducts	C-2	Yes	25
Supply and return exposed in space being served			None- unless indicated on drawings

- .2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:
 - .1 Use TIAC code C-1 insulation, scored to suit diameter of duct.
- .3 Finishes: Conform to following table:

	TIAC CODE	
	RECTANGULAR	ROUND
Indoor, concealed	None	none
Indoor, exposed elsewhere	CRF/2	CRD/3

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 This section includes specifications for refrigerant piping and valves.

1.2 RELATED SECTIONS

- .1 Division 01 - General Requirements.
- .2 Section 22 07 20 - Thermal Insulation for Piping.
- .3 Section 23 05 00 - Common Work Results for Mechanical.
- .4 Section 23 05 05 - Installation of Pipework.
- .5 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
- .6 Section 23 05 54 - Mechanical Identification.
- .7 Section 23 81 24 - Multiple Split Air Conditioning System.

1.3 REFERENCES

- .1 American Society of Mechanical Engineers(ASME)
 - .1 ASME B16.22-2001(R2005), Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings.
 - .2 ASME B16.24-2006, Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.
 - .3 ASME B16.26-2006, Cast Copper Alloy Fittings for Flared Copper Tubes.
 - .4 ASME B31.5-2006, Refrigeration Piping and Heat Transfer Components.
- .2 American Society for Testing and Materials (ASTM International)
 - .1 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM B280-08, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA B52-09, Supplement No. 1 to B52-05 Mechanical Refrigeration Code.
- .4 Environment Canada (EC)
 - .1 EPS 1/RA/1-96, Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

1.4 SUBMITTALS

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

- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings, valves and equipment.
- .3 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 – Closeout.

1.5 QUALITY ASSURANCE

- .1 Verify project requirements.
- .2 Review installation conditions.
- .3 Co-ordination with other building subtrades.
- .4 Review manufacturer's installation instructions and warranty requirements.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Waste management and disposal to be in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 – PRODUCTS

2.1 TUBING

- .1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.
 - .1 Hard copper: to ASTM B280, type ACR.
 - .2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5.

2.2 FITTINGS

- .1 Service: design pressure 2070 kPa and temperature 121 degrees C.
- .2 Brazed:
 - .1 Fittings: wrought copper to ASME B16.22.
 - .2 Joints: silver solder, 45% Ag-15% Cu-5% or copper-phosphorous, 95% Cu-5%P and non-corrosive flux.
- .3 Flanged:
 - .1 Bronze or brass, to ASME B16.24, Class 150 and Class 300.
 - .2 Gaskets: suitable for service.
 - .3 Bolts, nuts and washers: to ASTM A307, heavy series.
 - .4 Flared:
 - .1 Bronze or brass, for refrigeration, to ASME B16.26.

2.3 PIPE SLEEVES

- .1 Hard copper or steel, sized to provide 6 mm clearance around between sleeve and uninsulated pipe or between sleeve and insulation.

2.4 VALVES

- .1 22 mm and under: Class 500, 3.5 MPa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections.
- .2 Over 22 mm: Class 375, 2.5 MPa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moisture-proof seal for below freezing applications, brazed connections.
- .3 All valves to have CRN, registration number.
- .4 Acceptable manufacturers: Sporlan, Alco, Muller.

2.5 SIGHT GLASS

- .1 Provide moisture indicating double sight glass upstream from expansion valve.

PART 3 - EXECUTION

3.1 GENERAL

- .1 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5.
- .2 Connect to equipment with isolating valves and flanges.
- .3 Provide space for servicing, disassembly and removal of equipment and components all as recommended by manufacturer.
- .4 Protect all openings in piping against entry of foreign material.
- .5 Soft copper only allowed to use for connection to units; all other piping shall be hard rigid copper.

3.2 INSTALLATION AND TESTING

- .1 Installation shall be performed by certified refrigeration mechanics/technicians registered in Province of Nova Scotia.
- .2 Refrigeration Contractor shall provide to the Condenser/Evaporator Manufacturer a detailed piping schematic prior to shop drawing acceptance. Schematic to indicate: length and run of refrigerant piping connecting outdoor condensing units and cooling coils, all bends and changes in elevation in piping, line sizes, and size and manufacturer of thermal expansion valve, pump down solenoid and moisture indicating double sight glass. Condenser/Evaporator Manufacturer to verify refrigerant piping line sizes, prior to final shop drawing submission. Install double risers where instructed by Condenser/

Evaporator Manufacturer.

- .3 Upon reviewing Refrigerant Contractor's piping schematic Condenser/Evaporator Manufacturer to determine whether further refrigerant change is required. Charge only with amount of refrigerant as recommended by Condenser/ Evaporator Manufacturer and follow Condenser/ Evaporator Manufacturer's charging instructions.

3.3 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.

3.4 PIPING INSTALLATION

- .1 All pipes and cross tees to be Sch80 extra heavy.
- .2 General:
 - .1 Soft annealed copper tubing: bend without crimping or constriction. Hard drawn copper tubing: do not bend. Minimize use of fittings.
- .3 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 high and at each 7600 mm thereafter.
 - .3 Provide inverted deep trap at top of risers.
 - .4 Provide double risers for compressors having capacity modulation.
 - .1 Large riser: install traps as specified.
 - .2 Small riser: size for 5.1 m/s at minimum load. Connect upstream of traps on large riser.

3.5 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:
 - .1 The testing media shall be dry nitrogen. The Contractor shall perform the leak test before insulating, evacuating and charging, in the presence of the Parks Canada Representative.
 - .2 Charge the system to pressures listed above and allow it to remain under pressure for 24 hours. Maximum pressure drop shall be 34.5 kPa in 24 hours, at constant ambient temperature. For every 5.5°C drop in ambient temperature, from start of test, the maximum pressure drop may increase by 20.7 kPa.

- .3 Isolate the compressor from the leak test by firmly closing the suction and discharge valves.
- .4 Do not attempt to repair any leak while the system is pressurized. If any leaks are found, relieve the test pressure and perform repairs. Repeat test to ensure all leaks have been repaired.
- .5 Parks Canada Representative shall witness all tests.

3.6 FIELD QUALITY CONTROL

- .1 Tests shall be made in steps with a final pressure of 4135 kPa.
- .2 Site Tests / Inspection:
 - .1 Close service valves on factory charged equipment.
- .3 Ambient temperatures to be at least 13 degrees C for at least 12 hours before and during dehydration.
- .4 Use copper lines of largest practical size to reduce evacuation time.
- .5 Use two-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5 Pa absolute and filled with dehydrated oil.
- .6 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.
- .7 Triple evacuate 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 Engineer for review.
- .8 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.
- .9 Checks:
 - .1 Make all checks and measurements as per manufacturer's operation and maintenance instructions.
 - .2 Record and report measurements to Engineer.

3.7 CLEANING

- .1 Perform cleaning operations in accordance with manufacturer's recommendations.
- .2 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 SECTION INCLUDES

- .1 This section includes specifications and procedures for HVAC ductwork construction and installation.

1.2 RELATED SECTIONS

- .1 Division 01 - General Requirements.
- .2 Section 23 05 54 - Mechanical Identification.
- .3 Section 23 33 00 - Air Duct Accessories.
- .4 Section 23 33 14 - Dampers - Balancing.
- .5 Section 23 37 13 - Diffusers.
- .6 Section 23 81 21 - Multiple Split Air Conditioning System.

1.3 REFERENCES

- .1 American Society of Heating, Refrigerating and Air- Conditioning Engineers, Inc. (ASHRAE).
- .2 American Society for Testing and Materials (ASTM International).
 - .1 ASTM A480/A480M-10, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .2 ASTM A635/A635M-09b, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.
 - .3 ASTM A653/A653M-09a, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act(CEPA), 1999, c. 33.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .5 National Fire Protection Association (NFPA).
 - .1 NFPA (Fire) 90A, Installation of Air Conditioning and Ventilating Systems, 2009 edition.
 - .2 NFPA (Fire) 90B, Installation of Warm Air Heating and Air-Conditioning Systems, 2009 edition.
 - .3 NFPA (Fire) 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations, 2008 Edition.

- .6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA 1966, HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition 2005.
 - .2 SMACNA 1143, HVAC Air Duct Leakage Test Manual, 1985, 1st Edition, Technical Research Update - 92.

1.4 SUBMITTALS

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.5 QUALITY ASSURANCE

- .1 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.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Waste management and disposal to be in accordance with Section 01 4 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 SEAL CLASSIFICATION

- .1 Classification as follows:

<u>Maximum Pressure Pa</u>	<u>SMACNA Seal Class</u>
500	C
250	C
125	C

- .2 Seal classification:
 - .1 Class C: transverse joints and connections made air tight with gaskets, sealant, tape or combination thereof. Longitudinal seams unsealed.

2.2 SEALANT

- .1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30°C to plus 93°C.
 - .1 Acceptable manufacturers: Duro Dyne, Foster, Bakor.

2.3 TAPE

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.
 - .1 Acceptable manufacturers: Duro-Dyne, Bakor, Foster.

2.4 DUCT LEAKAGE

- .1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

2.5 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows:
 - .1 Rectangular: standard radius or short radius with single thickness turning vanes.
Centreline radius: 1.5 times width of duct, where possible.
- .3 Branches:
 - .1 Rectangular main and branch: with radius on branch 1.5 times width of duct, where possible.
 - .2 Round main and branch: enter main duct at 45° with conical tee.
 - .3 Provide volume control damper in branch duct near connection to main duct.
- 4 Main duct branches: with splitter damper.
- .5 Any round duct branches shall be conical tee constructed.
- .6 Transitions:
 - .1 Diverging: 20° maximum included angle.
 - .2 Converging: 30° maximum included angle.
- .7 Offsets:
 - .1 Full radiused elbows as required or as indicated.
- .8 Round ducts and fittings shall be galvanized steel of the following minimum gauges:

Duct Diameter	Spiral Duct Gauge	Plain Duct Gauge
203 mm and smaller	28	24
228 mm – 356 mm	26	24
380 mm – 660 mm	24	N/A

2.6 FIRESTOPPING

- .1 Retaining angles all around duct, on both sides of fire separation in accordance with section 07 84 00 - Firestopping.
- .2 Firestopping material and installation must not distort duct.
- .3 Coordinate with installer of fireproofing.

2.7 GALVANIZED STEEL

- .1 Lock forming quality: to ASTM A653/A653M, Z90 coating.

- .2 Thickness, fabrication and reinforcement: to ASHRAE and SMACNA.
- .3 Joints: to ASHRAE and SMACNA or proprietary manufactured duct joint. Proprietary manufactured flanged duct joint shall be considered to be a class A seal.
 - .1 Acceptable material: Ductmate Canada Ltd., Mez Industries, Ward Industries (for proprietary joints).

2.8 HANGERS AND SUPPORTS

- .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger: 500 mm.
- .2 Hanger configuration: to ASHRAE and SMACNA.
- .3 Hangers: galvanized steel angle with galvanized steel rods to ASHRAE and SMACNA following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

- .4 Upper hanger attachments:
 - .1 For concrete: manufactured concrete inserts.
 - .1 Acceptable manufacturers: Myatt, Grinnell, Erico.
 - .2 For steel joists: manufactured joist clamp or steel plate washer.
 - .1 Acceptable manufacturers: Grinnell, Myatt, Erico.
 - .3 For steel beams: manufactured beam clamps:
 - .1 Acceptable manufacturers: Grinnell, Myatt, Erico.

PART 3 - EXECUTION

3.1 GENERAL

- .1 Do work in accordance with ASHRAE, SMACNA and as indicated.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods. Insulate strap hangers 100 mm beyond insulated duct.
- .3 Support risers in accordance with ASHRAE and SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation.

- .5 Install proprietary manufactured flanged duct joins in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

3.2 HANGERS

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

3.3 SEALING AND TAPING

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturer's recommendations.

3.4 LEAKAGE TESTS

- .1 In accordance with SMACNA HVAC Duct Leakage Test Manual.
- .2 Do leakage tests in sections.
- .4 Make trial leakage tests as instructed to demonstrate workmanship.
- .5 Do not install additional ductwork until trial test has been passed.
- .6 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.
- .7 Complete test before performance insulation or concealment Work.
- .8 Test to be witnessed by Parks Canada Representative. Provide 3 days' notice prior to testing.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 This section includes specifications and procedures for HVAC ductwork construction and installation.

1.2 RELATED SECTIONS

- .1 Division 01 - General Requirements.
- .2 Section 23 31 14 - Metal Ducts - Low Pressure to 500 pa.
- .3 Section 23 33 14- Dampers - Balancing
- .4 Section 23 72 00 - Air-to-Air Energy Recovery Equipment
- .5 Section 23 81 24 - Multiple Split Air Conditioning System

1.3 REFERENCES

- .1 Sheet Metal and Air Conditioning National Association (SMACNA)
 - .1 SMACNA 1966, HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition 2005.

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 -Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet.
Indicate the following:
 - .1 Flexible connections.
 - .2 Duct access doors.
 - .3 Turning vanes.
 - .4 Instrument test ports.
- .3 Instructions: submit manufacturer's installation instructions.
- .4 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 QUALITY ASSURANCE

- .1 Verify project requirements.
- .2 Review installation conditions.
- .3 Co-ordination with other building subtrades.

- .4 Review manufacturer's installation instructions and warranty requirements.
- .5 Verification: contractor's verification in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Waste management and disposal to be in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 GENERAL

- .1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards CSA B228.1.

2.2 FLEXIBLE CONNECTIONS

- .1 Frame: galvanized sheet metal frame .66 mm thick with fabric clenched by means of double locked seams.
- .2 Material:
 - .1 Fire resistant, self-extinguishing, neoprene coated glass fabric, temperature rated at minus 40°C to plus 90°C, density of 1.3 kg/m2.

2.3 ACCESS DOORS IN DUCTS

- .1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.
- .2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.
- .3 Gaskets: neoprene.
- .4 Hardware:
 - .1 Up to 300 x 300 mm: 2 sash locks complete with safety chain.
 - .2 301 to 450 mm: 4 sash locks complete with safety chain.
 - .3 451 to 1000 mm: piano hinge and minimum 2 sash locks.
 - .4 Doors over 1000 mm: piano hinge and 2 handles operable from both sides with hold open devices.
 - .5 Acceptable manufacturers: Mifab, SMS, Acudor.

2.4 TURNING VANES

- .1 Factory or shop fabricated double thickness with trailing edge, to recommendations of SMACNA and as indicated.
- .2 Acceptable manufacturers: Duro Dyne, Dynair, AeroDyne.

2.5 INSTRUMENT TEST

- .1 1.6 MM thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.
- .3 28 mm minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.
- .5 Acceptable manufacturer: Duro Dyne.

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 data sheet.

3.2 INSTALLATION

- .1 Flexible Connections:
 - .1 Install in following locations:
 - .1 Inlets and outlets to fan coil units.
 - .2 Length of connection: 100 mm.
 - .3 Minimum distance between metal parts when system in operation: 75 mm.
 - .4 Install in accordance with recommendations of SMACNA.
 - .5 When fan is running:
 - .1 Ducting on sides of flexible connection to be in alignment.
 - .2 Ensure slack material in flexible connection.
- .2 Access Doors:
 - .1 Provide adequately sized galvanized steel access doors for all devices requiring inspection, maintenance or cleaning.
 - .2 Access doors shall be located before and after coils, filters, fans, automatic dampers, at fire dampers, fresh air and exhaust air plenums, bottoms of risers, and where required elsewhere.
 - .3 Access doors shall be minimum 305 mm x 305 mm for hand access and 610 mm x 610 mm for body access.
 - .4 Access doors shall be tight fitting with sealing gaskets and suitable quick

fastening locking devices. Insulate access doors where they are installed in insulated ductwork or plenums.

.5 Access points in ductwork shall be no more than 9000 mm apart.

.6 Gasketed panels (patches) minimum size 305 mm x 305 mm and fabricated from the same material as the duct and fastened with sheet metal screws are permitted if the access is for cleaning only; otherwise access doors shall be provided.

.3 Instrument Test Ports

.1 General:

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.2 Locate to permit easy manipulation of instruments.

.3 Install insulation port extensions as required.

.4 Locations:

.1 For traverse readings:

.1 Inlets and outlets of air handling systems.

.2 Main and sub-main ducts.

.3 And as indicated.

.4 Turning vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION

- .1 This section includes specifications for HVAC Includes duct balancing damper construction and installation.

1.2 RELATED SECTIONS

- .1 Division 01 - General Requirements. Sections
- .2 Section 23 31 14 - Metal Ducts - Low Pressure to 500 Pa.
- .3 Section 23 33 00 - Air Duct Accessories.
- .4 Section 23 37 13 - Diffusers

1.3 REFERENCES

- .1 Sheet Metal and Air Conditioning National Association (SMACNA)
 - .1 SMACNA 1966, HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition 2005.

1.4 SUBMITTALS

- .1 Product Data:
 - .1 Where applicable, submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

1.5 DELIVERY, STORAGE AND HANDLING

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

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Waste management and disposal to be in Management and accordance with Section 01 74 21 – Disposal Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 GENERAL

- .1 Manufacture to SMACNA standards.

2.2 SINGLE BLADE DAMPERS

- .1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height of 300 mm.
- .3 Locking quadrant with shaft extension to accommodate insulation thickness.
- .4 Inside and outside nylon or bronze end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.
- .6 Acceptable manufacturers:
 - .1 Nailor
 - .2 E.H. Price
 - .3 Titus
 - .4 Ruskin

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 datasheet.

3.2 INSTALLATION

- .1 Install on all branch ducts and where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .4 All dampers to be vibration-free.
- .5 Ensure damper operators are observable and accessible.

3.3 FIELD QUALITY CONTROL

- .1 Tests:
 - .1 Tests to demonstrate that system is functioning as specified.

END OF SECTION

PART 1 **GENERAL**

1.1 **SUMMARY**

- .1 Section Includes:
 - .1 Fire dampers.

1.2 **RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 35 29.06 – Health and Safety Requirements.
- .3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .4 Section 23 31 13.01 – Metal Ducts – Low Pressure to 500 Pa.

1.3 **REFERENCES**

- .1 American National Standards Institute/National Fire Protection Association (ANSI/NFPA)
 - .1 ANSI/NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 Underwriters Laboratories of Canada (ULC)
 - .1 CAN4-S112, Fire Test of Fire Damper Assemblies.
 - .2 CAN4-S112.2, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.
 - .3 ULC-S505, Fusible Links for Fire Protection Service.

1.4 **SUBMITTALS**

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Indicate the following:
 - .1 Fire dampers.
 - .2 Operators.
 - .3 Fusible links.
 - .4 Design details of break-away joints.

- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
- .3 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals

1.5 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .2 Certificates:
 - .1 Catalogue or published ratings those obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.6 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00 – Closeout Submittals.
 - .2 Provide the following:
 - .1 6 fusible links of each type.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 FIRE DAMPERS

- .1 Fire dampers: arrangement Type B or C, blades out of air stream listed and bear label of ULC, meet requirements of provincial fire authority and ANSI/NFPA 90A. Fire damper

- assemblies to be fire tested in accordance with CAN4-S112. Minimum rating 1 ½ hours, dynamically rated.
- .2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
 - .3 Top hinged: offset, round or square; multi-blade hinged or interlocking type; roll door type; or guillotine type; sized to maintain full duct cross section.
 - .4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.
 - .5 Retaining angle iron frame, 40 x 40 x 3 mm, on full perimeter of fire damper, on both sides of fire separation being pierced.
 - .6 Equip fire dampers with steel sleeve or frame installed to prevent disruption of ductwork or impair damper operation.
 - .7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.
 - .8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.
 - .9 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness.
 - .10 Unless otherwise indicated, the installation details given in SMACNA Fire, Smoke, and Radiation Damper Installation Guide for HVAC and in manufacturer's instructions for fire dampers shall be followed.

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 datasheet.

3.2 **INSTALLATION**

- .1 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.
- .2 Maintain integrity of fire separation.
- .3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
- .4 Install access door adjacent to each damper. See Section 23 33 00 – Air Duct Accessories.
- .5 Coordinate with installer of firestopping to Section 07 84 00 – Firestopping.

- .6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.
- .7 Install break-away joints of approved design on each side of fire separation.

3.3 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 4 **GENERAL**

4.1 **SUMMARY**

.1 Section Includes:

- .1 Materials and installation of flexible ductwork, joints and accessories.

4.2 **RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.
.2 Section 01 35 29.06 – Health and Safety Requirements.
.3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

4.3 **REFERENCES**

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
.2 Department of Justice Canada (Jus).
.1 Canadian Environmental Protection Act (CEPA).
.2 Transportation of Dangerous Goods Act, (TDGA).
.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
.1 Material Safety Data Sheets (MSDS).
.4 National Fire Protection Association (NFPA).
.1 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.
.2 NFPA 90B, Standard for Installation of Warm Air Heating and Air-Conditioning Systems.
.5 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).
.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible.
.2 SMACNA IAQ Guideline for Occupied Buildings under Construction.
.6 Underwriters' Laboratories Inc. (UL).
.1 UL 181, Standard for Factory-Made Air Ducts and Air Connectors.
.7 Underwriters' Laboratories of Canada (ULC).
.1 CAN/ULC-S110, Standard Methods of Tests for Air Ducts.

4.4 **SUBMITTALS**

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
.2 Product Data: submit WHMIS MSDS in accordance with Section 02 60 00.01 - Hazardous Materials for the following:

- .1 Thermal properties.
- .2 Friction loss.
- .3 Acoustical loss.
- .4 Leakage.
- .5 Fire rating.
- .3 Samples: submit samples with product data of different types of flexible duct being used in accordance with Section 01 33 00 - Submittal Procedures.

4.5 QUALITY ASSURANCE

- .1 Certification of Ratings:
 - .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

4.6 DELIVERY, STORAGE AND HANDLING

- .1 Protect on site stored or installed absorptive material from moisture damage.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
 - .4 Place materials defined as hazardous or toxic in designated containers.
 - .5 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
 - .6 Ensure emptied containers are sealed and stored safely.
 - .7 Fold up metal and plastic banding, flatten and place in designated area for recycling.

4.7 INDOOR AIR QUALITY (IAQ)

- .1 During construction, meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction.

PART 5 **PRODUCTS**

5.1 **GENERAL**

- .1 Factory fabricated to CAN/ULC S110.
- .2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.
- .3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

5.2 **METALLIC - UNINSULATED**

- .1 Type 1: spiral wound flexible aluminum.
- .2 Performance:
 - .1 Factory tested to 1000 Pa without leakage.
 - .2 Maximum relative pressure drop coefficient: 3.

PART 6 **EXECUTION**

6.1 **DUCT INSTALLATION**

- .1 Install in accordance with: NFPA 90A and NFPA 90B SMACNA.
- .2 Do leakage test in accordance with Section 23 05 94 - Pressure Testing of Ducted Air System.
- .3 Do trial test to demonstrate workmanship.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Division 01 - General Requirements.
- .2 Section 23 31 14 - Metal Ducts - Low Pressure to 500 Pa.

1.2 SYSTEM DESCRIPTION

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .2 Indicate following:
 - .1 Capacity.
 - .2 Throw and terminal velocity.
 - .3 Noise criteria.
 - .4 Pressure drop.
 - .5 Neck velocity.

1.4 DELIVERY, STORAGE AND HANDLING

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

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Waste management and disposal to be in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 – PRODUCTS

2.1 GENERAL

- .1 To meet capacity, pressure drop, velocity, throw, noise level, neck velocity as indicated.

- .2 Frames:
 - .1 Plaster frames where set into gypsum board.
 - .2 Concealed fasteners.
- .3 Colour: black
- .4 The unit shall be delivered with a spigot made and tagged by the manufacturer. The spigot shall be made of aluminum and includes a perforated plate for stabilizing air flow. The spigot shall be sized to meet the required air flow.
- .5 The diffuser front plate shall be attached to the spigot by a central screw.
- .6 When required, the plenum shall be supplied with a damper adjustable through the front plate, in order to adjust the volume of air. This damper shall be available in two options:
 - .1 Radial damper: Key with circular pivoting blades on a flexible metallic cable which is adjustable through the front plate of the diffuser allowing for air flow adjustment of 0% to 100%.
 - .2 Axial damper: Perforated swiveling flap from 0 to 90 degrees with a blocking system allowing for air flow adjustment of 25% to 100%.

2.2 DIFFUSERS

- .1 As indicated.
- .2 Acceptable manufacturers: NAD Klima

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 datasheet.

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Install with flat head cadmium plated screws in countersunk holes where fastenings are visible, color to match.

3.3 FIELD QUALITY CONTROL

- .1 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.5 BALANCING

- .1 Balance in accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 This section includes:
 - .1 Materials, components and installation for heat reclaim devices.
 - .2 Sustainable requirements for verification.

1.2 RELATED SECTIONS

- .1 Division 01 - General Requirements.
- .2 Section 26 05 00 - Common Work Results – for Electrical.

1.3 REFERENCES

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 84-2008, Method of Testing Air-to-Air Heat/Energy Exchangers.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 ANSI/AMCA 210-07, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .4 NFPA (Fire) 90A, Installation of Air Conditioning and Ventilating Systems, 2009 edition.
- .5 CSA C439-09, Standard Laboratory Methods of Test for Rating the Performance of Heat/Energy-Recovery Ventilators.
- .6 UL 1812, Ducted Heat Recovery Ventilators (2009).

1.4 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Indicate following:
 - .1 Capacities.
 - .2 Sound power levels.

- .3 Installation instructions.
- .4 Start-up instructions.
- .5 O&M instructions.
- .3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
- .4 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .5 Certificates:
 - .1 Catalogued or published ratings: obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.
 - .2 Provide confirmation of testing.

1.5 QUALITY ASSURANCE

- .1 Verify project requirements.
- .2 Review installation conditions.
- .3 Co-ordinate with other building sub-trades.
- .4 Review manufacturer's installation instructions and warranty requirements.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Waste management and disposal to be in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.8 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00 – Closeout Submittals.

PART 2 - PRODUCTS

2.1 GENERAL

- .1 Comply with ASHRAE 84.
- .2 Unit shall be constructed in accordance with CSA C22.2 and UL 1812 and shall carry CSA and UL labels of approval.
- .3 Insulation shall comply with ANSI/NFPA 90A requirements for flame spread and smoke generation.
- .4 Airflow data shall comply with ANSI/AMCA 210 method of testing.
- .5 Shall conform to CSA C439.

2.2 HEAT AIR RECOVERY UNIT (HRV-1)

- .1 Indoor packaged heat recovery ventilation unit suitable for indoor installation. Unit shall be vertical configuration consisting of energy recovery cores, supply air fan, exhaust air fan, fresh air intake and exhaust air discharge with factory wired motorized dampers, temperature sensors and microprocessor controls.
- .2 Supply fan and exhaust fan shall be equipped with spring vibration isolators to minimize vibration and noise transmission to building structure.
- .3 Energy exchanger shall be capable of transferring sensible energy between air streams.
 - .1 Minimum Sensible Efficiency: 65%.
- .4 Manufacturer shall be able to provide evidence of independent testing of the core by Underwriters Laboratory (UL), verifying a maximum flame spread index (FSI) of 25 and a maximum smoke developed index (SDI) of 50 thereby meeting NFPA 90A and NFPA 90B requirements for materials in a compartment handling air intended for circulation through a duct system. The method of test shall be UL Standard 723.
- .5 Unit shall be constructed in accordance with CSA Model Code SPE-1000 and carry CSA labels of approval.
- .6 Acceptable manufacturers: Venmar, Annexair, Renew Air, Greenheck

2.3 UNIT CABINET

- .1 Cabinet shall be constructed of prepainted 20 gauge G60 mill galvanized steel.
- .2 Cabinet shall have 12 gauge mill galvanized frame.

- .3 Cabinet shall be insulated throughout with foil faced fire retardant material.
- .4 Full access door on the left side of the cabinet shall hinge up and be fully removable.

2.4 OPERATING CHARACTERISTICS

- .1 Unit shall be capable of providing a constant volume of air with external static pressures as indicated on drawings.

2.5 FANS

- .1 Direct drive, double inlet fan wheels with forward curve blades shall be designed for continuous operation at all operating speeds. Fan wheels shall be satin coat galvanized steel.
- .2 Fan shall be provided with internal vibration isolation mounts.

2.6 MOTORS

- .1 Blower motors shall be Premium Efficiency, EISA compliant for energy efficiency. The blower motors shall be totally enclosed (TEFC) and be supplied with factory installed motor starters.
- .2 Motors shall be EISA-compliant for energy efficiency with open drip proof design and integral thermal protection.

2.8 ELECTRICAL REQUIREMENTS

- .1 Unit shall have a single point power connection only, complete with main Disconnect.
- .2 Supply power: as indicated on the drawings.
- .3 Magnetic combination starters to be breaker type with Hand-Off-Auto switch and pilot light.
- .4 Also see electrical specifications.

2.9 FILTERS

- .1 Provide 30% DSE filters.

2.10 CONTROLS

- .1 Unit shall be provided with a factory-mounted and factory-wired microprocessor control operating on 115V/1ph./60Hz.
- .2 All service connectors shall be quick disconnect type.
- .3 Unit circuitry shall allow the following operational characteristics:
 - .1 Remote fan interlock on call for ventilation.

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 datasheet.

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's recommendations.
- .2 Support independently of adjacent ductwork with flexible connections.

3.3 FIELD QUALITY CONTROL

- .1 Tests:
 - .1 Perform tests in accordance with Section 26 05 00 - Common Work Results – for Electrical.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.6 BALANCING

- .1 Refer to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for applicable procedures.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Division 01 - General Requirements.
- .2 Section 23 23 00 - Refrigerant Piping.

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 52.2-2007, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (ANSI/ASHRAE Approved.)
- .2 American Society for Testing and Materials (ASTM International)
 - .1 ASTM C547-07e1, Specification for Mineral Fibre Pipe Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-115.10-M90, Disposable Air Filters For Removal of Particulate Matter from Ventilating Systems.
 - .2 CAN/CGSB-115.15-M91, High Efficiency, Rigid Type Air Filters for Removal of Particulate Matter from Ventilating Systems.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA B52S1-09, Supplement No. 1 to B52-05, Mechanical Refrigeration Code.
 - .2 CAN/CSA-C656-05, Performance Standard for Single Package Central Air-Conditioners and Heat Pumps.
- .5 Environment Canada, (EC)/Environmental Protection Services (EPS)
 - .1 EPS 1/RA/2-1996, Code of Practice for Elimination of Fluorocarbons Emissions from Refrigeration and Air Conditioning Systems.
 - .2 Environment Canada-1994, Ozone-Depleting Substances Alternatives and Suppliers List.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Indicate major components and accessories including sound power levels of units.
- .3 Type of refrigerant used.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Waste management and disposal to be in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

PART 2 - PRODUCTS

2.1 GENERAL

- .1 Integrated package: to CAN/CSA-C656.
- .2 System type: Installed system shall be a VRF (variable refrigerant flow) and heat recovering multi split air conditioning system. The system shall utilize single air cooled condensing unit serving multiple indoor units.
- .3 Refrigerant: R-410A or non-ozone depleting refrigerant.
- .4 Unit capacity: as indicated on drawing.
- .5 Unit shall provide heating to at least -20°C.
- .5 Acceptable manufacturers: Mitsubishi City Multi, LG, Daikin, Trane, Samsung.
- .6 Note: System depicted on drawings is representative of the LG VRF System. Other manufacturers listed above may have different components, piping, electrical and control requirements. Any alterations shall be responsibility of the contractor to implement.

2.2 OUTDOOR UNITS

- .1 The outdoor unit shall be constructed from steel plate and painted with acrylic paint Munsel 5Y8/1.
- .2 The outdoor unit shall have two air cooled heat exchange coils constructed from copper tubing with aluminum fins. The coils shall be set in a 'V' formation with air being drawn in through two sides of the unit and discharged out of the top of the unit. The Y Series systems shall have a single fan mounted on top of the two coils. The coils shall be capable of being divided into 20, 30, 50, 70, 80, 100% sections to enable the outdoor unit capacity to match the capacity required by the indoor units.
- .3 The outdoor unit shall have one inverter controlled hermetic scroll compressor capable of controlling the compressor frequency in 1 Hz increments.
- .4 Extra sub-cooling shall be provided by a Heat Interchange Circuit (HIC), which allows better refrigerant distribution and control with electronic expansion valves.
- .5 The refrigeration process of the outdoor unit shall be maintained by pressure and temperature sensors controlling solenoid valves, check valves and bypass valves. The cooling mode of the outdoor unit shall be controlled by a 4-way valve. Condensate shall

be removed from the Y-Series by means of a drain pipe connector located on the bottom of unit.

- .6 The outdoor unit shall have one liquid discharge pipe which shall supply high pressure liquid to the indoor units. Refrigerant return to the outdoor unit shall be via one suction pipe. Both pipes shall be insulated. The system shall be capable of total pipe runs of up to 304 m.
- .7 Maximum allowable sound pressure level: 61 dBa
- .8 Capacities: as indicated on drawing.

2.3 INDOOR UNITS

- .1 Each indoor unit shall have a heat exchanger which shall be constructed from copper tubing with aluminum fins. The flow of refrigerant through the heat exchanger shall be controlled by a linear expansion valve. This valve shall be controlled by two pipe thermistors and a return air thermistor and shall be capable of controlling the variable capacity of the indoor unit between 25% and 100%.
- .2 Each indoor unit will require a 208-230 vac power supply. Control shall be via the 30 vdc M-Net data control signal from the outdoor unit.
- .3 The following types of indoor units shall be utilized:
 - .1 Above Ceiling Fan Coil Units:
- .4 Maximum allowable sound pressure level: 45dB(A)

2.4 SPACE TEMP TEMPERATURE CONTROLLER (AUTO SYSTEM ADDRESS)

- .1 This controller shall be wall mounted and hardwired to the indoor fan coil units. It shall be manufactured in ABS plastic with an LCD display and shall be the manufacturers standard colour.
- .2 The controller shall be capable of altering the following functions on indoor fan coil units:
 - .1 On/Off.
 - .2 Operating mode.
 - .3 Set point.
 - .4 Fan speed.
 - .5 Test run.
- .3 The controller shall be capable of controlling the electric reheat coil for secondary heating.

2.5 CENTRALIZED CONTROLLER

- .1 This controller shall be wall mounted and hardwired to the outdoor unit(s). It shall be manufactured in ABS plastic with an LCD display and shall be the manufacturers standard colour. The controller will require an additional power pack which will be

housed in a galvanized steel box.

- .2 The controller shall be capable of individually controlling the following functions on all indoor fan coil units:
 - .1 On/Off.
 - .2 Operating mode.
 - .3 Set point.
 - .4 Fan speed.
 - .5 Louvre position.
 - .6 Timer settings.
 - .7 Test run.
- .3 The controller shall also be capable of displaying the following information individually for all indoor fan coil units:
 - .1 On/off.
 - .2 Operating mode.
 - .3 Set point.
 - .4 Fan speed.
 - .5 Louvre position.
 - .6 Timer settings.
 - .7 Test run.
 - .8 Fault diagnosis.

2.6 CONTROL WIRING

- .1 The contractor shall be responsible for the interconnecting control wiring between the indoor and outdoor units and control wiring between remote controllers, centralized control and relevant components. This work shall be coordinated with the Electrical / Controls Contractor for the routing and trunking of the cables.
- .2 All control wiring is to be carried out in 2 core 18 AWG shielded cabling with colour coding and tagged with ID number at 2.75 m. intervals as per schematics for ease of identification and maintenance. Note: this is based on the LG system – if an alternative system is utilized the contractor meet new manufacturer requirements.
- .3 Control wiring shall not be run next to power wiring. A minimum space of 100 mm between both control and power cables shall apply.
- .4 Also see electrical specification for low voltage wiring requirements.

2.7 INSTALLATION

- .1 The fixing of all air conditioning equipment, installation of all refrigerant pipework and full commissioning shall be performed by a specialist refrigerant installer who shall be authorized to install electric VRF equipment. The installation of all internal and external units, refrigerant pipework, inter-connecting wiring, commissioning and testing shall be carried out by an approved refrigerant systems installer.
- .2 Full access shall be afforded to site during the installations stage of the project to allow

them to verify that installation methods are fully in accordance with all requirements and that the equipment warranties shall not be invalidated.

2.8 REFRIGERANT PIPEWORK

- .1 To Section 23 23 00 - Refrigerant Piping.
- .2 Supply, install, test and commission all interconnecting refrigeration pipework between the outdoor and indoor units.
- .3 All pipework must be suitable for R410A.
- .4 Longest possible lengths of copper pipe should be utilized to minimize joints on site.
- .5 After installation of pipework, and prior to sealing of insulation joints and starting of equipment, pipework should be tested as follows:
 - .1 Pressure test: 310 kPa, 1,515 kPa and 3,275 kPa tests for a minimum 3 minute duration each.
 - .2 Strength test: 4,135 kPa and check the system for leaks and deformation, then lower the pressure back to 3,275 kPa and pressure test for 24 hours and checked for leaks.
 - .3 Vacuum test: vacuumed/dehydrated to 300 microns, and hold at that vacuum for 12 hours (minimum).
- .6 Refrigerant (R410A) charge weight must be calculated, to the actual installed length of pipework in accordance to manufacturer's recommendations.
- .7 The charging should be carried out with an appropriate charging station.
- .8 Pipework to be properly fixed and supported at a minimum of 1.5 m. centres or as specified by local code and where required should be run on galvanized trays. All pipework to be labelled with ID number (condensing units ref.) at 2.75 m. intervals.
- .9 Joints in copper pipe shall be brazed. Brazing shall be carried out to the requirements of the local code and as per the Canadian Copper & Brass Development Association recommendations.

2.9 CONDENSATE PIPEWORK

- .1 A condensate line shall be installed to each indoor unit. This shall be installed and insulated all as per the standard specification. Minimum size of condensate pipes to be 25 mm copper, insulated and pumped or by gravity from each indoor unit/cassette, drains to run 1:80 min falls as indicated on drawings.

2.10 LOG BOOKS

- .1 Full Commissioning Logs shall be supplied by the local distributor. These shall be completed fully and included with the main Installation and Operation Manuals prior to hand over.

PART 3 - EXECUTION

3.1 GENERAL

- .1 Install as indicated, to manufacturer's recommendations, in accordance with EPS 1/RA/2 and in accordance with ED 4003-05.
- .2 Manufacturer to certify installation.
- .3 Run drain line from cooling coil condensate drain pan to terminate as shown on drawings.

3.2 EQUIPMENT PREPARATION

- .1 Provide services of manufacturer's field engineer to set and adjust equipment for operation as specified.

3.3 BALANCING

- .1 Balance in accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

END OF SECTION

PART 1.0 GENERAL

1.01 SUBMITTALS

- .1 Submit shop drawings/product data sheets for products specified in Part 2, including accessories.
- .2 Submit with delivery of each unit a copy of the factory inspection report, and include a copy of each report with O & M Manual project close-out data.
- .3 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this Section.
- .4 Submit 3 identified keys for cabinet doors for each humidifier prior to Substantial Performance of the Work.
- .5 At Substantial Performance of the Work, hand to Owner a complete set of spare filters in "as shipped" packaging.

1.02 QUALITY ASSURANCE

- .1 Refrigerant equipment is to be in accordance with CSA B52, Mechanical Refrigeration Code, and any applicable local Codes and Regulations.
- .2 Direct expansion refrigeration equipment must be installed by or under direct on site supervision of a licensed journeyman refrigeration mechanic.

PART 2.0 PRODUCTS

2.01 DEHUMIDIFIER

- .1 Unit to be factory assembled and run tested, package type dehumidifier in accordance with drawing schedule, designed to operate with R410A refrigerant or non-ozone depleting refrigerant.
- .2 Sectional cabinet constructed of formed and reinforced satin coated sheet steel with a #16 gauge base and #20 gauge panels, all phosphate degreased and coated with baked epoxy powder paint. Cabinet is equipped with:
 - .1 removable side service panels for access to all internal components;
 - .2 integral electrical power and control panel in a separate with #18 gauge subpanel for electrical components in a separate compartment so as not to disturb airflow during electrical servicing;
 - .3 integral filter rack with separate hinged access door with compression fasteners;
 - .4 15 mm (1/2") thick neoprene coated glass fibre duct liner meeting 25/50 flame spread/smoke developed ratings when tested to CAN/ULC S102, for the entire evaporator coil section, mechanically secured in place and protected with reinforcing mesh.

- .3 Factory pressure tested evaporator (dehumidifier) coil with seamless copper tubes mechanically expanded into plate type aluminium fins which are factory coated with "HyPoxy" corrosion resistant coating in accordance with ASTM B117/D1654 and ASTM D2126 corrosion resistance requirements. Coil casing and end plates are #16 gauge galvanized steel.
- .4 Type 304 #20 gauge stainless steel drain pan constructed and sloped so as to eliminate standing water, and factory insulated on the bottom and sides with insulation meeting 25/50 flame spread/smoke developed ratings when tested to CAN/ULC S102.
- .5 Factory pressure tested air reheat (hot gas) coil as specified above for evaporator coil.
- .6 Double width, double inlet, multi-blade, forward curved, galvanized steel centrifugal blower wheel mounted on a silicon coated solid steel shaft, statically and dynamically balanced, direct connected to a motor conforming to requirements specified in Section entitled Basic Mechanical Materials and Methods, and secured in a galvanized steel housing with a baked enamel finish.
- .7 Disposable, 50 mm (2") thick glass fibre media filters, ULC Class 2, minimum MERV 7 in accordance with ASHRAE 52.2.
- .8 Resiliently mounted, overload protected, suction gas cooled hermetic compressor for use with R410A refrigerant, and equipped with time delay start to prevent short cycling, and a refrigerant circuit complete with following:
 - .1 in-line solder type liquid line filter drier;
 - .2 liquid and moisture indicator visible from outside unit;
 - .3 thermal expansion valve and head pressure control;
 - .4 receiver with fusible plug (water cooled units) or receiver with pressure relief valve (air cooled units);
 - .5 tamper-proof, hermetically sealed, non-adjustable high and low pressure controls;
 - .6 refrigerant service valves located outside air stream;
 - .7 minimum 15 mm (½") thick closed cell insulation meeting 25/50 flame spread/smoke developed ratings when tested to CAN/ULC S102, for refrigerant suction lines.
- .9 Minimum NEMA 2 enamelled steel control panel, unit mounted, factory pre-wired, CSA certified, and complete with:
 - .1 protected blower motor and compressor motor contactors;
 - .2 power and control wiring terminal blocks;
 - .3 colour coded and numbered wiring;
 - .4 dry contact for remote on/off control;
 - .5 all other required contacts and hardware for control and/or monitoring connections as indicated on drawings;
 - .6 remote, electronic, adjustable tamper-proof thermostat and humidistat, each capable of independent control of unit operation without interfering with unit operation.

- .10 Acceptable manufacturers are: Thermoplus Air Inc., Dectron Inc

PART 3.0 EXECUTION

3.01 INSTALLATION OF DEHUMIDIFIER

- .1 Secure indoor cabinet assembly in place, level, and plumb, from structure by means of galvanized steel hanger rods with galvanized steel hardware, and vibration isolation spring hangers. Ensure unit drain pan is connected with properly sized, insulated condensate drainage piping terminated over a suitable drain point.
- .2 Install humidistat. Confirm exact locations prior to roughing-in.
- .3 Perform required control wiring (except building automation system connection) in conduit in accordance with manufacturer's control wiring schematics and wiring standards of the electrical work.
- .4 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system manufacturer certification requirements.
- .5 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.
- .6 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL

- .1 The General Conditions of the contract as well as provisions of Division 1 are part of and to be read in conjunction with this Section. This section covers items common to all sections of Division 26.

1.2 ELECTRICAL WORK INCLUDED

- .1 The specification complements the drawings in describing the supply and installation of a complete electrical system. This system shall include but not necessarily be limited to the following:
 - .1 Small power system including wiring devices, cable tray, wiring and conduit;
 - .2 Lighting system including luminaires and wiring;
 - .3 Demolition of existing as noted;
 - .4 Fire alarm system.

1.3 CONTRACT DRAWINGS

- .1 The specification together with the drawings are intended to provide a description of a complete electrical system and therefore there shall be no omission of the items necessary or required to make a finished, workmanlike, first class installation, even though each and every item of labour and material may not be mentioned in the specification or shown on the drawings.
- .2 Items indicated on floor plans and not on riser diagrams, or vice versa, shall be considered fully covered by both.
- .3 Runs of conduit and outlet locations indicated on the drawings are diagrammatic and exact locations must be determined by this contract as the work proceeds, with due regard to the structure and the work of other trades. This contract shall make any changes dictated by structural requirements, or conflicts with other trades, without charge.
- .4 Apparent errors or omissions shall be referred to the Engineer whose decision shall be final.
- .5 Building dimensions shall not be scaled from the electrical drawings but shall be obtained from the site or civil/structural drawings. Any discrepancy between the drawings and work area shall be questioned before proceeding with the installation.

1.4 CODES AND STANDARDS

- .1 As a minimum standard perform all work in accordance with the requirements of the Canadian Electrical Code C22.1-2015 Part 1. These standards together with all local or municipal rules, regulations, and ordinances shall be considered as the latest approved editions at the time of tender closing. In no instance, shall the standard established in these contract documents, be reduced by any codes.
- .2 Do underground systems in accordance with CSA CAN-C22.3 No. 7-15.
- .3 Abbreviations for electrical terms: to CSA Z85-1983.

- .4 Comply with CSA Certification Standards and Electrical Bulletins in force at the time of tender submission.

1.5 INSPECTIONS, PERMITS AND FEES

- .1 Obtain all inspections and permits required by all laws, ordinances, rules and regulations by the public authority having jurisdiction at the site for work of this Contract, and obtain certificates of such inspections and submit same and pay all charges in connection therewith. The final certificate of inspection shall be obtained before final payment for work shall be considered due.
- .2 Electrical Permit
 - .1 Submit to the Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
 - .2 Pay associated fees.
 - .3 Furnish certificates of Acceptance from Inspection Department and AHJ on completion of work.

1.6 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- .1 Submit shop drawings, product data and samples in accordance with Division 1. Provide all shop drawings within 30 days after contract has been awarded. Failure to do so will delay progress payments.
- .2 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
- .3 Where applicable, include wiring, single line and schematic diagrams.
- .4 Include wiring drawings or diagrams showing interconnection with work of other Sections.
- .5 Keep one copy of shop drawings and product data on site, available for reference at all times.

1.7 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into Operation and Maintenance Manuals as specified in Division 1.
- .2 Include in the 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 feature of installation.
 - .2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical description of items and parts lists. **Advertising or sales literature not acceptable.**
 - .3 Wiring and schematic diagrams and performance curves.
 - .4 Names and addresses of local suppliers for items included in maintenance manuals.

- .5 Copy of reviewed shop drawings.
- .6 Signed receipt for all spare parts.

.3 Approvals:

- .1 Submit one draft of Operating and Maintenance Manual to Engineer for approval one month prior to estimated substantial completion date. Submission of individual data will not be accepted unless so directed by Engineer.
- .2 Make any changes in submission as may be required and re-submit as directed.
- .3 **Failure to do so will result in delay of progress payment.**
- .4 Provide two (2) final bound copies of Operation and Maintenance Manuals to Owner and one (1) bound copy to Engineer.

1.8 PROJECT RECORD DOCUMENTS

- .1 Provide Project Record Documents in accordance with Division 1.
- .2 Submit record drawings to Departmental Representative showing changes of wire sizes, circuit numbering and location of raceways, fittings, fixtures, panels and equipment, and their sizes, the location of which has changed or deviated during the work.
- .3 Submit sepia or reproducible of record drawings after record drawings have been approved by the Engineer. Originals shall be made available by the Departmental Representative for the making of sepia or reproducible of the contract drawings. All changes reflected on record drawings are to be indicated on these sepia or reproducible.

1.9 MAINTENANCE MATERIAL

- .1 Provide maintenance materials in accordance with Division 1.

1.10 CARE, OPERATION AND START UP

- .1 Instruct operating personnel in the operation, care and maintenance of the equipment.
- .2 Arrange and pay for services of the manufacturer's service engineer to supervise start-up and to check, adjust, balance and calibrate components.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

1.11 VOLTAGE RATINGS

- .1 Operating voltages to meet requirements of CAN3-C235.
- .2 Motors, control and distribution equipment to operate satisfactorily at 60 Hz within normal operating limits established by the above standard. Equipment to operate in extreme operating conditions established in the above standard without damage to the equipment.

1.12 MATERIAL AND EQUIPMENT

- .1 Provide materials and equipment in accordance with Division 1.
- .2 Equipment and materials to be C.S.A. certified, and manufactured to standard quoted.
- .3 Where there is no alternative to supplying equipment which is not C.S.A. certified, obtain special approval from C.S.A.
- .4 Factory assemble control panels and component assemblies.
- .5 For the purposes of uniformity similar materials shall be of one manufacturer (i.e. all panels; all motor control equipment; all fixtures in as much as is possible, etc.).
- .6 To avoid the possibility of the work being delayed, order all materials as soon as the shop drawings are reviewed, and report at once to the Engineer any delays in the delivery of materials which would hold up the completion of the job.

1.13 GROUNDING

- .1 All equipment and exposed non-current carrying metal, conduits and parts shall be permanently and effectively grounded to meet minimum requirements of the C.E.C. Section 10, and as indicated on the drawings and further specified. Standards set either by drawings or specifications which are above those covered by C.E.C. Section 10, shall not be reduced under any circumstances.

1.14 FINISHES

- .1 Shop finish metal enclosure surfaces by removal of rust and scale, cleaning, application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint outdoor electrical equipment, "Equipment Green" finish to EEMAC Y1-1-1955.
 - .2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .3 Clean, prime and paint exposed hangers, racks, and fastenings to prevent rusting.
- .4 Where wire guards are specified in other sections, they are to be constructed of stainless steel. Painted steel is not acceptable.

1.15 EQUIPMENT IDENTIFICATION

- .1 All disconnect switches, receptacles, pushbuttons, control panels, etc., shall have "Lamacoid" nameplates mounted on or adjacent for identification which shall include the panel designation, voltage, phase, wires overcurrent protection, H.P., KW and amperage as applicable. The nameplates shall be affixed to metal equipment with metal type pop rivets, and to all other equipment with contact type cement applied to the entire nameplate backing.
- .2 Size of identification shall be suitable for equipment and importance of information.

- .3 All fused disconnect switches shall have lamacoid plates identifying the equipment they feed and a separate plate indicating maximum fuse size and type.
- .4 Lettering shall be of sufficient size to be readable from normal viewing distance and the information required on the nameplates shall dictate the physical size of plates.
- .5 Nameplates shall have **white lettering on black background** except for equipment connected to emergency power source, which shall have **white lettering on red background**.
- .6 All "D" and "E" boxes 200mm x 200mm x 100mm or larger and "C" and "T" cabinets shall have lamacoid plates affixed indicating voltages and/or systems housed within.
- .7 Nameplates:
 - .1 Lamacoid 3mm thick plastic engraving sheet on metal surfaces, 1.5mm where not applied to metals.

NAMEPLATE SIZES

Size 1	10mm x 50mm	1 line	5mm high letters
Size 2	13mm x 75mm	1 line	6mm high letters
Size 3	16mm x 75mm	2 lines	5mm high letters
Size 4	19mm x 91mm	1 line	10mm high letters
Size 5	38mm x 91mm	2 lines	12mm high letters
Size 6	25mm x 100mm	1 line	12mm high letters
Size 7	25mm x 100mm	2 lines	6mm high letters
Size 8	50mm x 150mm	2 lines	12mm high letters

- .8 Labels:
 - .1 Embossed plastic labels with 6.5mm high letters unless specified otherwise.
- .9 Wording on nameplates and labels to be approved by the Engineer prior to manufacture.
- .10 Allow for average of forty (40) letters per nameplate and label.
- .11 Identification to be English.

1.16 WIRING IDENTIFICATION

- .1 Conductor insulation shall be colour coded as follows:

Phase A	-	Red
Phase B	-	Black
Phase C	-	Blue
Neutral	-	White/Grey
Ground /Bond	-	Green
Isolated Ground	-	Green w/Yellow stripe

This shall apply to all phase conductors up to and including #2AWG and all sizes of neutral, bond and ground conductors up to and including #3/0AWG.

- .2 For conductors exceeding sizes as described above, identification of wiring with approved coloured plastic tapes shall be acceptable. Attach to both ends of all conductor runs a minimum of 12" from terminations, and in all junction and/or pull boxes.
- .3 Maintain phase sequence and colour coding throughout.
- .4 Colour code shall be as per Section 26 05 21.
- .5 Use color coded wires in branch circuit wiring, systems wiring and communication cables.

1.17 WIRING TERMINATION

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors as indicated.

1.18 MANUFACTURERS AND CSA LABELS

- .1 Manufacturers and CSA labels shall be visible and legible after equipment is installed.

1.19 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Division 1.
- .2 Change location of outlets at no extra cost or credit providing distance does not exceed 3 metres and information is given before installation.
- .3 Coordinate on site the location of outlets with other trades and equipment before work is to start.

1.20 MOUNTING HEIGHTS

- .1 Mounting heights of equipment is from centreline of bottom of tunnel to centre line of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not indicated verify before proceeding with installation.
- .3 Install electrical equipment at the following heights unless indicated otherwise.
 - .1 Local switches, to switch: 1200mm
 - .2 Wall receptacles: as indicated on drawings
 - .3 Luminaires: as indicated on drawings

1.21 PROTECTION

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark live parts "LIVE 120 VOLTS" or with appropriate voltage in English.

1.22 TESTS

- .1 Conduct and pay for tests of the following:

- .1 Power distribution system including phasing, voltage, grounding and load balancing.
- .2 Lighting and its controls.
- .3 Polarity check on receptacles.
- .2 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .3 The Engineer reserves the right to use any piece of electrical equipment, device, or material installed under this contract for such reasonable lengths of time and at such times as he may require in order to make a complete and thorough test of the same, before the final completion and acceptance of the work.
- .4 Such tests shall not be construed as acceptance of any part of the work.
- .5 Submit test results for Engineer's review.

1.23 INSULATION RESISTANCE TESTING

- .1 Test all wiring, included in the work to ensure that no shorts and/or grounds are present on phase conductors for feeders or branch circuits and that insulation values are as required by the Canadian Electrical Code.
- .2 All testing of conductors to be done prior to energization of conductors with 600 volt and 1000 volt meggers as required by the Canadian Electrical Code.
- .3 Systems to be tested for capacitive leakage are as follows: 120/208V/3PH/4W.
- .4 Check resistance to ground before energizing. Ensure resistance to ground is not less than 50 megohms.
- .5 Submit test results for Engineer's review. Test results shall include time of test, feeder tested, and instrument readings.

1.24 CLEANING

- .1 Do final cleaning in accordance with Division 1.
- .2 At time of final cleaning, clean lighting reflectors, lenses and other lighting surfaces that have been exposed to construction dust and dirt.
- .3 On completion of work, remove debris resulting from work of this Division and leave the site neat and tidy. Equipment shall be checked for proper fitting and alignment, adjusted, cleaned, repainted where necessary, and left in first class condition.
- .4 This section shall be responsible for the removal of spatters, droppings, soil, labels, and debris from finished surfaces and from surfaces to receive finishes, before the set up. Work and adjacent finished work shall be left in new condition.
- .5 Only cleaning materials which are recommended for the purpose by both the manufacturer of the surface to be cleaned and of the cleaning material shall be used.

- .6 Immediately before and during finishing work shall be made "broom clean".
- .7 Material at site cannot be burned or buried except where approved by Engineer. Removal shall be as often as required to avoid accumulation in order to ensure site is maintained clean.
- .8 Volatile fluid wastes cannot be disposed of in storm or sanitary sewers or in open drain courses.
- .9 Lowering of materials shall be controlled and shall not be dropped or thrown from above.

1.25 COORDINATION

- .1 Cooperate and investigate with other trades to make maximum use of the spaces. Avoid conflicts with pipes, ducts, etc. Prepare shop drawings indicating the route of main conduits and ducts for submission to the Engineer for approval.
- .2 Cooperate with other trades on the site and carry out the work, in such a way, as not to hinder or hold up the work of other trades.
- .3 Consult with other trades, where their respective installations conflict and re-route conduits, ducts, outlets, equipment, etc., as required, subject to the approval of the Engineer.

END OF SECTION

PART 1 – GENERAL

1.1 REFERENCE STANDARDS

- .1 CSA C22.2 No. 18 - Clamps and connectors.
- .2 CSA C22.2 No. 65 Wire Connectors.

1.2 RELATED WORK

- .1 Not Applicable

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Not Applicable

1.4 OPERATION AND MAINTENANCE DATA

- .1 Not Applicable

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Joints required in branch wiring #10 AWG and smaller shall be made using fixture twist-on type connectors with current carrying parts made of copper.
 - .1 Standard of Acceptance: Marrette #31, #33 or #35 as required.
- .2 Joints for wiring #8 AWG and larger shall be made using pressure type colour keyed compression connectors with current carrying parts made of copper using compression tools. A first layer of tape shall be compound type followed by a layer of Scotch #3 vinyl type.
 - .1 Standard of Acceptance: 54000 series.
- .3 Bushing stud connectors are not acceptable.
- .4 Clamps or connectors for armoured cable and flexible conduit as required.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No. 65.
 - .2 Install fixture type connectors and tighten with pliers or appropriate tool. Finger-tightening alone is not acceptable. Replace insulating cap.

- .2 All connections shall be made electrically and mechanically secure. Sizes of connectors shall be according to manufacturer's recommendations for each wire size and combination of wires. Twist wires together before installing connectors. All stranded conductors shall be twisted together prior to connection around terminal.

END OF SECTION

PART 1 – GENERAL

1.1 REFERENCE STANDARDS

- .1 CSA C22.2 No. 38 - Thermoset insulated Wires and Cables.
- .2 CSA C22.2 No. 51 - Armoured cables.
- .3 Wire and cable shall conform to the latest specification of the Canadian Standards Association (CSA), Electrical and Electronic Manufacturers Association of Canada (EEMAC), the Insulated Power Cable Engineers Association (IPCEA), and the American Society of Testing Materials (ASTM).

1.2 RELATED WORK

- .1 Not Applicable

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit product data in accordance with Division 1.

1.4 OPERATION AND MAINTENANCE DATA

- .1 Not Applicable

PART 2 - PRODUCTS

2.1 WIRES

- .1 Conductors: Copper, soft drawn stranded, at least 98% conductivity for #12 AWG and larger. Insulation shall be chemically cross-linked thermosetting polyethylene rated 600 volts on all RW90 conductors and 1000 volts for RWU-90 for incoming service. Size as indicated on drawings and schedules. Conductor insulation shall be colour coded as follows:

Phase A	-	Red
Phase B	-	Black
Phase C	-	Blue
Neutral	-	White/Grey
Ground/Bond	-	Green
Isolated Ground	-	Green w/Yellow stripe
Isolated Power	-	as indicated hereinafter.

Where extra colours are required for three-way switches, etc., they shall be yellow.
Approved colour coded tape is acceptable for colour coding phase conductors #1 AWG and larger and for neutral and ground conductors #4/0 and larger.

2.2 ARMOURED CABLES

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminium strip.
- .4 Connectors: to manufacturer's recommendations.

2.3 CONTROL CABLES

- .1 600 V Type: 2 stranded copper conductors, 95% conductivity, full size AWG gauge, sizes as indicated with PVC insulation Type TW with shielding of magnetic tape wire braid over each pair of conductors and overall covering of thermoplastic jacket. Colour code shall be yellow.

2.4 SYSTEM WIRING

- .1 Wiring for auxiliary systems will be as indicated in specification or on drawings and/or as recommended by Manufacturer of the system.

2.5 MANUFACTURERS

- .1 Standard of Acceptance: Nexans or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION OF BUILDING WIRES

- .1 Install all wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34.

3.2 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in EMT conduit complete with all associated steel connectors and couplings where run on surfaces of walls or open ceilings. Conduits shall be extended to within 760mm of all devices associated with the piece of equipment which they control. Final connection shall be made using liquid-tight flexible metal conduit and associated liquid-tight connectors.
- .2 EMT type conduit wall-stub c/w flush installed device box shall be located in all partitions to accommodate wiring between the device and the accessible ceiling space.
- .3 EMT connectors complete with nylon insulated throat or threaded type bushing shall be installed on end of EMT stubs where they protrude through the wall above, and within finished accessible ceilings. CSA approved EMT plastic end cap bushings may also be used.
- .4 All EMT conduit stubs shall be bonded to ground as required by CEC.

- .5 Control cable shields, if applicable, shall be bonded to ground.

3.3 INSTALLATION OF ARMoured CABLES

- .1 Group cables wherever possible.
- .2 Flexible type conduit c/w RW90 conductors sized as noted and/or flexible armoured cable AC90 (BX) complete with separate grounding conductor.
- .3 “Fixture drop” is defined as that portion of AC90 cable or flexible conduit being used to make the final connection between the accessible type junction or outlet box located in ceiling space and its respective luminaire.
- .4 Flexible type conduit c/w RW90 conductors sized as noted and/or flexible armoured cable AC90 (BX) complete with separate grounding conductor.
- .5 AC-90 cable or RW90 in flex is to be used for branch circuit wiring drops from ceiling junction boxes to light fixtures, receptacles and other equipment requiring power in the same room only unless otherwise noted on the drawings. AC 90 (BX) cable used for fixture drops with a minimum size of No. 12. Total length of any individual AC-90 cable or flex c/w RW90 not to exceed 4500mm in length unless specifically indicated otherwise. The use of AC90 for home runs or wiring between rooms is not permitted.
- .6 All flex c/w RW90 or AC-90 cables used for fixture drops shall be secured within 300mm of the junction box.
- .7 Where application of AC-90 cables and/or other types of pliable cables are to be used, they shall be installed parallel or perpendicular to the building lines unless otherwise noted.
- .8 Support and securing of type AC-90 cables shall not be derived from either suspended ceiling support wires or directly laying atop of the ceiling grid system.
- .8 All AC-90 feeds shall originate from the sides of outlet boxes and not from the box cover. There shall not be more than 4 drop feeds permitted from any one box regardless of its size. Where 3 or more drop feeds extend from any one box, that box shall be sized no smaller than 119mm square.

3.4 INSTALLATION - GENERAL

- .1 Where pulling wires and cables, the use of an approved lubricant only will be permitted. No wires or cables shall be pulled in conduits until such conduits are free from moisture and in no case shall wires be pulled until approval of the Architect and/or Engineer is obtained.
- .2 All stranded conductors prior to terminating under device bolts such as circuit breakers, light switches, receptacles, etc., to be twisted together to form a single conductor to ensure a reliable mechanical connection.

- .3 All branch circuits are to utilize conduit pathways for home runs to each room or area, including rooms in which the panel is located. Where the branch circuit has multiple splices and/ or drop offs to multiple rooms, the use of AC90 for the drop off is permitted, however, the home run conduit shall be continued until the final room destination splice or drop off is reached.
- .4 "Labelling" of all branch circuit wiring including phase conductors, neutrals, grounding and/or bonding conductors to be done on **both ends** of all circuit wires plus in any junction and/or pull boxes located in between using "Panduit" write-on, self laminating labels Nos. PDL-1 and PDL-2 as required.
- .5 The following wiring methods are designed to enhance the ability to perform capacitive leakage tests:
 - .1 All circuit conductors are to be individually tie wrapped to their corresponding labelled neutral conductor in all panelboards, pullboxes and junction boxes. Enough slack conductor length should be left to enable the ability to clamp the ground detector around the individually tie-wrapped circuit conductor and its corresponding labelled neutral. This wiring method is to be neat and of good workmanship quality.
 - .2 The tie wrapping of the neutral with its respective phase conductors is to be made at the closest point of entry into panelboards, pullboxes and junction boxes.
 - .3 After all electrical wiring has been completed by the Electrical Sub-Contractor, he is to test the grounded electrical distribution system to ensure there are not ground shorts and capacitive leakage in the system.
 - .4 All feeders or branch circuits which do not have neutral conductors are to have their respective phase conductors tie-wrapped together in accordance to the methods described previously.
 - .5 Run all circuits so that the voltage drop in no case exceeds 3% of the line volts. The neutral wire, wherever it is run, shall be continuous with no fuses, switches, or breaks of any kind.
 - .6 For 15 amp, 120 volt circuits the following table shall be used to determine the minimum conductor sizes required to compensate for voltage drop. In no case does this table allow a reduction in conductor size from that shown on the drawings or as specified elsewhere in the specifications. Voltage drop shall not exceed 3% in any instance.

.1	From	0.3m to 24m	#12 Wire
.2	From	24m to 37m	#10 Wire
.3	From	37m to 55m	#8 Wire
 - .7 Increased wire sizes where required shall not be decreased in size in any portion of length of run between panelboard and the wiring device itself.
 - .8 All wiring shall be colour coded as per Code requirements and/or as specified herein.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

- .1 CSA C22.2 No. 41 - Grounding and Bonding Equipment.

1.2 RELATED WORK

- .1 Electrical General Instructions: Section 26 05 00
- .2 Wires and Cables, 0 to 1000V: Section 26 05 21

PART 2 - PRODUCTS

2.1 EQUIPMENT

- .1 Clamps for grounding of conductor, size as required to electrically conductive ground rods.
- .2 System and circuit, equipment, grounding conductors, bare stranded copper, un-tinned, soft annealed, un-armoured, size as indicated.
- .3 Insulated grounding conductors to Section 26 05 21.
- .4 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.

2.2 MANUFACTURERS

- .1 Standard of Acceptance: Thomas & Betts.
- .2 Other approved manufacturers: Burndy, McGraw Edison.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous, system and circuit, equipment, grounding systems including, electrodes, conductors, connectors, accessories, as indicated, to conform to requirements of Engineer, and local authority having jurisdiction over

installation. Where EMT is used for panelboard or motor control board feeders, run a separate green 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 electrodes, using compression type connectors.
- .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.
- .8 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .9 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- .10 Connect building structural steel to ground by welding copper to the steel near service entrance.
- .11 Connect boiler stack, diesel generator stack and boiler blow-off stack to ground by wire braid.

3.2 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to the neutral of the 120/208V and 600V/347V systems as required.

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 centres, starters, control panels, building steel work, distribution panels, and outdoor lighting.

3.4 COMMUNICATION SYSTEMS

- .1 Install grounding connections for telephone, fire alarm, intercommunication systems as follows:
 - .1 Telephones: make telephone grounding system in accordance with telephone company's requirements.
 - .2 Fire alarm, intercommunication systems as required.

3.5 TESTS

- .1 Perform tests in accordance with Section 26 05 00.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Engineer and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Submit test results for Engineer's review.

END OF SECTION

PART 1 – GENERAL

1.1 REFERENCE STANDARDS

- .1 Not Applicable

1.2 RELATED WORK

- .1 Common Work Results Electrical: Section 26 05 00

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Division 1.

1.4 OPERATION AND MAINTENANCE DATA

- .1 Not Applicable

PART 2 - PRODUCTS

2.1 SUPPORT DEVICES

- .1 U shape, size 41mm x 41mm, 2.5mm thick, surface mounted or suspended as required.
- .2 Supply and install all necessary inserts, rods, channels, brackets, etc., to form a support system capable of carrying at least twice the weight of the equipment supported.
- .3 In concrete, use cast-in threaded inserts wherever possible. Should additional inserts be required use a "red head" type of insert capable of carrying at least 45 kgs.
- .4 All hanger rods shall be 10mm diameter continuous threaded rod cut to required lengths. Cut off excess to within 13mm of bottom of channel.
- .5 All conduits not installed on Unistrut or approved equal type support channels to be supported as follows:
 - .1 13mm up to and including 35mm conduits - one hole steel straps.
 - .2 41mm and larger sizes - two hole steel straps.
- .6 All suspended conduit runs containing horizontal or vertical elbows shall have one additional support rod installed at not more than 300mm from midpoint of all 90 degree bends.
- .7 Beam clamps to secure conduit to exposed steel work.
- .8 In no case will the use of tie-wraps for supporting purposes be acceptable unless explicitly approved for the purpose, such as for securing wiring in-place.

- .8 All trays, wireways, and multiple conduits, shall be supported by a steel channel support system with all components, hangers, wall supports, cable clamps, etc., specifically manufactured and approved for their application.
- .9 Fastening devices for cabinets, boxes, supports, etc., shall be nut and bolt, ramset, expansion shields, wedge anchors, or toggle bolts, size and number to suit the application or as detailed on the drawings. Toggle bolts shall not be used in gypsum wallboard construction.
- .10 Fastening devices for outlet boxes shall be nut and bolt, ramset, expansion shields, wedge anchors or caddy clips, size and number to suit the application or as detailed on the drawings.
- .11 Suspended outlet, pull and junction boxes shall be supported with minimum 10mm threaded rod, nuts and flat washers. Threaded rods shall be secured to boxes with one flat washer and nut installed on both sides of box. Threaded rods shall be installed as follows:
 - .1 One rod required for all types of boxes sized 150mmx150mm and smaller;
 - .2 Two rods required for all types of boxes sized larger than 150mmx150mm up to and including 300mmx300mm;
 - .3 Minimum of four rods required for all boxes larger than 300mmx300mm.

2.2 MANUFACTURERS

- .1 Standard of Acceptance: Burndy.
- .2 Other approved manufacturers: Erico, Electrovert, Pursley, Unistrut.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Secure equipment to hollow or solid masonry tile and plaster surfaces with lead anchors.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry wall, or suspended ceilings with toggle bolts.
- .4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T-bars are adequately supported to carry weight of equipment specified before installation.
- .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6 Suspended support systems.
 - .1 Support individual cable or conduit runs with 10mm dia threaded rods and spring clips.

- .2 Support 2 or more cables or conduits on channels supported by 10mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .7 For surface mounting of two or more conduits use channels at 1.5m on center spacing.
- .8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Engineer.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .13 Coordinate the location of any insert to miss concrete reinforcement and obtain approval of Architect and/or Engineer prior to installing.
- .14 Secure all equipment in a manner so as not to distort or cause undue stress on any components.
- .15 Support of any equipment shall not rely on the strength of plaster or gypsum board construction.

END OF SECTION

PART 1 – GENERAL

1.1 REFERENCE STANDARDS

- .1 CSA C22.2 No. 40 - Junction and pull boxes.

1.2 RELATED WORK

- .1 Not Applicable

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and products data for splitters and cabinets in accordance with Division 1.

1.4 OPERATION AND MAINTENANCE DATA

- .1 Not Applicable

PART 2 - PRODUCTS

2.1 JUNCTION AND PULL BOXES

- .1 Pull and junction boxes, where larger than standard switch boxes, shall be sized according to C.E.C. Section 12-3038.
- .2 Welded steel construction with screw-on flat covers for surface mounting.
- .3 Covers with 25mm minimum extension all around, for flush-mounted pull and junction boxes.
- .4 Junction boxes 150mm x 150mm and larger used in branch circuit wiring shall be complete with bonding terminal strips.

2.2 MANUFACTURERS

- .1 Standard of Acceptance: Bel
- .2 Other approved manufactures: Hammond, Hoffman.

PART 3 - EXECUTION

3.1 JUNCTION, PULL BOXES AND CABINETS

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2000mm above finished floor.

- .3 Install terminal block as indicated in Type "T" cabinets.
- .4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 1000 ft. of conduit run between pull boxes.
- .5 In **no case** shall a pull or junction box be installed in a space that is not considered accessible unless provision is made for access to the box as approved by Engineer.
- .6 All branch conductors to be identified in all junction and/or pull boxes with "Panduit" write-on, self-laminating label Nos. PLD-1 and PLD-2 as required or approved equal by Thomas & Betts.
- .7 All junction boxes containing six or more branch circuits shall be installed in type "E" box c/w terminal strip. **Minimum size** of box to be 300mm x 300mm x 100mm.
- .8 Terminal strip(s) to be large enough to terminate all phase, neutral and bonding conductors as required plus size spare terminals.
- .9 All "E" box coverplates to have "Lamicoid" nameplates identifying designated panel letter and/or number affixed via pop rivet method.
- .10 All pull and junction boxes 150mm x 150mm and larger having auxiliary systems housed within shall be identified with "Lamicoid" nameplates permanently affixed.

3.2 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00.
- .2 Install size 2 identification labels indicating system name, voltage, and phase.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

- .1 CSA C22.2 No. 18 - Outlet boxes, conduit boxes and fittings.

1.2 RELATED WORK

- .1 Not Applicable

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Not Applicable

1.4 OPERATION AND MAINTENANCE MANUAL

- .1 Not Applicable

PART 2 - PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with Canadian Electrical Code, Part 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.
- .5 Combination boxes with CSA approved barriers where outlets for more than one system are grouped.
- .6 Outlet boxes for concealed use in frame construction shall be sectional, galvanized, pressed steel; these shall be restricted for use with flexible conduit AC-90 cable (where indicated) or other pliable type cable. The installation of any type of rigid type conduit in sectional boxes is prohibited. Where wire fill dictates larger boxes for outlets, use suitably sized square boxes with raised, square, welded tile ring style extensions. Tile rings shall not be used in surface mounted installations. Plaster type rings are not acceptable.
- .7 All outlet boxes connected to AC90 cabling shall be specifically designed for the purpose. Dual rated boxes are not acceptable.

- .8 Where multiple flush boxes are installed grouped together in metal drywall partitions, they shall be supported between the studs with a box mounting bracket (Caddy RBS or SGB series).

2.2 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel single and multi-gang flush **device boxes** for flush installation, minimum size 75 x 50 x 63mm or as indicated with a minimum volume of 262,192 cu. Mm (similar to Iberville # BC-3104-LSSAX). 100mm (4 inch) square outlet boxes when more than one conduit enters one side, with extension and tile rings (square, welded type) as required. For use in masonry construction, style MB (S or D) shall be used.
- .2 100 mm square or octagonal outlet boxes for lighting fixtures.
- .3 100mm square outlet boxes with extension and plaster rings for flush mounting special devices in finished plaster or tile walls.
- .4 All new furniture connection boxes shall be 4-11/16" square outlet boxes complete with 1-1/2" tile rings.

2.3 MASONRY BOXES

- .1 Electro-galvanized steel **masonry boxes** single and multi gang for devices flush mounted in exposed block walls and where indicated.
- .2 Provide a 2-gang deep masonry outlet box for al multimedia outlets, c/w stainless steel cover plates. Minimum dimensions are as follows: 95mm X 96mm X89mm deep. Install Caddy RBS Type mounting bracket.

2.4 CONCRETE BOXES

- .1 Electro-galvanized sheet steel **concrete boxes** for flush mounting in concrete with matching extension and plaster rings as required.
- .2 Where wire fill dictates larger boxes than single gang outlets, use suitable sized square boxes, with raised "tile ring" style extension.

2.5 CONDUIT BOXES

- .1 Cast FS Aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.
- .2 Metal type "FS" device plates to be used on all type "FS" boxes unless noted otherwise.

2.6 RIGID CONDUIT BOXES

- .1 Cast FS or FD feraloy **rigid conduit boxes** with factory-threaded hubs and mounting feet for surface wiring where rigid conduit other than "EMT" is used.

2.7 MULTI-OUTLET BOXES

- .1 Electro-galvanized steel barrier pre-ganged **multi-outlet boxes** for devices with different sources of voltage in the same box.
- .2 The barrier of sheet steel shall not be less than (No. 16 MSG) thick used to divide the space into separate compartments for the conductors of each system. The barrier shall be fastened rigidly to the box.

2.8 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of foreign materials.
- .3 Conduit outlet bodies for conduit up to 32mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

2.9 CONDUIT SUPPORTS

- .1 In steel stud framing construction provide for boxes a metal stud clip (Caddy MSF) and a far side support (Caddy 766) or a separate quick mount support (Caddy "H" Series).
- .2 Use adjustable screws gun brackets (caddy "TS" series) where box requires mounting between steel studs.
- .3 Other support systems will be accepted only after review by Engineer.

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 construction material. Remove filling material at completion of project.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 65mm of opening.

- .4 Provide correct size of openings in boxes for conduit and armoured cable connections. Reducing washers not allowed.
- .5 At each local switch, receptacle, ceiling or wall fixture, continuous row of fixtures, or system unit (i.e. fire alarm, T.V., etc.) provide and install a standard or twin filler or barrier pressed steel outlet box, unless specifically noted otherwise. All outlet boxes shall be fabricated of galvanized sheet steel and set flush with finished surfaces. They shall be rigidly and securely set.
- .6 All flexible conduit fixture feeds shall originate from the side of the outlet box and not from the box cover, with the exception of the modular furniture connections, which shall be permitted to exit from the cover.
- .7 In locating outlets, take care to allow for radiation, pipes, ducts, etc., and for the variation in arrangement and thickness of finishes, etc. Failure to comply with this will not relieve Electrical Contractor from the cost of necessary alterations.
- .8 Allow for the relocation of an outlet up to a dimension of 3m from that indicated on drawings, provided notice is given before roughing-in has been completed.
- .9 Install floor boxes in concrete formwork, prior to concrete pour, securely set to ensure finished collar is flush with the surface of the specified finish flooring.

END OF SECTION

PART 1 – GENERAL

1.1 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
 - .2 CSA C22.2 No. 45, Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83, Electrical Metallic Tubing.
 - .5 CAN/CSA C22.2 No 227, Flexible Nonmetallic Tubing.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with local requirements.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .4 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

PART 2 - PRODUCTS

2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel threaded, size as indicated.
- .2 Thin wall type electrical metallic tubing "EMT" with steel set screw couplings, galvanized, size as indicated.
- .3 Rigid PVC conduit, size as indicated.

2.2 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.3 FISHCORD

- .1 6.5 mm standard nylon pull rope with tensile strength of 5 kN.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
- .3 Use epoxy coated conduit in underground or in corrosive areas.
- .4 Use electrical metallic tubing (EMT) except in cast concrete and above 2.4 m not subject to mechanical injury.
- .5 Use rain-tight connectors and couplings where vertical portion of EMT conduit runs terminate into the top of electrical equipment incorporating drip shields or hoods.
- .6 Use rigid PVC conduit underground and in corrosive areas. Thin-wall (DB2) rigid PVC shall be permitted only where encased in concrete.
- .7 Use flexible metal conduit for connection to recessed incandescent fixtures without a prewired outlet box, connection to surface or recessed fluorescent fixtures and work in movable metal partitions.
- .8 Use liquid tight flexible metal conduit (minimum 3/8" internal diameter) for connection to motors or vibrating equipment in all locations, including controls and related devices
- .9 Use explosion proof flexible connection for connection to explosion proof motors.
- .10 Install conduit sealing fittings in hazardous areas. Fill with compound.
- .11 Minimum conduit size for lighting and power circuits: 19 mm.
- .12 Install EMT conduit from branch circuit panel to outlet boxes located in sub floor.
- .13 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .14 Mechanically bend steel conduit over 19 mm diameter.
- .15 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

- .16 Install fish cord in empty conduits.
- .17 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .18 Dry conduits out before installing wire.
- .19 Use electrical metallic tubing (EMT) for the following:
 - .1 Communication outlets between the device box and accessible ceiling space in all wall and partitions;
 - .2 All security system wiring;
 - .3 All wiring within electrical rooms and mechanical rooms;
 - .4 Structured wiring for system copper backbone cable;
 - .5 Home runs to panel boards from all branch circuit wiring;
 - .6 Where noted elsewhere.

3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with minimum 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 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.3 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.

END OF SECTION

PART 1 - GENERAL

1.1 LOCATION

- .1 Drawings indicating cable trays are in diagrammatic form only. Review exact locations of existing cable trays on site.

1.2 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Division 1.
- .2 Submit complete information on the product, c/w all accessories, including:
 - .1 Cable Tray.
 - .2 Barrier, barrier splice strips, horizontal bends, barrier clips, etc.
 - .3 Connecting hardware, connecting assemblies, etc.
 - .4 Grounding clamps.
 - .5 Cable tray clamps.
 - .6 Blind End Sections.
 - .7 Bonding jumpers.

PART 2 - PRODUCTS

2.1 CABLE TRAY

- .1 General Distribution
 - .1 Cable Trays and fittings: to EEMAC F5-1-1977.
 - .2 Channel type, to CSA C22.2 NO. 126.1-09
 - .3 Expansion joints and reducers where required. Fittings: manufactured accessories for the cable tray supplied.
 - .4 Adjustable vertical and horizontal splice plates where changes in direction preclude the use of standard fittings. Always use manufactured fittings. Do not use field modified fittings.
 - .5 Dead ends of cable trays shall be closed by the use of manufacturer fabricated blind end sections.
- .2 Manufacturers
 - .1 Acceptable Manufacturers to the requirements above:
 - .1 B-Line
 - .2 CFRP Comtray.
 - .3 ElectroTray.
 - .4 Pilgrim.
 - .5 Canadian Electrical Raceways.
 - .6 Thomas and Betts.
 - .7 Legrand/Cablofil

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Prior to ordering cable tray the electrical contractor shall prepare a detailed sketch illustrating the following:
 - .1 Proposed method of installation.
 - .2 Proposed hanger type and dimensions.
 - .3 Proposed method of grounding cable tray.
 - .4 Proposed routing of cable tray.
- .2 Support cable tray on both sides, using trapeze support kits where installed from hangers.
- .3 Install cable tray clamps on each side of every support strut.
- .4 Wall mounted cable tray to be supported with angle brackets.
- .5 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

3.2 CONTINUITY OF CABLE TRAY

- .1 The entire run of cable tray is to be continuous. Include all required fittings, vertical splices, horizontal splices, offsets, etc., to allow for changes in elevation, direction, etc.
- .2 Always use manufactured fittings. Do not use field modified fittings. Where changes in direction preclude the use of standard fittings use adjustable vertical and horizontal splice plates.

3.3 COORDINATION WITH OTHER TRADES

- .1 Coordinate installation with other services and equipment. Reroute cable tray as necessary to avoid conflict with the work of other trades.
- .2 Minimum clearances for cable trays shall be **in strict accordance** with CEC Rule 12-2200.

3.4 BONDING

- .1 Install a minimum continuous #6 bare bonding conductor in all runs of cable tray. Connect each section of cable tray to the bonding conductor using bolted clamps or a similar approved fitting.

3.5 SUPPORTS

- .1 Provide trapeze and cantilever supports at 3 metre (10 foot) intervals.
- .2 Cut off excess rod within 13 mm (1/2 inch) of channel bottom.
- .3 Minimum sized threaded rods to be 9.5 mm (3/8 inch).

- .4 Sandwich channel between nuts and washers located on both upper and lower surfaces.
- .5 Provide hold down clips to secure tray to strut.

END OF SECTION

PART 1 – GENERAL

1.1 REFERENCE STANDARDS

- .1 CSA C22.2 No. 29-M1983 - Panelboards and panelboard enclosures.

1.2 RELATED WORK

- .1 Common Work Results Electrical: Section 26 05 00.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Division 1.
- .2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.4 OPERATION AND MAINTENANCE MANUAL

- .1 Not Applicable

PART 2 - PRODUCTS

2.1 PANELBOARDS

- .1 Panelboards: product of one manufacturer.
- .2 Type: 250V and 600V LT, 3 phase, 4 wire, as indicated.
- .3 Panelboards shall have surface trim and doors finished for surface or flush mounted as shown on drawings, bolt-on circuit breaker type, sized and of types and electrical characteristics as indicated on drawings.
- .4 Cabinets for panelboards shall be minimum number 14 gauge galvanized steel, minimum of 508mm wide and 147mm deep, of dead front construction, and doors shall be single type, 120 degree door swing, with spring latch and lock. Two keys shall be supplied with each panelboard and all shall be keyed alike. Surface mounted panelboards shall be finished in ASA61 baked enamel. Panel bus bars shall be of aluminum with lugs suitable for copper conductor connections.
- .5 **Drip Hoods:** on all surface mounted panelboards factory installed.
- .6 All 3 phase, 4 wire panelboards rated at 225 amperes or less to have grounding terminal strip supplied and installed by manufacturer capable of terminating a minimum of two #2s, four #6s with balance of terminations to accept #12 conductors.

- .7 All panelboards rated at 225 amperes or less with voltages and phases as indicated on drawings requiring **isolated** grounding, to be capable of terminating quantities and sizes as indicated on electrical drawings.
- .8 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.
- .9 Ratings: mains, number of circuits, and number and size of main and branch circuit breakers as indicated in panel schedules.

2.2 BREAKERS

- .1 Breakers: to Section 26 28 16.
- .2 Breakers with thermal magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker: When indicated separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker. If main breaker is mounted on the bottom of panel, panel shall be approved for that purpose and shall be so marked.
- .4 Lock-on devices on handles of circuit breakers shall be installed for exit light circuits, fire alarm circuits, CCTV system, alarm monitoring and security, sump pumps to prevent accidental operation.

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00.
- .2 Nameplate for each panelboard size 4 engraved or as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved or as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit.

2.4 MANUFACTURERS

- .1 Standard of Acceptance: Cutler Hammer.
- .2 Other approved manufacturers: Siemens, Square D.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.
- .3 Mount panelboards to height specified in Section 26 05 00 or as indicated.
- .4 Connect loads to circuits as indicated.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.
- .6 Panels shall be installed in an upright position and the bottom of the panelboard shall be located not less than 1000mm above finished floor level where practicable.
- .7 Install a typed directory under transparent cover on the inside of each new panelboard showing the location and load connected to each circuit.
- .8 Wiring in panelboards shall be secured with tie wrap or equivalent means to present a neat workmanlike appearance. Branch circuitry wiring within panelboards shall have approximately 300mm of "slack" wire installed in 150mm loop adjacent to respective breakers where **phase** conductors terminate. All branch circuit **neutral**, ground and/or bond conductors to have approximately 300mm of slack wire neatly "looped" prior to terminations taking place. All **feeder conductors** to be installed in such a manner as to enable "clip on" type capacitive leakage tester to encompass neutral plus phase conductors together. Feeder conductors to be provided with additional slack wire adjacent to termination lugs.
- .9 Panels shall be flush or surface mounted as indicated in the schedule and shall be equipped with all breakers of the amperage and interrupting capacity noted on the drawings.
- .10 Run two 25mm spare conduits up to the ceiling space from each flush panel. Terminate these conduits in a 150 x 150 x 100mm junction box in the ceiling space. Box to have affixed nameplate indicating panel.
- .11 Circuit numbers on drawings do not necessarily correspond to the numbers on the lighting and power panels. Circuits sharing a common neutral shall not be connected to the same phase. Any changes in circuit numbering is to be included on "record drawings". Individual light fixtures fed with two branch circuits are to derive their source from **two pole** breakers.
- .12 The Lamacoid identification plate on panelboards shall include the voltage phase and wires and amperage (of breaker or fuse protecting it) in addition to the panel designation itself.

- .13 "Labelling" of all branch circuit phase conductors plus neutral and/or bond conductors shall be done with "Panduit" write-on, self laminating labels Nos. PDL-1 and PDL-2 as required or approved equal.
- .14 **Maximum size** conduits housing 15A or 20A branch circuits to be limited to 25mm in size exiting any panelboard.

3.2 TESTS

- .1 Perform tests in accordance with Section 26 05 00.

END OF SECTION

PART 1 – GENERAL

1.1 REFERENCE STANDARDS

- .1 CSA C22.2 No. 5.1 - Moulded Case Circuit Breakers.

1.2 RELATED WORK

- .1 Not Applicable

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit product data in accordance with Division 1.

1.4 OPERATION AND MAINTENANCE DATA

- .1 Not Applicable

PART 2 - PRODUCTS

2.1 BREAKERS GENERAL

- .1 Bolt-on moulded case circuit breaker, quick-make, quick-break type, de-ionizing arc chambers for manual and automatic operation with temperature compensation for 40 degree C ambient. Breakers to be trip-free of operating handles on overloads with a definite indication when tripping has taken place.
- .2 Mini type circuit breakers are not acceptable.
- .3 Multi-pole breakers shall have common trip mechanisms; tie handles are not acceptable.
- .4 Magnetic instantaneous trip elements in circuit breakers, to operate only when the value of current reaches setting. Trip settings on breakers with adjustable trips to range from 10 to 12 times current rating.
- .5 Circuit breakers with interchangeable trips as indicated.
- .6 Minimum acceptable circuit breaker interrupting rating shall be 14,000 RMS symmetrical amperes or as indicated on the drawings.

2.2 MANUFACTURERS

- .1 Breaker manufacturer and type shall match that of panel in which they are installed.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Circuit breakers shall be securely mounted in switchboards, panelboards, or EEMAC one (1) enclosures as indicated on the drawings and as required by other sections of the specifications.

END OF SECTION

PART 1 – GENERAL

1.1 REFERENCE STANDARDS

- .1 CSA C22.2 No. 39 - Fuseholder Assemblies.
- .2 CSA C22.2 No. 4 - Enclosed switches.

1.2 RELATED WORK

- .1 Common Work Results Electrical: Section 26 05 00

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit Shop Drawings and Product Data in accordance with Division 1.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

- .1 Fusible and non-fusible disconnect switches in CSA enclosures as indicated.
- .2 Provision for padlocking.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 ON-OFF switch position indication on switch enclosure cover.
- .5 Fuseholders: suitable without adaptors, for type and size of fuse as indicated.
- .6 Quick-make, quick-break action.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00.
- .2 Indicate name of load controlled on size 4 nameplate.

2.3 MANUFACTURERS

- .1 Standard of Acceptance: Eaton.
- .2 Other approved manufacturers: Siemens, Square D.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install disconnect switches as indicated.

- .2 Mount all disconnect switches in a secure manner, easily accessible, and at a height as specified in Section 26 05 00.
- .3 In finished areas mount disconnect switch on top of flush mounted junction box with conduit nipple on its coverplate into back of the switch.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

- .1 Unit equipment for emergency lighting to CSA C22.2 No. 141

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Division 1.
- .2 Data to indicate system components, mounting method, source of power and special attachments.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- .1 As noted on the drawings. Heads to be LED, remotes to have a minimum of 2 heads. Battery packs to be universal voltage (120-347V AC), heads to be 12V DC.

2.2 CONDUCTORS

- .1 120 or 347V AC supply: Use minimum #12 AWG conductor in minimum 13mm EMT.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install unit equipment for emergency lighting in accordance with CSA C22.1-15.
- .2 Install unit equipment 2100mm above finished floor or on ceiling as indicated.
- .3 Direct heads as indicated to provide adequate emergency illumination, in accordance with NBC (2015).

3.2 TESTS

- .1 Perform tests in accordance with Section 26 05 00.
- .2 Test system for operation and adjust heads if necessary for best coverage. Do test for 30 minutes on battery power.

END OF SECTION

PART 1 – GENERAL

1.1 REFERENCE STANDARDS

- .1 CSA – C860 – Performance of Internally Lighted Exit Signs.

1.2 RELATED WORK

- .1 Common Work Results for Electrical – Section 26 05 00

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section Division 1.
- .2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified or requested for approval by Engineer.

PART 2 - PRODUCTS

2.1 EXIT LIGHTS GENERAL

- .1 Exit lights to be pictogram “Running Man” exit signs.
- .2 Light emitting diode lamp, 120-347V, 25 year life.
- .3 Steel housing.
- .4 Surface mount allowing for ceiling, wall or end mount as indicated.
- .5 Field adjustable faces.
- .6 Unit to be self-powered, with a high performance Ni-Cd battery and solid state transfer to battery charger c/w 90 minutes of battery life.

2.2 MANUFACTURERS

- .1 As noted on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install exit lights as indicated, to requirements of NBC-2015.
- .2 Connect fixtures to exit light circuits as indicated.
- .3 Ensure that exit light circuit breakers are locked in on position.

END OF SECTION

PART 1 – GENERAL

1.1 REFERENCE STANDARDS

- .1 Standard for the Installation of Fire Alarm Systems: ULC-S524
- .2 Standard for Fire Alarm Control Units: ULC-S527-99

1.2 RELATED WORK

- .1 Common Work Results for Electrical: 26 05 00

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with Division 1.

1.4 OPERATION AND MAINTENANCE DATA

- .1 Submit operation and maintenance data in accordance with Division 1.
- .2 All new equipment shall be ULC approved and installed to the applicable standards.

1.5 SUMMARY

- .1 The fire alarm system is existing. Pane is to be relocated as shown on drawings. Relocate, supply and install new devices to connect to existing systems.

PART 2 - PRODUCTS

2.1 NOTIFICATION APPLIANCE CIRCUITS

- .1 Provide as indicated on the plans, supervised hard-wired Notification Appliance (Signal) Circuits (NAC) for the control of 24Vdc notification appliances. Each NAC shall operate as Class B (Style Y) power limited circuit.
- .2 NAC's shall be capable of providing steady, 20bps, 120bps or temporal rate outputs.

2.2 DETECTORS

- .1 Heat Detector shall have a solid state heat sensor, and shall transmit an alarm at a fixed temperature of 135° F (57°C) or due to a temperature Rate of Rise of 15°F/minute (9°C/minute). The detector shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. Cat # SIGA-HRS

- .2 The heat detector shall be rated for ceiling installation at 70 ft (21.3m) centers and be suitable for wall mount applications.

2.3 DEECTOR MOUNTING BASES

- .1 Mounting bases shall support all microprocessor-based detector types detailed in this specification
- .2 Removal of the respective detector shall not affect communications with other addressable devices.
- .3 Field wiring connections shall be made to the room side of the base, so that wiring connections can be made or disconnected by the contractor without the need for remove the mounting base from the electrical box.
- .4 Bases will have the option of external LED operation, Relay Base or Data Line Isolator Base. Cat # SIGA-SB

2.4 MANUAL PULL STATIONS

- .1 Fire Alarm / Life Safety System shall incorporate single stage microprocessor-based addressable Manual Pull Stations connected over a 2 wire electronic communications loop, using both broadcast and serial polling protocols. All Manual Pull Stations shall display communications and alarm status via LED's mounted on their integral, factory assembled module.
- .2 All addressing of the Manual Pull Stations shall be done electronically, and the electrical location of each station shall be automatically reported to the Fire Alarm Control Panel, where it may be downloaded into a PC, or printed out. The addressing of the Manual Pull Station will not be dependent on their electrical location on the circuit.
- .3 Provide polycarbonate vandal resistant covers over pull stations where indicated.
- .4 All Manual Fire Alarm station shall be suitable for operation in the following environment:
 - .1 Temperature: 32°F to 120°F (0°C to 49°C)
 - .2 Humidity: 0-93% RH, non-condensing

2.5 FIRE ALARM NOTIFICATION APPLIANCES - GENERAL

- .1 All appliances which are supplied for the requirements of this specification shall be ULC Listed.
- .2 All appliances shall be of the same manufacturer as the Fire Alarm Control Panel specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturer's instructions.
- .3 Any appliances that do not meet the above requirements, and are submitted for use must show written proof of their compatibility for the purpose intended. Such proof shall be in

the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purpose intended.

.4 Bells

- .1 Provide 6 and 10" bells where indicated on the drawings
- .2 Cat # MB6-24 6" or MB10-24 10"

2.6 END OF LINE DEVICES

- .1 End-of-line devices to control supervisory current in alarm circuits and signalling 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.

2.7 MONITORING

- .1 Owner shall use their own existing monitoring company. Contractor to ensure that system dual line dialer can communicate with third party monitoring station. If platform does not allow for proper communication then contract to allow for independent dialer.

2.8 MANUFACTURERS

- .1 To match existing.

PART 3 - EXECUTION

3.1 WIRING

- .1 The normal power supply to the fire alarm system shall be 120 volts 60 Hz.
- .2 All wiring shall be installed to conform to the requirements of the Canadian Electrical Code, Part 1 and applicable Provincial Codes. Wiring shall be sized in accordance with Class 2 requirements, but shall be protected from mechanically injury or other injurious conditions such as moisture, excessive heat or corrosive action in accordance with Class 1 requirements. Conductors shall be solid copper, 18 AWG. Cable shall be type FAS, 300 volt, FT4 insulated, color red, for alarm receiving devices and #14 AWG for signal devices.

3.2 VERIFICATION AND CERTIFICATION OF FIRE ALARM EQUIPMENT

- .1 The manufacturer shall make an inspection of the fire alarm equipment, including those components necessary to the direct operation of the system such as manual stations, thermal detectors and controls, whether or not manufactured by the manufacturer. The inspection shall comprise an examination of such equipment for the following:
 - .1 That the type of equipment installed is that designated by the Engineer's specifications;
 - .2 That the wiring connections to all equipment components show that the installer undertook to have observed ULC and CSA requirements;

- .3 That the manufacturers equipment has been installed in accordance with the written recommendations, and that all signalling devices of whatever manufacture have been operated or tested to verify their operation;
- .4 That the supervisory wiring of those items of equipment connected to a supervised circuit is operating and that the governmental regulations, if any, concerning such supervisory wiring, have been met to the satisfaction of inspecting officials.
- .2 The manufacturer shall supply to the electrical contractor reasonable amounts of technical assistance with respect to any changes necessary to conform the work of paragraphs .1, .2, .3 and .4 above. During period of inspection by the manufacturer, electricians shall be available as designated by the manufacturer.

3.3 INSPECTION

- .1 On completion of the inspections and when all of the above conditions have been complied with, the manufacturer shall issue to the consulting engineer:
 - .1 A copy of the inspections technician report showing 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.

3.4 INSPECTION COSTS

- .1 All costs involved in this inspection both from the manufacturer and the electrical contractor's work shall be included with the electrical contractor's total tender price.

END OF SECTION