
PWGSC Ontario
Region Project
R. 065355.001

SPECIFICATION
TITLE SHEET

Section 00 00 00
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Project Title Canada Revenue Agency, Fitup
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Project Number R.065355.001

Project Date 2013-11-29



Architect

Mechanical Engineer

Electrical Engineer



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PART 1 - GENERAL

1.1 MINIMUM
STANDARDS

- .1 Execute work to meet or exceed:
- .1 National Building Code of Canada 2010, National Fire Code of Canada 2010, Ontario Building Code 2012 and any other code of provincial or local application, including all amendments up to project date, provided that in any case of conflict or discrepancy, the more stringent requirements shall apply as directed by the Departmental Representative.
 - .2 Rules and regulations of authorities having jurisdiction.
 - .3 Treasury Board of Canada Secretariat, Fire Protection Standard, April 1, 2010.
 - .4 Observe and enforce construction safety measures required by National Building Code 2010, Part 8 Safety Measures at Construction and Demolition Sites, Occupational Health and Safety Act and Regulations for Construction Projects, Revised Statutes of Ontario 1990, Chapter O.1 as amended, O. Reg. 213/91 as amended by O. Reg. 631/94, O. Reg. 143/99, O. Reg. 571/99, O. Reg. 145/00, O. Reg. 527/00, R.R.O. 1990, Reg. 834, O. Reg. 278/05 (Asbestos), Workplace Safety and Insurance Board and municipal statutes and authorities.
 - .5 Environmental Protection Act, O. Reg. 102/94 and O. Reg. 103/94.
 - .6 Comply with CSA B651-12, Accessible Design for the Built Environment, unless specified otherwise. In any case of conflict or discrepancy between the building codes and CSA B651, the requirements of CSA B651 shall apply.

1.2 AUTHORITIES
HAVING JURISDICTION

- .1 Fire Testing requirements are for ULC or WHI listed and labelled products.
- .2 Substitution of ULI or other Fire testing reports for required ULC and WHI testing is acceptable to the Departmental Representative only if the issuing organization is accredited and listed in the "Directory of Accredited Certification Organizations (CAN-P-1505C), 1993" published by the Standards Council of Canada, 1-800-267-8220. Testing shall be to the Canadian standards and the tested products shall bear the appropriate label.
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1.2 AUTHORITIES
HAVING JURISDICTION
(Cont'd)

- .3 Submit 3 copies of test reports under the letterhead of the accredited organization to the Departmental Representative.

1.3 SAFETY PLANS
FOR WORK ORDERS

- .1 Provide a Fire Safety Plan, specific to the work location, in accordance with NBC 2010, Division B, Part 8, Article 8.1.1.1 and NFC 2010, Division B, Part 2, subsection 2.8.2 prior to commencement of work. The plan shall be coordinated with, and integrated into, the existing Building Emergency Procedures and Evacuation Plan in place at the site. Departmental Representative will provide Building Emergency Procedures and Evacuation Plan. Deliver two copies of the Fire Safety Plan to the Departmental Representative not later than 14 days before commencing work.
- .2 On award of Contract, submit to Departmental Representative, two copies of Contractor's and sub-contractors':
- .1 Site Specific Safety Plan.
 - .2 Safety Communication Plan.
 - .3 Emergency Procedures Plan.
 - .4 WSIB - Workplace Safety and Insurance Board Experience report.

1.4 TAXES

- .1 Pay applicable Federal, Provincial and Municipal taxes.

1.5 FEES, PERMITS,
CERTIFICATES AND
LETTERS

- .1 Provide authorities having jurisdiction with information requested.
- .2 Pay fees and obtain certificates, permits and letters required.
- .3 Obtain PWGSC Fire Protection Inspection Letter of Deficiencies from Departmental Representative. Submit a copy of the letter with a list of remedial measures taken to correct deficiencies.
- .4 Furnish certificates, permits and letters when requested.
- .5 Obtain receipt from carpet manufacturer for existing carpet returned for recycling and submit to Departmental Representative with request for final payment.

- 1.6 WORK BY OTHERS .1 Work of the Contract which will be undertaken by other Contractors and which are specifically excluded from this Contract are as follows:
- .1 Systems Furniture.
 - .2 Security Devices.
 - .3 Structured Cabling (data and communications by Shared Services Canada).
- .2 Coordinate work by others with the Work of this Contract.
- 1.6 EXAMINATION .1 Examine existing conditions and determine conditions affecting work.
- .2 Conduct concrete floor moisture testing using Calcium Chloride moisture tests.
- .1 Submit test results to Departmental Representative for approval prior to installing any flooring. Conduct one test per 100 sq. metres of area being covered.
- 1.7 DOCUMENTS .1 Keep one copy of contract documents and shop drawings on the site.
- 1.8 ELECTRONIC SUBMITTALS .1 Submit number of hard copies specified for each type and format of submittal and also submit in electronic format as pdf files. Forward pdf, NMSEdit Professional spp, MS Word, MS Excel, and Autocad dwg files; on USB compatible with PWGSC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Departmental Representative.
- 1.9 CONTRACTOR'S AS-BUILT DRAWINGS AND SPECIFICATIONS .1 As work progresses, neatly record significant deviations from the Contract drawings and specifications using fine, red marker on full size white prints and specifications. Make the same changes on the electronic files.
- .2 Neatly print lettering and numbers in size to match original. Lines may be drawn free-hand but shall be neat and accurate. Add at each title block note: "AS BUILT". Also circle on List of Drawings each title and number of drawing marked with "AS-BUILT" information.
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1.9 CONTRACTOR'S
AS-BUILT DRAWINGS
AND SPECIFICATIONS
(Cont'd)

- .2 (Cont'd)
Circle on Table of Contents each specification section number and title of specification sections marked with "AS-BUILT" information.
- .3 Departmental Representative will provide one electronic set of drawings, schedules and specifications for as-built drawing and specification purposes.
 - .1 Drawings are in Autocad.
 - .2 Specifications are in NMSEdit Professional.
 - .3 Amendments and addenda are in MS Word.
- .4 Record following significant deviations:
 - .1 Depths of various elements of foundation.
 - .2 Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvement.
 - .3 Location of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure.
 - .4 Field changes of dimension.
 - .5 Other significant deviations which are concealed in construction and can not be identified by visual inspection.
 - .6 Alternative materials and systems installed replacing original materials and systems specified by trade name.
- .5 Turn one set, paper copy and electronic copy, of AS-BUILT drawings and specifications over to Departmental Representative on completion of work. Submit pdf files on USB compatible with PWGSC encryption requirements, through email or alternate electronic file sharing service such as ftp.
- .6 If project is completed without significant deviations from Contract drawings and specifications submit to Departmental Representative one set of drawings and specifications marked "AS-BUILT".

1.10 OPERATIONS AND
MAINTENANCE DATA

- .1 On completion of project submit to Departmental Representative 3 copies of Operations and Maintenance Data assembled in three 255 x 295 mm vinyl-covered, 3-ring, loose-leaf binders with title sheet labelled "Operations Data and Maintenance Manual", project title, date and list of contents.

1.10 OPERATIONS AND .1
MAINTENANCE DATA
(Cont'd)

(Cont'd)
Organize content into applicable sections between hard paper dividers with labelled tabs.

- .2 Include in each binder maintenance instructions for finished surfaces, warranties and guarantees in form approved by Departmental Representative, hardware schedule, schematic diagrams for electrical hardware, complete set of final shop drawings (bound separately), names, addresses and phone numbers of sub-contractors and suppliers, list of materials with names of manufacturer and source of supply. Neatly type lists and rates. Use clear drawings, diagrams or manufacturer's literature.

1.11 SHOP DRAWINGS .1
AND PRODUCT DATA
SHEETS

Prior to submission check and certify as correct, shop drawings and product data sheets. Issue to Departmental Representative each submission at least 14 days before dates reviewed submission will be needed.

- .2 Where technical sections specify that shop drawings bear the stamp of a Registered Professional Engineer, the Engineer must be registered in the Province of Ontario.
 - .3 Submit 3 prints and 1 electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
 - .4 Submit 3 prints and 1 electronic copy 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.
 - .5 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept. This review shall not mean that PWGSC 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 all requirements of construction and Contract
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- 1.13 DESIGN DATA, .3 (Cont'd)
TEST REPORTS, Canada, Canadian Environmental Protection Act,
CERTIFICATES, Environmental Choice Product Guidelines:
MANUFACTURER'S .1 Submit two copies of the licensing
INSTRUCTIONS, criteria statements and the verification of
MANUFACTURER'S compliance with Sections 3(a) and 3(b) of the
FIELD REPORTS ECP to the Departmental Representative. For
(Cont'd) adhesives, paints, primers and sealants,
cleaners and degreasers, floor polishes, water
borne surface coatings, indicate VOC in g/l.
.2 Alternatively, material in original
containers bearing the 'Ecologo' or products
bearing the 'Ecologo' will satisfy this
requirement.
- .4 Responsibility for errors, omissions or
deviations from requirements of Contract
Documents is not relieved by Departmental
Representative's review of submittals.
- 1.14 SAMPLES .1 Submit duplicate samples in full range of
colours.
.2 Identify manufacturer's name, product and
colour.
.3 Installed work shall match reviewed sample.
- 1.15 ADDITIONAL .1 Departmental Representative may furnish
DRAWINGS additional drawings to clarify work.
.2 Such drawings become part of Contract
Documents.
- 1.16 PROTECTION .1 Protect existing work from damage.
.2 Replace damaged existing work with material
and finish to match original.
.3 Remove coverings and clean following
completion of each work period.
.4 Provide temporary, non-combustible, steel
stud and drywall dustproof partitions between
occupied and work areas. Maintain access to
fire exits and washroom facilities. Remove
partition on completion of work. Allow for
both 1 sided and 2 sided partitions as
indicated on drawings.
-

1.17 EXISTING
SERVICES

- .1 Establish location, protect and maintain existing utility lines.
- .2 Maintain existing services in occupied areas.
- .3 Use designated existing sanitary facilities.
- .4 Use existing water and electrical services at no cost.
- .5 Use elevator designated, protect walls from damage.

1.18 TEMPORARY
FACILITIES AND
SERVICES

- .1 Provide and maintain temporary facilities and services required to carry out work.
- .2 Remove temporary facilities and services on completion of work.

1.19 METRIC SIZED
MATERIALS

- .1 SI metric units of measurement are used exclusively on the drawings and in the specifications for this project.
 - .2 The Contractor is required to provide metric products in the sizes called for in the Contract Documents except where a valid claim can be made that a particular product is not available on the Canadian market.
 - .3 Claims for exemptions from use of metric sized products shall be in writing and fully substantiated with supportive documentation. Promptly submit application to Departmental Representative for consideration and ruling. Non-metric sized products may not be used unless Contractor's application has been approved in writing by the Departmental Representative.
 - .4 Difficulties caused by the Contractor's lack of planning and effort to obtain modular metric sized products which are available on the Canadian market will not be considered sufficient reasons for claiming that they cannot be provided.
 - .5 Claims for additional costs due to provision of specified modular metric sized products will not be considered.
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- 1.20 MATERIAL AND EQUIPMENT
- .1 Use new products unless otherwise specified.
 - .2 Deliver and store material and equipment to manufacturer's instructions with manufacturer's labels and seals intact.
 - .3 When material or equipment is specified by standard or performance specifications, upon request of Departmental Representative, obtain from manufacturer an independent testing laboratory report, stating that material or equipment meets or exceeds specified requirements.
- 1.21 CONCEALMENT
- .1 Conceal pipes, ducts, conduits and wiring in finished areas.
- 1.22 CUTTING AND REMEDIAL WORK
- .1 Co-ordinate work to keep cutting and remedial work to a minimum.
 - .2 Execute cutting and remedial work required. Notify Departmental Representative before cutting, boring or sleeving structural members.
 - .3 Prior to cutting or drilling horizontal or vertical surfaces including concrete, concrete block or other structural substrate, determine location of reinforcing, service lines, pipes, conduits or other items by x-ray, ground penetrating radar or other appropriate method. Submit findings to Departmental Representative prior to cutting or drilling.
 - .4 Use specialists in affected material to execute cutting and remedial work.
 - .5 Match work to adjoining construction and finishes.
 - .6 Fit components tight to adjoining surfaces.
 - .7 Make good surfaces exposed or disturbed by work with material and finish to match existing adjoining surfaces.
 - .8 After patching wall, ceiling or other painted surfaces, paint the entire wall or area up to the next change in plane or direction as directed by Departmental Representative.
-

1.23 FASTENINGS

- .1 Provide fastenings of type, size and spacing required to assure secure anchorage.
- .2 Obtain Departmental Representative's permission before using explosive actuated fasteners.

1.24 CO-ORDINATION
AND CO-OPERATION

- .1 Site will be occupied during execution of work.
- .2 Building will be occupied during execution of work.
- .3 Work area will not be occupied during execution of work.
- .4 Execute work with minimum disturbance to occupants, public and normal use of site building and work area.
- .5 Maintain access and exits.
- .6 Where security has been reduced by work of contract, provide temporary means to maintain security.

1.25 ALTERATIONS TO
EXISTING BUILDING

- .1 Remove and recycle or dispose of:
 - .1 Items indicated on demolition drawings indicated, but not limited to
 - .1 Gypsum board.
 - .2 Ceiling Tiles (excluding beveled edge tiles).
 - .3 Metal stud framing.
 - .4 Carpets not designated for reuse.
 - .5 Rasied flooring including ramp, steps and handrails.
 - .6 Mechanical and electrical items as indicated.
 - .2 Remove in good order, turn over to Department, and store within building where designated by Departmental Representative:
 - .1 Existing marble slab wainscotting at Corridor 202 not being reused.
 - .2 Existing wood wainscotting cap trim at Corridor 202 not being reused.
 - .3 Mechanical and electrical items as indicated.
-

1.25 ALTERATIONS TO .3
EXISTING BUILDING
(Cont'd)

- Remove, temporarily store, clean, alter to suit and reinstall:
- .1 Existing wood doors including hardware.
 - .2 Existing 1220 x 610 mm beveled edged ceiling tiles.
 - .3 Existing beige accent carpet tile in sufficient quantity for reinstallation at second floor door frames.
 - .4 Existing marble slab wainscotting at Corridor 202.
 - .5 Existing bound edged carpet base in sufficient quantity for reinstallation.
 - .6 Existing floor tile and floor tile base in Corridor 103 area in sufficient quantity for reinstallation.
 - .7 Mechanical and electrical items as indicated.
- .4 Provide new openings required in existing construction.
 - .5 Block in openings where items removed with material and finish to match existing adjoining construction.
 - .6 Undercut existing doors to clear new carpet.

1.26 TEMPORARY
SIGNS

- .1 Erect dressed wood frame capable of supporting signs in 130 km/h winds.
 - .2 Public Works and Government Services Canada and Contractor's signs of 1200 x 2400 x 20 mm thick, medium density overlaid plywood. Apply to frames with non-ferrous or hot dip galvanized fasteners. Sand and seal plywood edges.
 - .3 Paint wood surfaces with 1 coat primer to CGSB 1-GP-55M and 2 coats exterior enamel to CAN/CGSB-1.59-M89, paints Ecologo certified. Frames black and signs white colour.
 - .4 Install overlay in accordance with manufacturer's instructions. Overlay and instructions supplied by Public Works and Government Services Canada.
 - .5 Contractor's sign to match size, style and format of PWGSC sign. All information in both official languages. Do not include Federal symbols and logo. Submit drawing of Contractor's sign for Departmental Representative's review prior to erection.
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- 1.26 TEMPORARY SIGNS
(Cont'd) .6 Maintain signs for duration of project.
.7 Dismantle and dispose of signs and frames on completion of work.
- 1.27 INSPECTION AND TESTING
TESTING .1 When initial tests and inspections reveal work not to contract requirements, pay for tests and inspections required by Departmental Representative on corrected work.
- 1.28 COST BREAKDOWN .1 Within 48 hours of notification of acceptance of bid furnish a cost breakdown by Section aggregating contract price.
.2 Show separately cost of equipment purchased exempt from Ontario Retail Sales Tax under your Ontario Sales Tax licence number.
.3 Within 48 hours of acceptance of bid submit a list of subcontractors.
- 1.29 SCHEDULING
SCHEDULING .1 On award of contract submit bar chart construction schedule for work, indicating anticipated progress stages within time of completion. When schedule has been reviewed by the Departmental Representative take necessary measures to complete work within scheduled time. Do not change schedule without notifying Departmental Representative.
.2 Carry out work Monday to Saturday from 07:00 to 23:00 hours and on Sundays from 11:00 to 18:00.
.3 Carry out noise generating work Monday to Friday from 17:00 to 23:00 hours and 7:00 to 23:00 on Saturdays and 11:00 to 18:00 on Sundays.
.4 Carry out interior painting in occupied areas Monday to Saturday from 07:00 to 23:00 hours and on Sundays from 11:00 to 18:00. Thoroughly ventilate areas painted during "off hours".
.5 Interior painting of washrooms, service areas, new space or unoccupied space may be carried out during normal working hours.
.1 Provide continuous ventilation during and after application of paint. Run
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- 1.29 SCHEDULING .5 (Cont'd)
(Cont'd)
- .1 (Cont'd)
ventilation system 24 hours per day during installation at 30% outside air; provide continuous ventilation for 7 days after completion of application of paint.
- 1.30 CLEANING .1 Maintain project free of accumulated waste and rubbish.
- .2 Final cleaning in work area:
.1 Remove temporary protection.
.2 Remove dust, dirt and foreign matter from surfaces. HEPA vacuum interior surfaces.
.3 Polish all glass in work area and metal surfaces.
.4 Broom clean paved exterior surfaces, rake clean other exterior surfaces.
- 1.31 CONSTRUCTION & DEMOLITION WASTE .1 Carefully deconstruct and source separate materials/equipment and divert from D&C waste destined for landfill to maximum extent possible. Reuse, recycle or sell material off site for reuse except where indicated otherwise. On site sales are not permitted. Target for this project is 95% diversion from landfill.
- .2 For construction and demolition projects, even for those not over 2,000 m² total floor area, source separate waste and maintain waste audits in accordance with the Environmental Protection Act, Ontario Regulation 102/94 and Ontario Regulation 103/94.
.1 Provide facilities for collection, handling and storage of source separated wastes.
.2 Source separate the following waste:
.1 Brick and portland cement concrete.
.2 Corrugated cardboard.
.3 Wood, not including painted or treated wood or laminated wood.
.4 Gypsum board, unpainted.
.5 Steel.
- .3 Submit a waste reduction workplan indicating the materials and quantities of material that will be recycled and diverted from landfill.
.1 Indicate how material being removed from the site will be reused or recycled.
-

1.31 CONSTRUCTION & .4
DEMOLITION WASTE
(Cont'd)

Submit proof that all waste is being disposed of at a licensed land fill site or waste transfer site. A copy of the disposal/waste transfer site's license and a letter verifying that said landfill site will accept the waste must be supplied to Departmental Representative prior to removal of waste from the demolition site.

1.32 ASBESTOS .1
DISCOVERY

If during alteration work existing asbestos material is discovered (e.g. fireproofing, acoustic or thermal insulation, pipe or tank covering) stop work and immediately notify Departmental Representative. Do not remove any existing material containing asbestos fibres.

1.33 DESIGNATED .1
SUBSTANCES

The project site has been surveyed for the presence of designated substances referred to in the Occupational Health and Safety Act and Regulations for Construction Projects, O.Reg. 213/91 as amended.

.2 The list of designated substances present at the project site is attached at the end of this section.

.3 Copies of this list will be provided to each prospective subcontractor prior to entering into a contract with them.

.4 Post prominent notices identifying and warning of the hazardous agent in the part of the workplace in which the agent is found or used. Notices shall be in English and other languages prescribed under the Act.

1.34 HALOCARBONS .1

Comply with Federal Halocarbon Regulations 2003 under the Canadian Environmental Protection Act 1999, EPAM and PWGSC Ontario Region Halocarbon Information Sheet dated March 2010.

- 1.35 SPECIAL PROTECTION AND PRECAUTIONS .1 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and the provision of material safety data sheets acceptable to ESDC - Labour Program.
- 1.36 IAQ - INDOOR AIR QUALITY .1 Comply with CSA Z204-94(R1999), Guideline for Managing Indoor Air Quality in Office Buildings.
- 1.37 POLLUTION CONTROL .1 Spills of deleterious substances:
.1 Immediately contain, limit spread and clean up in accordance with provincial regulatory requirements.
.2 Report immediately to Ontario Spills Action Centre: 1-800-268-6060.
.3 Further information on dangerous goods emergency cleanup and precautions including a list of companies performing this work can be obtained from the Transport Canada 24-hour number (613) 996-6666 collect.
- 1.38 OPSS AND OPSD .1 OPSS Ontario Provincial Standard Specifications and OPSD Ontario Provincial Standard Drawings quoted in these specifications are available online at <http://www.raqsa.mto.gov.on.ca/techpubs/ops.nsf/OPSHomepage>.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

PART 1 - GENERAL

- 1.1 REFERENCES .1 CSA International
.1 CSA S350-M1980(R2003), Code of Practice
for Safety in Demolition of Structures.
- .2 U.S. Environmental Protection Agency
(EPA)/Office of Water
.1 EPA 832/R-92-005, Storm Water Management
for Construction Activities: Developing
Pollution Prevention Plans and Best Management
Practices.
- 1.2 ACTION AND INFORMATIONAL
SUBMITTALS .1 Submit in accordance with Section 01 11 01.
- 1.3 SITE CONDITIONS .1 Review "Designated Substance Report" and take
precautions to protect environment.
- .2 If material resembling spray or
trowel-applied asbestos or other designated
substance listed as hazardous be encountered,
stop work, take preventative measures, and
notify Departmental Representative
immediately.
.1 Proceed only after receipt of written
instructions have been received from
Departmental Representative.
- .3 Notify Departmental Representative before
disrupting building access or services.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not used.
-

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Inspect building with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.
- .3 Notify and obtain approval of utility companies before starting demolition.
- .4 Disconnect, cap, plug or divert, as required, existing public utilities within the property where they interfere with the execution of the work, in conformity with the requirements of the authorities having jurisdiction. Mark the location of these and previously capped or plugged services on the site and indicate location (horizontal and vertical) on the record drawings. Support, shore up and maintain pipes and conduits encountered.
 - .1 Immediately notify Departmental Representative and utility company concerned in case of damage to any utility or service, designated to remain in place.
 - .2 Immediately notify the Departmental Representative should uncharted utility or service be encountered, and await instruction in writing regarding remedial action.

3.2 PROTECTION

- .1 Prevent movement, settlement, or damage to adjacent parts of building to remain in place. Provide bracing and shoring required.
 - .2 Keep noise, dust, and inconvenience to occupants to minimum.
 - .3 Protect building systems, services and equipment.
 - .4 Provide temporary dust screens, covers, railings, supports and other protection as required.
-

3.3 PREPARATION

- .1 Protection of In-Place Conditions:
 - .1 Keep noise, dust, and inconvenience to occupants to minimum.
 - .2 Protect building systems, services and equipment.
 - .3 Provide temporary dust screens, covers, railings, supports and other protection as required.
 - .4 Do Work in accordance with Section 01 11 01.

 - .2 Demolition/Removal:
 - .1 Bulk demolition of ground and second floor materials to be scheduled to be completed after normal working hours on a weekend, commencing Friday 17:00 and completed before Sunday 18:00.
 - .2 Remove items as indicated.
 - .3 Remove partitions, doors and frames in existing building to permit new alterations.
 - .4 Remove floor finishes complete with all adhesives in area of new work.
 - .5 Trim edges of partially demolished building elements to tolerances as defined by Departmental Representative to suit future use.

 - .3 Slaved Items:
 - .1 Remove, handle and transport Products indicated to be salvaged and stored for future use. Transport Products to storage area(s) designated by Departmental Representative. Perform Work to prevent any damage to Products during removal and in storage. Products damaged during removal, will be inspected by Departmental Representative. Departmental Representative will determine extent of damage and accept or refuse Products.

 - .4 Removed and Replaced Items:
 - .1 Where acoustic ceiling tiles are indicated for removal and subsequent reinstallation, the tile are to be removed and stored on site in a dry and safe location approved with the Departmental Representative. The suspension system and framing is to be removed only as required for work above the ceiling, and subsequently re-installed with the ceiling tiles.
 - .2 Stone wall panels: Salvage and stockpile original stone wall wainscoting for reinstallation on second floor as indicated on drawings or as indicated on site. Salvaged materials shall not be chipped, cracked, or
-

-
- 3.3 PREPARATION .4 Removed and Replaced Items:(Cont'd)
(Cont'd) .2 Stone wall panels:(Cont'd)
damaged and shall be free of mortar. Stockpile
stone on wood skids.
- 3.4 ROOF CUTTING AND .1 Cut openings through existing roofing to
PATCHING accommodate new penetrations. Make good
roofing around new penetrations.
- .2 Existing roofing is an insulated 2-ply
modified bitumen in a conventional assembly.
Verify actual system in the field by means of
a simple cut test and report to the Consultant
result of test. Make good cut areas.
- .3 At all locations where new openings are
required in the existing roofing system,
carefully cut and remove portions of existing
roofing as required for remedial work required
by this Section, including but not limited to
cants, blocking and metal flashings. Seal all
open roof edges to prevent damage to
unfinished and undisturbed roof areas.
- .4 Remove only enough existing roofing system
materials that can be replaced with new roof
system the same day as the weather will
permit.
- .5 Supply and install plywood catchboard
immediately under areas to be cut, to protect
structure interior from falling debris.
Install catchboard in combination with
dust/weather protection.
- .6 Seal joints at items projecting through
membrane watertight to acceptance of
Consultant.
- 3.5 CLEANING .1 Progress Cleaning: clean in accordance with
Section 01 11 01.
.1 Leave Work area clean at end of each
day.
- .2 Final Cleaning: upon completion remove
surplus materials, rubbish, tools and
equipment in accordance with Section 01 11 01.
-

3.5 CLEANING
(Cont'd)

- .3 Refer to demolition drawings and specifications for items to be salvaged for reuse.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 11 01.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 American Society for Testing and Materials International, (ASTM):
 - .1 ASTM A123/A123M-12, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM A666-10, Standard Specification for Annealed or Cold Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating
 - .3 Canadian Standards Association (CSA):
 - .1 CSA B651-12, Accessible Design for the Built Environment.
 - .2 CSA G40.20-04(2009)/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .3 CAN/CSA-W59-03(R2008), Welded Steel Construction (Metal Arc Welding).
 - .4 The Master Painters Institute (MPI) / Architectural Painting Specification Manual - February 2004.
 - .1 MPI #79 - Primer, Alkyd, Anti-Corrosive for Metal.
- 1.2 SUBMITTALS
- .1 Submit shop drawings and product data of each item specified in accordance with Section 01 11 01.
 - .1 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details and accessories.
 - .2 Indicate each item's conformance with CSA B651.
 - .3 Each shop drawing submission shall bear signature and stamp of qualified professional engineer registered or licensed in province of Ontario.
-

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Steel: to CSA G40.20/G40.21, Grade 300W, minimum 30% recycled content.
- .2 Stainless steel sheet, strip, plate and flat bar: to ASTM A666, type 304, AISI No. 4 finish, minimum 75% recycled content.
- .3 Hollow Structural Sections (HSS): to CSA G40.20/G40.21, Grade 350W, Class H, minimum 30% recycled content.
- .4 Alkyd primer: to MPI #79, E3 environmental rating.
- .5 Galvanizing: hot dip, unpassivated, to ASTM A123/A123M, Coating Grade 85, minimum 600 g/m².
- .6 Zinc rich primer for galvanized surfaces: zinc rich, readymix to CAN/CGSB-1.181, Ecologo certified.
- .7 Grout: non-shrink, non-metallic, flowable, 24 h, 15 MPa, pullout strength 7.9 MPa.

2.2 FABRICATION

- .1 Fit joints in true planes and securely fasten.
- .2 Weld to CSA W59. File or grind welds smooth and flush with adjoining surface.
- .3 Shop assemble work.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Supply other sections with templates, instructions and built-in items.
 - .2 Install work straight, plumb and level to a tolerance of 1:600.
 - .3 Provide required reinforcing and anchorage.
 - .4 Touch-up burnt, scratched or chipped primer.
-

3.2 LATERAL SUPPORT .1
ANCHORS

Provide one piece, galvanized steel anchors to provide lateral support of new partitions where they abutt the underside of deck.

3.3 CORNER GUARDS .1

Provide 50 mm x 50 mm x 3mm thick stainless steel corner guards, 1220 mm high.

.2 Adhere corner guards to surface as indicated on drawings.

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 ASTM International:
 - .1 ASTM C919-08, Standard Practical for Use of Sealants in Acoustical Applications.
 - .2 ASTM C920-11, Standard Specification for Elastomeric Joint Sealants.
 - .2 Architectural Woodwork Manufacturers Association of Canada (AWMAC):
 - .1 AWI/AWMAC/WI AWS-2009.
 - .3 Canadian Standards Association (CSA):
 - .1 CSA B651-12, Accessible Design for the Built Environment.
 - .2 CSA O121-08, Douglas Fir Plywood.
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Submit in accordance with Section 01 11 01 and AWS Section 1.
 - .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for architectural woodwork and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS.
 - .3 Shop Drawings:
 - .1 Submit two copies of drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Indicate details of construction, profiles, jointing, fastening and other related details.
 - .1 Scales: profiles full size, details half full size.
 - .3 Indicate materials, thicknesses, and finishes.
 - .4 Samples:
 - .1 Submit duplicate samples of hardwood: sample size 300 x 300 mm or 300 mm long.
 - .5 Certifications: submit AWMAC GIS certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .1 Architectural woodwork shall be manufactured and/or installed to the current AWMAC Architectural Woodwork Standards and
-

1.2 ACTION AND
INFORMATIONAL
SUBMITTALS
(Cont'd)

- .5 Certifications:(Cont'd)
- .1 (Cont'd)
shall be subject to an inspection at the plant
and/or site by an appointed AWMAC Certified
Inspector.
- .2 Inspection costs shall be included in
the bid price for this project. Contact your
local AWMAC Chapter for details of inspection
costs.
- .3 Shop drawings shall be submitted to the
AWMAC Chapter office for review before work
commences.
- .4 Work that does not meet the AWMAC
Architectural Woodwork Standards, as
specified, shall be replaced, reworked and/or
refinished by the architectural woodwork
contractor, to the approval of AWMAC, at no
additional cost to the. Departmental
Representative.
- .5 If the woodwork contractor is an AWMAC
Manufacturer member in good standing, a two
(2) year AWMAC Guarantee Certificate will be
issued.
- .6 The AWMAC Guarantee shall cover
replacing, reworking and/or refinishing any
deficient architectural woodwork due to faulty
workmanship or defective materials supplied by
the woodwork contractor, which may appear
during a two (2) year period following the
date of issuance.
- .7 If the woodwork contractor is not an
AWMAC Manufacturer member they shall provide
the Departmental Representative with a two (2)
year maintenance bond, in lieu of the AWMAC
Guarantee Certificate, to the full value of
the architectural woodwork contract.

1.3 ACCESSIBILITY

- .1 Comply with CSA B651, Accessible Design for
the Built Environment.
-

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Exposed hardwood (wainscotting cap trim Corridor 202): to AWI/AWMAC/WI Architectural Woodwork Standards, Section 3: kiln dried wood, moisture content 6-12%, premium grade, cherry, uniform colour.
 - .1 Special characteristics: Solid cherry, heartwood to match existing.
 - .2 Transparent finish: to match existing.
- .2 Concealed blocking and framing: S-DRY, graded and stamped to National Lumber Grades Authority, Standard Grading Rules for Canadian Lumber, December 2010, SPF, 121c. "STUD" and 101d. "D" FINISH.
- .3 Concealed plywood: douglas fir to CSA 0121, Good One Side, urea formaldehyde free, fire rated.
- .4 Sealant: 1 component, silicone base, solvent curing to ASTM C919 and ASTM C920-08, primerless, Type S, Grade NS, Class 50, SWRI validated, Ecologo certified, mould and mildew resistant.
- .5 Construction adhesive: to CSA 0112 Series, cartridge loaded.
 - .1 Maximum allowable VOC limit 140 g/L.
 - .2 SCAQMD Rule 1168, Adhesives and Sealants Applications.

2.2 FABRICATION

- .1 Fabricate new and rework existing wainscotting cap trim at new and relocated doorways.
 - .2 Fabricate new profile to match existing as required.
-

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Set items in place, plumb, straight and level to a tolerance of 1:400 and rigidly secure in place in accordance with AWI/AWMA/Architectural Woodwork Standards.
- .2 Apply sealant to junction of wainscoting trim and substrate.
- .2 Compatible finishes to be field applied to match existing finishes.

PART 1 - GENERAL

1.1 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S101-07, Standard Methods of for Fire Endurance Tests of Building Construction and Materials.
 - .2 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .3 CAN/ULC-S115-11, Standard Method of Fire Tests of Firestop Systems.

1.2 DEFINITIONS

- .1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.
- .2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.
- .3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.
- .4 Continuity of Fire Separations: NBC 2010, Division B, Parts 3.1.8 and 3.1.9.1, 9.10.9):
 - .1 Wall, partition or floor assemblies required to be a fire separation shall be: constructed as a continuous element; have a fire resistance rating; have openings protected by a closure; and have penetrations sealed by a firestop.

- 1.3 SUBMITTALS
- .1 Provide submittals in accordance with Section 01 11 01.
 - .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 11 01.
 - .3 Shop Drawings:
 - .1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.
 - .2 Construction details should accurately reflect actual job conditions.
 - .4 Samples:
 - .1 Submit duplicate 300 x 300 mm samples showing actual fire stop material proposed for project.
 - .5 Quality assurance submittals: submit following in accordance with Section 01 11 01.
 - .1 Test reports: in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.
 - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.
 - .4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.
-

1.4 QUALITY
ASSURANCE

- .1 Qualifications:
 - .1 Installer: person specializing in fire stopping installations with 5 years documented experience and approved by manufacturer.
 - .2 All fire stopping material shall be from one manufacturer.
 - .3 All fire stopping installation work for entire project shall be by a single contractor experienced in firestopping. Individual disciplines shall NOT fire stop their own work.

- .2 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with contractor's representative and Departmental Representative in accordance with Section 01 11 01 to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.

- .3 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
 - .1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.

1.5 DELIVERY,
STORAGE AND
HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 11 01.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.

- .2 Storage and Protection:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

1.5 DELIVERY,
STORAGE AND
HANDLING
(Cont'd)

- .2 Storage and Protection:(Cont'd)
 - .2 Replace defective or damaged materials with new.
- .3 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 11 01.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Fire stopping and smoke seal systems: in accordance with CAN/ULC-S115.
 - .1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN/ULC-S115 and not to exceed opening sizes for which they are intended and conforming to specified special requirements described in PART 3.
 - .2 Fire stop system rating: F.
 - .2 Service penetration assemblies: systems tested to CAN/ULC-S115.
 - .3 Service penetration fire stop components: certified by test laboratory to CAN/ULC-S115.
 - .4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
 - .5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
 - .6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
 - .7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
 - .8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
 - .9 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.
-

2.1 MATERIALS .10 Sealants for vertical joints: non-sagging.
(Cont'd)

PART 3 - EXECUTION

3.1 MANUFACTURER'S .1 Compliance: comply with manufacturer's
INSTRUCTIONS written recommendations or specifications,
including product technical bulletins,
handling, storage and installation
instructions, and datasheets.

3.2 PREPARATION .1 Examine sizes and conditions of voids to be
filled to establish correct thicknesses and
installation of materials.
.1 Ensure that substrates and surfaces are
clean, dry and frost free.
.2 Prepare surfaces in contact with fire
stopping materials and smoke seals to
manufacturer's instructions.
.3 Maintain insulation around pipes and ducts
penetrating fire separation.
.4 Mask where necessary to avoid spillage and
over coating onto adjoining surfaces; remove
stains on adjacent surfaces.

3.3 INSTALLATION .1 Install fire stopping and smoke seal material
and components in accordance with
manufacturer's certified tested system
listing.
.2 Seal holes or voids made by through
penetrations, poke-through termination
devices, and unpenetrated openings or joints
to ensure continuity and integrity of fire
separation are maintained.
.3 Provide temporary forming as required and
remove forming only after materials have
gained sufficient strength and after initial
curing.
.4 Tool or trowel exposed surfaces to neat
finish.
.5 Remove excess compound promptly as work
progresses and upon completion.

3.4 SEQUENCES OF
OPERATION

- .1 Proceed with installation only when submittals have been reviewed by Departmental Representative.
- .2 Install floor fire stopping before interior partition erections.
- .3 Metal deck bonding: fire stopping to precede spray applied fireproofing to ensure required bonding.
- .4 Mechanical pipe insulation: certified fire stop system component.
 - .1 Ensure pipe insulation installation precedes fire stopping.

3.5 FIELD QUALITY
CONTROL

- .1 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.
- .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 as described in PART 1 - SUBMITTALS.
 - .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 PART 1 - QUALITY ASSURANCE.

3.6 CLEANING

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

3.7 SCHEDULE

- .1 Fire stop and smoke seal at:
 - .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.

3.7 SCHEDULE
(Cont'd)

- .1 (Cont'd)
- .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, ceilings and roofs.
 - .6 Openings and sleeves installed for future use through fire separations.
 - .7 Around mechanical and electrical assemblies penetrating fire separations.

PART 1 - GENERAL

- 1.1 ENVIRONMENTAL CHOICE PROGRAM .1 Provide sealant products bearing the 'Ecologo' of the Environmental Choice Program, Department of the Environment, Canadian Environmental Protection Act, Environmental Choice Product Guidelines ECP/PCE-45-92 for Sealants and Caulking Compounds, except maximum VOC 60 g/L during application and curing.
- .2 For primers and sealants, indicate VOC in g/L during application and curing.

- 1.2 PRODUCT DATA .1 Submit manufacturer's literature indicating recommended surface preparation, sealant selection and primer for each substrate in accordance with Section 01 11 01.

- 1.3 DESIGN REQUIRMENTS .1 Minimum speech privacy category SPC Standard Speech Privacy 60-65 tested to ASTM E2638-10.
- .2 Minimum sound transmission rating of installed partition, floor and ceiling to be STC 30, tested to ASTM E90-09.

PART 2 - PRODUCTS

- 2.1 SEALANTS .1 Provide sealant products bearing Ecologo to ECP/PCE-45-92 with maximum VOC 60 g/L.

- 2.2 SEALANT MATERIAL DESIGNATIONS .1 Urethanes One Part '2C'.
.1 Self-Leveling to CAN/CGSB-19.13-M87, Type 1.
- .2 Silicones One Part '3'.
.1 To ASTM C920-11, primerless, Type S, Grade NS, Class 50, SWRI validated.
- .3 Interior glazing sealant: one part silicone to ASTM C920-11, Type S, Grade NS, Class 25.
-

2.2 SEALANT
MATERIAL
DESIGNATIONS
(Cont'd)

- .4 Acoustical Sealant '6'.
 - .1 One part silicone to ASTM C920-11, primerless, Type S, Grade NS, Class 25, SWRI validated.
- .5 Preformed compressible and non-compressible back-up materials '10', CFC free.
 - .1 Polyethylene, urethane, neoprene or vinyl foam. Extruded open cell foam backer rod. Size: oversize 30 to 50%.
 - .2 Bond breaker tape. Polyethylene bond breaker tape which will not bond to sealant.

2.3 SEALANT
SELECTION

- .1 Interior control and expansion joints in floor surfaces: Designations 2C, 10.
- .2 Perimeters of interior frames, as detailed and itemized: Designations 3.
- .3 Joints at tops of non-load bearing masonry walls at the underside of poured concrete: Designations 6.
- .4 Exposed interior control joints in drywall: Designations 6.

2.4 JOINT CLEANER

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

PART 3 - EXECUTION

3.1 PREPARATION OF
JOINT SURFACES

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
- .2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair work.
- .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have

3.1 PREPARATION OF
JOINT SURFACES
(Cont'd)

- .3 (Cont'd)
been performed to ensure compatibility of materials. Remove coatings as required.
- .4 Ensure joint surfaces are dry and frost free.
- .5 Prepare surfaces in accordance with manufacturer's directions.

3.2 PRIMING

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

3.3 BACKUP MATERIAL

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

3.4 MIXING

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

3.5 APPLICATION

- .1 Ventilate interior spaces during application and curing of sealants to maintain VOCs less than 50 g/l. Coordinate with building manager to ensure existing ventilation system or temporary ventilation supplies sufficient outside air.
 - .2 Sealant.
 - .1 Protect installed work of other trades from staining or contamination.
 - .2 Apply sealant in accordance with manufacturer's application manual and written instructions. Maintain STC rating of assemblies.
 - .3 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint. remove tape after sealant applied.
 - .4 Apply sealant in continuous beads.
-

3.5 APPLICATION
(Cont'd)

- .2 (Cont'd)
 - .5 Apply sealant using gun with proper size nozzle.
 - .6 Use sufficient pressure to fill voids and joints solid.
 - .7 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
 - .8 Tool exposed surfaces before skinning begins to give slightly concave shape.
- .3 Curing.
 - .1 Cure sealants in accordance with sealant manufacturer's instructions.
 - .2 Do not cover up sealants until proper curing has taken place.
- .4 Cleanup.
 - .1 Clean adjacent surfaces immediately and leave work neat and clean.
 - .2 Remove excess and droppings, using recommended cleaners as work progresses.
 - .3 Remove masking tape after initial set of sealant.

PART 1 - GENERAL

1.1 RELATED SECTIONS .1 Section 08 80 00: Glazing.

1.2 REFERENCES .1 Aluminum Association (AA)
.1 DAF 45-2003(R2009) Designation System
for Aluminum Finishes.
.2 Canadian General Standards Board (CGSB)
.1 CAN/CGSB 1.108-M89 (withdrawn),
Bituminous Solvent Type Paint.

1.3 SHOP DRAWINGS .1 Submit shop drawings in accordance with
Section 01 11 01.

PART 2 - PRODUCTS

2.1 MATERIALS .1 Aluminum extrusions: to Aluminum Association
Designation AA6063-T5 in finish designation
AA-A31 clear anodized.
.2 Fasteners: stainless steel, Type 303.
.3 Bituminous paint: epoxy solution or acid and
alkali resistant bituminous paint to CAN/CGSB-
1.108, type II, Ecologo certified.
.4 Weatherstrip: mohair.
.5 Thermal break: rigid PVC.

2.2 FABRICATION .1 Vestibule profiles to match existing exterior
aluminum framing at Church Street exit.
.2 Of porthole extrusions, 3 mm thick.
.3 Applied stops with continuous weatherstrip.
.4 Minimum 50 mm stiles and top rails at doors,
200 mm bottom rail.

2.2 FABRICATION
(Cont'd)

- .5 Reinforce for hardware.
- .6 No visible nameplates.
- .7 Provide exterior weepholes in horizontal sill members.
- .8 Provide minimum 2 mm thick clear anodized aluminum perimeter trim.
- .9 Close bottom edge of doors.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Apply bituminous paint to aluminum in contact with concrete or masonry..
- .2 Units plumb, square and level, free of warp, twist and superimposed loads.
- .3 Securely anchor units in place with concealed fasteners.
- .4 Install hardware in accordance with manufacturer's instructions and templates.

PART 1 - GENERAL

- 1.1 WARRANTY .1 For wood doors specified in this Section 08 14 11 the 12 month warranty period prescribed in General Conditions GC3.13 is extended to three years.
- 1.2 REFERENCES .1 American National Standards Institute (ANSI):
.1 ANSI/BHMA A156.16-2008, Auxiliary Hardware.
.2 American Society for Testing and Materials International (ASTM)
.1 ASTM A568-11a/A568M-11a, Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
.2 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.3 Architectural Woodwork Manufacturers Association of Canada (AWMAC):
.1 AWI/AWMAC/WI AWS-2009.
.4 Canadian Standards Association (CSA):
.1 CAN/CSA-O132.2 SERIES-90(R2003,) Wood Flush Doors.
- 1.3 PRODUCT DATA SHEETS .1 Submit product data sheets in accordance with Section 01 11 01.
.2 Acoustic door assemblies: submit manufacturer's data for tested assembly indicating assembly meets STC specified.
-

PART 2 - PRODUCTS

2.1 MATERIALS AND FABRICATION

- .1 Metal frames: tension levelled sheet steel to ASTM A568/A568M, Class 1, with ZF075 zinc coating on both sides designation to ASTM A653/A653M, minimum 30% total recycled content.
 - .1 Frames: 1.6 mm steel, welded type. Anchors adjustable, type to suit each jamb condition.
- .2 Wood doors to CAN/CSA-0132.2 Series, flush:
 - .1 Interior Type II bond adhesive plywood faced, birch, Grade II Good, solid, mat-formed wood particleboard core, 35 mm hardwood stiles including 19 mm hardwood edge (veneer backing not acceptable), 45 mm wood rails, solid wood lock reinforcing.
 - .2 Face veneer: Face cut cherry veneer, bookmatched, centre balanced with low lustre clear finish.
- .3 Door bumpers: to ANSI A156.16, type L03011.
- .4 Glazing: In accordance with Section 08 80 00.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install doors and hardware in accordance with CAN/CSA-0132.2 Series 90, Appendix A.
- .2 Provide even margins between doors and jambs and doors and flooring as follows:
 - .1 Hinge side: 1.0 mm.
 - .2 Latch side and head: 1.5 mm.
 - .3 Flooring: 13 mm.
- .3 Install hardware in accordance with CAN/CSA-0132.2.4 Series 90. Adjust hardware after doors installed for smooth effortless operation.

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 08 14 11: Wood doors and metal frames.
- 1.2 PRODUCT DATA SHEETS .1 Submit one copy of product data sheets in accordance with Section 01 11 01.
- .2 Product data sheets shall consist of catalogue cuts, manufacturer's name and number, finish and reference identification to specified standard.
- 1.3 SCHEMATIC DIAGRAMS .1 Submit schematic diagrams of electrical components for inclusion in maintenance manual specified in Section 01 11 01.
- 1.4 REFERENCES .1 Standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by CSDMA - Canadian Steel Door Manufacturers' Association and CSA B651-12, Accessible Design for the Built Environment.
- .2 Use abbreviations and symbols recommended in "Abbreviations and Symbols as used in Architectural Door and Hardware Schedules and Specifications", 1983, published by the Door and Hardware Institute.
- .3 Use hardware schedule format recommended in "Sequence and Format for the Hardware Schedule", June, 1984, published by the Door and Hardware Institute.
- 1.5 DEFINITIONS .1 Master Key (MK):
- .1 A key which operates all the master keyed locks or cylinders in a group, each lock or cylinder usually operated by its own change key.
- .2 To combinate a group of locks or cylinders such that each is operated by its own key as well as by a master key for the entire group.
-

1.5 DEFINITIONS
(Cont'd)

- .2 Master Key System:
 - .1 Any keying arrangement which has two or more levels of keying.
 - .2 A keying arrangement which has exactly two levels of keying.
- .3 Grand Master Key (GMK): The key which operates two or more separate groups of locks, each operated by a different master key.
- .4 Grand Master Key System: A master key system which has exactly three levels of keying.
- .5 Great Grand Master Key (GGMK): The key which operates two or more separate groups of locks, which are each operated by a different grand master key.
- .6 Great Grand Master Key System: A master key system which has exactly four levels of keying.
- .7 Top Master Key (TMK): The highest level master key in a master key system.

1.6 REGULATORY
REQUIREMENTS

- .1 Use ULC listed and labelled hardware for doors in fire rated partitions and fire exits.
- .2 Use UL 437 listed cylinders in locking devices where indicated on door and frame schedule, to security rating indicated.

1.7 HARDWARE LIST

- .1 Submit hardware schedule in accordance with Section 01 11 01.
 - .2 Submit literature cuts, indicating hardware proposed, including make, model, base material, function, ANSI Function where ANSI used in this specification, Grade, Type, Series, BHMA finish, trim, ULC listing, UL listing, manufacturer and other pertinent information. Indicate which model or accessory is being provided where more than one model or accessory appears on a page.
-

PART 2 - PRODUCTS

2.1 KEYING,
ACCESSORIES AND
FINISH

- .1 Each lock different key under [existing] master key MK, 2 keys per lock, 2 master keys.
 - .1 Keying systems: to ANSI/BHMA-A156.28-2007.
- .2 Provide accessories with hardware.
- .3 626 finish (satin chrome plated on brass or bronze) unless noted otherwise.
- .4 Finish fasteners to match the exposed surface on which they appear.
- .5 Provide temporary construction keying.
- .6 Final keying: to ANSI/BHMA-A156.5-2010, Grade 1.
- .7 Security cylinder (interchangeable core): 7 pin, brass, restricted keyway, key duplication by registered signatures only.
- .8 Use lock and latch sets with solid metal, U shape, lever handles meeting requirements of CSA B651-12, Accessible Design for the Built Environment, clause 5.2.7 Door Hardware and Figure 20, unless specified otherwise.
- .9 Provide lever handles of same style for bored and mortise locksets.
- .10 Door prep: to ANSI/BHMA-A156.115-2006 for steel doors and frames and ANSI/BHMA-A156.115-W-2006 for wood doors and frames.

2.2 MATERIALS

- .1 Hinge: to ANSI/BHMA-A156.1-2006, Grade indicated, 626 satin chrome, use anti-friction (ball) bearing hinges with closers, one hinge for each 750 mm of door height, 101 mm hinges for 38 mm doors, 115 mm hinges on 45 mm doors, 125 mm hinges on 50 mm doors, button tips, non-rising removable pins unless indicated NRP on hardware schedule.
 - .1 Interior:
 - .1 Grade 1: A8111 - heavy weight, steel, 4 ball bearing.
 - .2 Grade 2: A8112 - standard weight, steel, 2 ball bearing.

2.2 MATERIALS
(Cont'd)

- .1 Hinge:(Cont'd)
 - .1 Interior:(Cont'd)
 - .3 Grade 3: A8133 - standard weight, steel, plain bearing.
- .2 Door closer: to ANSI/BHMA-A156.4-2008, Grade 1, size to suit door width and mass. Disabled access doors: to operate at a minimum pressure not exceeding 38 N for exterior doors, 22 N for interior doors and close in not less than 5 seconds from an open position of 90°.
- .3 Lock and latch set (bored): to ANSI/BHMA-A156.2-2011, Series 5000, Grade 1, bolted through door, ANSI door prep ANSI/BHMA-A156.115- 2006 for steel doors and frames and ANSI/BHMA-A156.115-W-2006 for wood doors and frames, deadlatching bolt, function indicated, 626 satin chrome.
- .4 Lock and latch set (mortised): to ANSI/BHMA-A156.13-2012, Operational Grade 1, lock trim lever with cylinder on exterior, lock trim lever and rose trim with thumbturn on interior, anti-friction latch bolt, function indicated, UL 437 listed cylinder.
- .5 Exit device: to ANSI/BHMA-A156.3-2008, Grade 1, flat push pad type design with removable cover plates concealing mechanism and fasteners. Mechanism case with minimum average wall thickness of 3.5 mm. All internal parts zinc dichromated to resist corrosion. Internal springs - compression type. Complete with UL 437 listed cylinder.
- .6 Door pull: to ANSI/BHMA-A156.6-2010.
- .7 Push plate: to ANSI/BHMA-A156.6-2010, type J301, rectangular, square 90° corners, bevelled edges.
- .8 Kick plate: to ANSI/BHMA-A156.6-2010, type J102 stainless steel, 1.55 x 200 mm x door width, 3 bevelled edges.
- .9 Power supply for exit device: ULC approved, rated for and compatible with Electric Strike.
 - .1 Acceptable material: 'Model MPB 842' manufactured by Von Duprin 905-278-6128 www.vonduprin.com, division of Ingersoll-Rand.

PART 3 - EXECUTION

3.1 HARDWARE .1 Refer to Drawing A1000 for hardware schedule.
SCHEDULE

PART 1 - GENERAL

- 1.1 SUBMITTALS
- .1 Submit one representative sample each type of glazing film in accordance with Section 01 11 01.
 - .2 Approved sample may be installed as part of completed Work.
 - .3 Submit maintenance data for glazing film to Departmental Representative in accordance with Section 01 11 01.
- 1.2 QUALITY ASSURANCE
- .1 Qualifications of glazing film applicator: trained, approved and certified by glazing film manufacturer. Submit proof of certification in writing to Departmental Representative in accordance with Section 01 11 01.
 - .2 Glazing film inspection: manufacturer's representative shall view the film at a distance of 3 m (10 feet) at angles up to 45 degrees from either side of the glass during regular daylight conditions (not in direct sunlight). To be accepted the film itself shall not appear distorted. Submit manufacturer's written inspection report to Departmental Representative in accordance with Section 01 11 01.

PART 2 - PRODUCTS

- 2.1 MATERIALS
- .1 Clear tempered safety glass: to CAN/CGSB-12.1-M90, Type 2-tempered, Class B of thickness indicated.
 - .2 Glass setting channel: Provide anodized aluminum channel in depth as indicated on drawings for 16 mm thick glazing.
 - .2 Setting blocks: neoprene, Shore "A" 80 durometer hardness to ASTM D2240-05(2010), 100 x 6 mm x width to suit glass.
 - .3 Glazing tape: preformed butyl with continuous spacer, Shore "A" 10-15 durometer hardness, paper release, black colour, 3 x 9.5 mm.
-

2.1 MATERIALS
(Cont'd)

- .4 Gasket: black neoprene to ASTM C542-05(2011), "U" cavity type with lock strip.
- .5 Sealant: one part silicone to ASTM C920-11, Type S, Grade NS, Class 50.
- .6 Security Film: Multi-ply optically clear polyester film with factory applied adhesive, abrasion resistant coating and release liner.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Glass:
 - .1 Clean and dry surfaces.
 - .2 Apply glazing tape to fixed stops.
 - .3 Place setting blocks at 1/3 points.
 - .4 Set glass on setting blocks against tape.
 - .5 Apply glazing tape to glass.
 - .6 Install stops.
- .2 Glazing film:
 - .1 Cut film edges straight and square.
 - .2 Ensure security film is installed behind window stops.
 - .3 Cut edges 3 mm minimum from edge of glass sealing device in accordance with manufacturers written instructions.
 - .4 Apply and attach film to glass in accordance with manufacturer's written instructions.
- .3 Glazing channel: Install glazing channel at top and bottom of glass mullion junction and provide 16 mm thick tempered glazing. Seal all joints with sealant.

PART 1 - GENERAL

- 1.1 REFERENCES .1 ASTM International
- .1 ASTM C475-02(2007)/C475M-02(2007), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .2 ASTM C840-11, Standard Specification for Application and Finishing of Gypsum Board.
 - .3 ASTM C919-12, Standard Practice for Use of Sealants in Acoustical Applications.
 - .4 ASTM C920-11, Standard Specification for Elastomeric Joint Sealants.
 - .5 ASTM C1002-07, 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.
 - .6 ASTM C1047-10a, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - .7 ASTM C1280-13, Standard Specification for Application of Gypsum Sheathing.
 - .8 ASTM C1396/C1396M-13, Standard Specification for Gypsum Board.
 - .9 ASTM E90-09 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .2 Association of the Wall and Ceilings Industries International (AWCI)
- .1 AWCI Levels of Gypsum Board Finish 101a-97.
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS .1 Submit in accordance with Section 01 11 01.
- .2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum board assemblies and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.3 DESIGN REQUIREMENTS .1 Partition assemblies to be both non-combustible construction and fire resistance rated.
- .2 Minimum sound transmission rating of installed panel partition to be STC 30, tested to ASTM E90.

PART 2 - PRODUCTS

- 2.1 MATERIALS
- .1 Standard board: to ASTM C1396/C1396M, minimum 40% recycled content, 15.9 mm thick, 1200 mm wide x maximum practical length, ends square cut, edges squared.
 - .2 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.
 - .3 Resilient drywall furring: 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.
 - .4 Steel drill screws: to ASTM C1002.
 - .5 Laminating compound: as recommended by manufacturer, asbestos-free.
 - .6 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, Zinc, 0.5 mm base thickness, perforated flanges, one piece length per location.
 - .7 Sealants: in accordance with Section 07 90 00.
 - .8 Joint compound: to ASTM C475/C475M, asbestos-free.
 - .9 Joint tape: to ASTM C475/C475M.
 - .1 Paper tape for standard gypsum board.

PART 3 - EXECUTION

- 3.1 EXAMINATION
- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for gypsum board assemblies installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and
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- 3.1 EXAMINATION .1 (Cont'd)
(Cont'd) .3 (Cont'd)
after receipt of written approval to proceed
from Departmental Representative.
- 3.2 ERECTION .1 Do application and finishing of gypsum board
to ASTM C840 except where specified otherwise.
- .2 Do application of gypsum sheathing to ASTM
C1280.
- .3 Install wall furring for gypsum board wall
finishes to ASTM C840, except where specified
otherwise.
- .4 Furr openings and around built-in equipment,
cabinets, and access panels, on four sides.
Extend furring into reveals. Check clearances
with equipment suppliers.
- .5 Furr duct shafts, beams, columns, pipes and
exposed services where indicated.
- .6 Erect drywall resilient furring transversely
across studs, spaced maximum 600 mm on centre
and not more than 150 mm from ceiling/wall
juncture. Secure to each support with 25 mm
drywall screw.
- .7 Install 150 mm continuous strip of 12.7 mm
gypsum board along base of partitions where
resilient furring installed.
- 3.3 APPLICATION .1 Apply gypsum board after bucks, anchors,
blocking, sound attenuation, electrical and
mechanical work have been approved.
- .2 Apply gypsum board to metal furring or
framing using screw fasteners. Maximum spacing
of screws 300 mm on centre.
- .1 Single-Layer Application:
.1 Apply gypsum board on ceilings
prior to application of walls to ASTM
C840.
.2 Apply gypsum board vertically or
horizontally, providing sheet lengths
that will minimize end joints.
- .2 Double-Layer Application:
.1 Install gypsum board for base layer
and exposed gypsum board for face layer.
-

3.3 APPLICATION
(Cont'd)

- .2 (Cont'd)
- .2 Double-Layer Application:(Cont'd)
- .2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm.
- .3 Apply base layers at right angles to supports unless otherwise indicated.
- .4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.
- .3 Apply 12 mm 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, in partitions where perimeter sealed with acoustic sealant.
- .4 Install gypsum board on walls vertically to avoid end-butt joints. At high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.
- .5 Install gypsum board with face side out.
- .6 Do not install damaged or damp boards.
- .7 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.4 INSTALLATION

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm on centre.
- .2 Install casing beads around perimeter of suspended ceilings.
- .3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

3.4 INSTALLATION
(Cont'd)

- .4 Install insulating strips/acoustic gaskets continuously at intersections between wall and ceiling construction.
- .5 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.
- .6 Locate control joints where indicated.
- .7 Install control joints straight and true.
- .8 Splice corners and intersections together and secure to each member with 3 screws.
- .9 Install access doors to electrical and mechanical fixtures specified in respective sections.
 - .1 Rigidly secure frames to furring or framing systems.
- .10 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.
- .11 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with AWCI Levels of Gypsum Board Finish:
 - .1 Levels of finish:
 - .1 Level 4: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
 - .2 Level 5: 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.
- .12 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.
- .13 Fill screw head depressions with joint and taping compounds to bring flush with adjacent

3.4 INSTALLATION
(Cont'd)

- .13 (Cont'd)
surface of gypsum board so as to be invisible after surface finish is completed.
- .14 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .15 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.
- .16 Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.
- .17 Mix joint compound slightly thinner than for joint taping.
- .18 Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks.
- .19 Allow skim coat to dry completely.
- .20 Remove ridges by light sanding or wiping with damp cloth.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 01.
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 11 01.

3.6 PROTECTION

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

PART 1 - GENERAL

1.1 REFERENCE
STANDARDS

- .1 American National Standards (ANSI) for the Installation of Ceramic Tile/ Ceramic Tile Institute of America (CTIOA):
 - .1 ANSI A108/A118/A136.1-2011, Installation of Ceramic Tile.
 - .1 ANSI A108.1A, Installation of Ceramic Tile in Wet-Set Method, with Portland Cement Mortar.
 - .2 ANSI A108.5, Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
 - .3 ANSI A118.1, Dry-Set Portland Cement Mortar.
 - .4 ANSI A118.3, Chemical Resistant Water Cleanable Tile-Setting and Grouting Epoxy and Water cleanable tile Setting Epoxy Adhesive.
 - .5 ANSI A118.4, Latex Portland Cement Mortar.
 - .6 ANSI A118.9, Cementitious Backer Units.
 - .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C207-06(2011), Standard Specification for Hydrated Lime for Masonry Purposes.
 - .2 ASTM C373-88(2006), Standard Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products.
 - .3 ASTM C1028-07e1, Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
 - .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .2 CAN/CSA-A3001-08, Cementitious Materials for Use in Concrete.
 - .3 CAN/CSA-A179-04(R2009), Mortar and Grout for Unit Masonry.
 - .4 CSA B651-12, Accessible Design for the Built Environment.
-

1.1 REFERENCE
STANDARDS
(Cont'd)

- .4 Terrazzo Tile and Marble Association of
Canada (TTMAC) 1-800-201-8599, 905-660-9640,
www.ttmac.com.
 - .1 Hard Surface Maintenance Guide.
 - .2 TTMAC Specification Guide 09 30 00 -
Tile Installation Manual 2012/2014.
- .5 Tile Council of North America (TCNA),
1-864-646-8453, www.tileusa.com.
 - .1 Handbook for Ceramic, Glass and Stone
Tile Installation, 2011.
- .6 CGSB 71-GP-22M+Amdt-June-78, Adhesive,
Organic, for Installation of Ceramic Wall
Tile.
- .7 CAN/CGSB-75.1-M88, Tile, Ceramic.

1.2 SUBMITTALS

- .1 Submit TTMAC Installation Detail No. or Tile
Council of America Installation Detail No. or
shop drawing showing installation for each
tile specified.
- .2 Submit list of materials suitable for sealing
and finishing each tile specified.
- .3 Submit proof of each non-slip tile's
conformance to CSA B651-12.

1.3 QUALIFICATIONS

- .1 Use installation and grouting materials
produced by a manufacturer that has been
regularly engaged in producing these materials
for a minimum of 10 years and has completed a
minimum of 5 successful installations of this
type, each at least five years old.
 - .2 Employ workmen with previous experience of
more than 5 years in each different assembly
specified.
 - .3 Provide references of 3 installations of
similar type and size more than 3 years old
for each assembly.
-

PART 2 - PRODUCTS

2.1 MATERIAL

- .1 Porcelain tile (CT-1): Existing reused or to match 300 x 300 mm floor tile, field colour in Reception Area 100.1.
- .2 Porcelain Tile (CT-2): Existing reused or to match 300 x 300 mm floor tile, dark border in Reception Area 100.1.
- .3 Porcelain Tile (CT-3): Existing reused or to match 300 x 100 mm floor base tile, field colour in Reception Area 100.1.
- .4 Porcelain Tile (CT-4): Existing reused or to match 300 x 100 mm floor base tile, dark border in Reception Area 100.1.
- .5 Stone wall wainscotting: Salvaged stone wall panels.
- .5 Portland cement: to CAN/CSA-A3001-08, type GU Normal.
- .6 Sand: to CSA A179-04.
- .7 Hydrated Lime: to ASTM C207-06.
- .8 Latex: formulated for use in cement mortar.
 - .1 Acceptable material: 'Planecrete 50' manufactured by Mapei, 1-800-668-1212.
 - .2 Acceptable material: 'Laticrete 4237' manufactured by Laticrete International 416-743-5514.
- .9 Tile backer units: cementitious backer units to ANSI A118.9.
- .10 Water: potable.
- .11 Dry set mortar: to ANSI A118.1.
- .12 Organic adhesive: to CGSB 71-GP-22M+Amdt-June-78, Type 1.
- .13 Epoxy mortar: two part; epoxy resin, catalyst and mineral fillers; to ANSI A118.3; 100 % solids.
- .14 Thin set bond coat (interior): dry set mortar, pre-mixed, thin set mortar formulated

2.1 MATERIAL
(Cont'd)

- .14 Thin set bond coat (interior):(Cont'd)
with Portland cement, sand and latex additive.
Complying with ANSI A118.4.
 - .1 Acceptable material:
 - .1 'Versatile 52, Thin-Set Mortar'
manufactured by Flextile Ltd.,
416-255-1111, 1-800-699-3623,
www.flextile.net.
 - .2 'Ultra/Flex II' manufactured by
Mapei, 1-800-668-1212.
- .15 Floor grout (thin set system): pre-mixed, dry
set grout. Colour to match tile colour.
 - .1 Acceptable materials:
 - .1 'Flextile 600 Polymer Modified
Floor Grout' manufactured by Flextile
Ltd., 416-255-1111, www.flextile.net.
 - .2 'Laticrete 1500 Sanded Grout'
manufactured by Laticrete International
Inc. 1-800-243-4788, www.laticrete.com
distributed by Dal-Tile of Canada
905-738-2099.
 - .3 'Ultracolor' manufactured by Mapei,
1-800-668-1212.
- .16 Wall grout (thin set system): pre-mixed, dry
set grout. Colour to match tile colour.
 - .1 Acceptable material:
 - .1 'Polymer Modified Wall Grout'
manufactured by Flextile Ltd.,
416-255-1111, 1-800-699-3623.
 - .2 'Unsanded Wall Grout 600 Series'
manufactured by Laticrete International
Inc 1-800-243-4788, www.laticrete.com
distributed by Dal-Tile of Canada
905-738-2099.
 - .3 'Keracolor-Wall' with 'Plastijoint'
manufactured by Mapei, 1-800-668-1212.
- .17 Prefabricated expansion joint: PVC and CPE
joint with +/- 33% movement capability, colour
selected from manufacturers standard range.
- .18 Metal transitions: Clear anodized aluminum
edge trim at transitions between tile and
carpet.
- .19 Finish: as recommended by tile manufacturer.

PART 3 - EXECUTION

3.1 SURFACE
PREPARATION

- .1 Do not proceed with installation unless substrate is structurally sound, solid and well fastened.
- .2 New concrete: properly cured and designed with proper expansion and control joints.
- .3 Surfaces must be clean and free from dust, dirt, oil, grease, paint, wax, sealers, curing compounds or any other substances which may reduce or prevent adhesion.

3.2 SYSTEM
REQUIREMENTS

- .1 Provide assemblies composed of compatible materials from the same manufacturer.
- .2 The completed assembly will meet the service requirements Extra-Heavy Duty described in Handbook For Ceramic Tile Installation and CSA B651.

3.3 MIXING

- .1 To ANSI A108.1A.
 - .2 Levelling coat (by volume):
 - .1 1 part portland cement.
 - .2 4 parts sand.
 - .3 1/10 part latex.
 - .4 1 part water (includes latex additive).
 - .5 Adjust water volume to suit water content of sand.
 - .3 Scratch coat (by volume):
 - .1 1 part portland cement.
 - .2 1/5 to 1/2 parts hydrated lime.
 - .3 4 parts sand.
 - .4 1 part water.
 - .5 Adjust water volume to suit water content of sand.
 - .6 Latex, volume recommended by manufacturer.
 - .4 Slurry bond coat:
 - .1 Portland cement and water Mix to creamy paste consistency.
 - .2 Latex, volume recommended by manufacturer.
-

3.3 MIXING
(Cont'd)

- .5 Wall, mortar bed (by volume):
 - .1 1 part portland cement.
 - .2 1/5 to 1/2 parts hydrated lime.
 - .3 4 parts sand.
 - .4 1 part water.
 - .5 Adjust water volume to suit water content of sand.
 - .6 Latex, volume recommended by manufacturer.
- .6 Floor, mortar bed (by volume):
 - .1 1 part portland cement.
 - .2 4 parts sand.
 - .3 1 part water.
 - .4 Adjust water volume to suit water and content of sand.
 - .5 Latex, volume recommended by manufacturer.
- .7 Portland cement Bond coat (by volume):
 - .1 1 part portland cement.
 - .2 1/3 part hydrated lime.
 - .3 1 part water.
- .8 Thin set bond coat and grout: dry set mortar; mix to manufacturer's instructions.

3.4 WORKMANSHIP

- .1 Minimum surface and air temperature 12°C, before and during application and during curing period.
- .2 Provide back-buttering in addition to the usual notch-trowel-applied bond coat in the following applications:
 - .1 With rib-backed tiles and heavy lug-backed tiles.
 - .2 In hot, dry or windy weather or where notched mortar bed was prepared too far in advance.
- .3 Backbuttering: remove residual dust, wipe the back of the tile with a damp cloth or sponge, apply a full coverage 2 mm thick coat of mortar, apply no more than 10-15 minutes before tiles are set so that both back-butter and mortar are wet at time of setting.
- .4 Use Box Screed jig with large sized tiles which are not of uniform thickness.
- .5 Trowel in one direction and press the tile into the mortar with a sliding motion perpendicular to the trowel ridges. Twist,

3.4 WORKMANSHIP
(Cont'd)

- .5 (Cont'd)
vibrate or beat the tiles to compress the trowel ridges to comply with requirements of ANSI A108.5.
- .6 Perimeter tile minimum 1/2 size.
- .7 Cut tile around corners and built-in objects smooth, even, chip and split free.
- .8 Accurately form intersections, corners and returns.
- .9 Joints uniform:
 - .1 Walls: 1.5-3.0 mm wide.
 - .2 Ceramic floor tiles: 3.0-6.0 mm wide.
- .10 Surfaces plumb, straight, true, even and flush to a tolerance of 1:1000.
- .11 Replace broken or hollow sounding tile.
- .12 Allow 24 hours before grouting.
- .13 Fill joints solid with grout, free of voids, cracks, excess mortar or grout.
- .14 Clean surfaces after curing.
- .15 Floors traffic free for 48 hours.
- .16 Seal and finish floors in accordance with manufacturer's recommendations.

3.5 SETTING
BACK-BUTTERED TILE

- .1 Firmly push, twist and immediately beat or vibrate the tiles or stone units.

3.6 FLOOR TILE

- .1 Install in accordance with:
 - .1 TTMAC detail 311F-2012/2014 Detail A Interior/ Exterior.
 - .2 Bond coat and grout manufacturer's written instructions.
 - .2 Install metal transitions trims between tile floor and carpet floor as indicated on drawings.
-

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- 3.7 WALL TILE .1 Install in accordance with:
- .1 TTMAC details 330LFTW-2012/2014 Large Format Tile on Interior Walls.
 - .2 Bond coat and grout manufacturer's written instructions.
 - .3 Reinstall salvaged stone wainscotting with bond coat behind stone and retaining wood cap and top.
- 3.8 EXPANSION AND CONTROL JOINTS .1 Install movement joints in accordance with TTMAC detail 301MJ-2012/2014 Control Joint to match existing, G Perimeter Joint and in accordance with joint manufacturer's recommendations and as follows:
- .1 Interior: 4.8 m to 6 m each direction.
 - .2 Interior exposed to sunlight or moisture: 3.659 m to 4.878 m in both directions.
 - .3 Exterior: 2.439 m to 3.659 m in both directions.
 - .4 Where tile abutts restraining surfaces (walls, dissimilar floors, curbs, columns, pipes, ceilings and where changes occur in backing materials).
- .2 Provide expansion joints where tile spans cold joints, construction joints, saw-cuts and seismic joints.
- .3 Construct during installation of mortar beds and/or tile, rather than saw-cutting joints after installation.

PART 1 - GENERAL

- 1.1 CERTIFICATES .1 Submit certificate stating that suspended ceiling systems provide adequate support for electrical fixtures, as required by current bulletin of Electrical Inspection Department of Ontario Hydro.

PART 2 - PRODUCTS

- 2.1 MATERIALS .1 Heavy duty system to ASTM C635/C635M-13.
- .2 Acoustic units (ACT 1): water-felted mineral fibre 610 x 1219 x 19 mm, bevelled edge, Two / 24 pattern, to match existing Radar Illusion tile by CGC in all respects.
- .1 NRC: .55.
- .2 CAC: 35
- .3 LR: .89
- .3 Exposed tee bar grid components for ACT: cold rolled steel, zinc coated, shop painted, satin sheen, white, interlocking, main and cross tee of double web with rectangular bulb, depth governed by span, 24 mm wide exposed face to match existing DONN DX by CGC in all respects.
- .4 Hangers: 3.6 mm galvanized soft annealed steel wire.
- .5 Accessories: splices, clips, wire ties, retainers, acoustic gasket between wall and ceiling and wall moulding reveal, to complement suspension system components, as recommended by system manufacturer.
-

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install in accordance with ASTM C636/C636M-13 except where specified otherwise.
- .2 Co-ordinate suspension system with related components.
- .3 Cut acoustic units to fit adjacent work. Butt joints tight, terminate edges with moulding.
- .4 Support suspension system main runners at 1200 mm oc maximum with hangers from structure. Assembly shall support super-imposed loads. Maximum permissible deflection, 1/360th of span to ASTM C635/C635M-07 deflection test.
- .5 Attach cross member to main runner to provide rigid assembly.
- .6 Install suspension assembly to manufacturer's written instructions.
- .7 Install flush edge moulding at junction of acoustic unit ceiling and other materials around entire length of joint.

PART 1 - GENERAL

- 1.1 REFERENCES .1 ASTM International.
.1 ASTM F1861-08(2012), Standard
Specification for Resilient Wall Base.
- .2 CSA Group
.1 CSA B651-12, Accessible Design for the
Built Environment.
- .3 Scientific Certification Systems (SCS)
.1 SCS-EC10.2-2007, Indoor Air Quality
Performance.
- 1.2 WHMIS .1 Submit WHMIS MSDS - Material Safety Data
Sheets acceptable to Labour Canada and Health
Canada for primer, cement and adhesive.
Indicate VOC content.
- .2 Submit WHMIS MSDS in accordance with Section
01 11 01.
- 1.3 SAMPLES .1 Submit samples in accordance with Section
01 11 01.
- .2 Submit duplicate 300 mm long base samples.
- 1.4 MAINTENANCE
MATERIALS .1 Provide 3 lineal metres of resilient base of
matching colour for each profile in addition
to the resilient base required to complete the
present installation.
- .2 Deliver to job site in boxes clearly marked
with information on contents and include
address and date of installation.
- .3 Unload and store within building where
directed by Departmental Representative.
- 1.5 ENVIRONMENTAL
CHOICE PROGRAM .1 Provide adhesive products bearing the
'Ecologo' of the Environmental Choice Program,
Department of the Environment, Canadian
Environmental Protection Act, Environmental
Choice Product Guidelines ECP/PCE-44-92 for
Adhesives.
-

1.5 ENVIRONMENTAL CHOICE PROGRAM (Cont'd)

- .2 Submit one copy of the licensing criteria statements and the verification of compliance with Sections 3(a) and 3(b) of the ECP to the Departmental Representative.

1.6 AIR QUALITY

- .1 Select materials and off gas flooring products off site in accordance with CSA B651, including Annex A Environmental Considerations, A.5 Indoor Air Quality and FloorScore certified to SCS-EC10.2-2007.
- .2 No detectable odour after installation from base or adhesive.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Resilient base: to ASTM F1861, Type TP rubber thermoplastic, 100 mm high, continuous, Style B-coved preformed inside and outside corners at coved base.
- .2 Adhesive: zero VOC, low odour, no alcohol, glycol or amonia, Ecologo certified.

PART 3 - EXECUTION

3.1 PREPARATION AND INSTALLATION

- .1 Maintain room and material temperature at approximately 20°C for 3 days before laying, and minimum 2 days after laying.
- .2 Prepare substrate and install base in accordance with base manufacturer's instructions.
- .3 Roll surface with 45 kg roller.
- .4 Base joints at maximum length available or at internal or preformed corners.
-

3.2 CLEANING AND
WAXING

.1 Clean, and seal to manufacturer's
instructions.

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 Contract Carpet Manual, Canadian Carpet Institute, (613) 232-7183.
 - .2 NFCA Specification Manual, National Floor Covering Association, c/o Floor Covering Institute of Ontario, 987 Clarkson Road South Suite 101, Mississauga, Ontario, L5J 2V8, 905-822-2280, www.thefio.ca.
 - .3 Carpet and Rug Institute www.carpet-rug.org and Canadian Carpet Institute, www.canadiancarpet.org.
 - .1 CRI Carpet Installation Standard 2011.
 - .2 CRI Green Label Indoor Air Quality Testing Program.
 - .4 Electrostatic Propensity of Carpets, AATCC 134-2006, AATCC, P.O. Box 12215, Research Triangle Park, North Carolina, 27709, U.S.A.
 - .5 Colorfastness to Light, AATCC 16-2004, AATCC, P.O. Box 12215, Research Triangle Park, North Carolina, 27709, U.S.A.
 - .6 ASTM D1335-05, Test Method for Tuft Bind of Pile Floor Coverings.
 - .7 CAN/CGSB-25.20-95, Surface Sealer Floors.
 - .8 CAN/CGSB-4.129-93, Carpet for Commercial Use.
- 1.2 PRODUCT DATA
- .1 Submit product data sheet for each carpet, adhesive, concrete floor sealer and Ecologo products in accordance with Section 01 11 01.
 - .1 Indicate recycled/reclaimed content of each component of carpet.
 - .2 Indicate which recycling program (supplying mill or fibre producer) the carpet is eligible for and provide program parameters.
 - .2 For adhesives, indicate VOC in g/L during application and curing.
-

- 1.3 SHOP DRAWINGS .1 Submit shop drawings in accordance with Section 01 11 01.
- .2 Indicate nap, open edges and other details required by Departmental Representative to clarify work.
- 1.4 SAMPLES .1 Submit for Departmental Representative's review, duplicate carpet tile samples in each colour selected in accordance with Section 01 11 01.
- 1.5 DESIGN DATA, TEST REPORTS, CERTIFICATES, MANUFACTURER'S INSTRUCTIONS AND FIELD REPORTS .1 Submit evidence of prequalification compliance.
- .2 Submit a report by an independent testing laboratory verifying tuft bind meets requirements specified when tested to ASTM D1335.
- .3 Submit WHMIS MSDS - Material Safety Data Sheets acceptable to Labour Canada and Health Canada for carpet adhesive and seam cement. Indicate VOC content.
- 1.6 MAINTENANCE DATA .1 Provide maintenance data for carpet tile for incorporation into Operation and Maintenance Manual specified in Section 01 11 01.
- .2 Include information on recycling of carpet tile including manufacturer's reprocessing program. Indicate which portions of materials are recyclable.
- 1.7 MAINTENANCE MATERIALS .1 Deliver 2 m² of each type, pattern and colour of carpet tile required for this project for maintenance use. Identify each roll. Store where directed.
- .2 Maintenance materials to be full size piece of same production run as installed materials.
-

- 1.8 QUALIFICATIONS .1 Applied by installer trained and certified by carpet tile manufacturer for application of its products.
- .2 Manufacturer's representative:
.1 Inspect substrate prior to commencement of work, during application of materials and upon completion of work.
.2 Provide technical assistance to the installer and assist where required in correct installation of carpet tile.
- 1.9 GUARANTEE .1 Provide a manufacturer's written material guarantee stating that the carpet will remain free of manufacturing defects and deterioration for a period of twenty years. Non-pro-rated guarantee.
- .2 Provide a manufacturer's written material guarantee stating that the carpet tile will remain free of manufacturing defects and deterioration for a period of fifteen years. Non-pro-rated guarantee.

PART 2 - PRODUCTS

- 2.1 MATERIALS .1 Carpet tile (CPT1): to CAN/CGSB-4.129, to match existing "To Scale" by Interface in 7768 "Cross Section" colour. Characteristics as follows:
.1 Recycled content: 49%
.2 Size: 500 x 500 mm.
.3 Type: tufted, textured loop.
.4 Face yarn fibre type: Post consumer content, Type 6,6 nylon.
.5 Colour fastness: 100% solution dyed.
.6 Yarn weight: 24 oz.
.7 Pile thickness: 2.5 mm.
.8 Density: 6,120 minimum.
.9 Backing: recycled vinyl.
.1 Recycled content: 40%.
.10 Soil Resistance: protective anti-soil treatment heat applied by carpet mill.
- .2 Carpet tile adhesive: water based.
.1 Acrylic release type: low VOC, recommended by carpet tile manufacturer.
- .3 Concrete floor sealer: to CAN/CGSB-25.20, Type 1.
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2.1 MATERIALS
(Cont'd)

PART 3 - EXECUTION

- .4 Sub-floor filler: premixed latex mixed with water to produce cementitious paste.

3.1 SUB-FLOOR TREATMENT

- .1 Remove all existing carpet residue, tile mortar and existing floor materials beneath raised access flooring.
- .2 Remove all ridges and bumps.
- .3 Apply sub-floor filler to low spots and cracks to achieve floor level to a tolerance of 1:500; allow to cure.
- .4 Seal porous and powdery surfaces with concrete floor sealer.
- .5 Remove dust, old adhesive, dirt, sealer and wax from existing surfaces.

3.2 INSTALLATION

- .1 Prepare floor surfaces in accordance with CRI Carpet Installation Standard.
- .2 Commence work after finishing work is completed.
- .3 Install to CRI Carpet Installation Standard.
- .4 Cut and fit around projections through floor.
- .5 Finish installation to present smooth wearing surface free from burring or embedded foreign matter.
- .6 HEPA Vacuum finished area with commercial grade vacuum with a beater bar head.
- .7 Ensure colour, pattern and texture match within any one area.
- .8 Fit carpet tight to abutting vertical surfaces.

3.3 CARPET TILE

- .1 Apply adhesive and install carpet tile in accordance with manufacturer's instructions with acrylic release type adhesive.
- .2 Lay tiles with seams within manufacturer's tolerances.

3.3 CARPET TILE .2 (Cont'd)
(Cont'd)

PART 1 - GENERAL

1.1 RELATED
SECTIONS

- .1 Section 06 40 01 - Architectural Woodwork.

1.2 REFERENCES

- .1 Architectural Painting Specifications Manual, Master Painters Institute (MPI), 2010.
- .2 Systems and Specifications Manual, SSPC Painting Manual, Volume Two, Society for Protective Coatings (SSPC).
- .3 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).
- .4 National Fire Code of Canada 2010 (NFC).

1.3 QUALITY
ASSURANCE

- .1 Contractor shall have a minimum of five years proven satisfactory experience. When requested, provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.
- .2 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.
- .3 Conform to latest MPI requirements for interior painting work including preparation and priming.
- .4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with MPI Painting Specification Manual "Approved Product" listing and shall be from a single manufacturer for each system used.
- .5 Other paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Painting Specification Manual
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- 1.3 QUALITY ASSURANCE (Cont'd)
- .5 (Cont'd)
and shall be compatible with other coating materials as required.
 - .6 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Departmental Representative.
 - .7 Standard of Acceptance:
 - .1 Walls: No defects visible from a distance of 1000 mm at 90° to surface.
 - .2 Ceilings: No defects visible from floor at 45° to surface when viewed using final lighting source.
 - .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.
- 1.4 ENVIRONMENTAL PERFORMANCE REQUIREMENTS
- .1 Provide paint products meeting MPI "Environmentally Friendly" E1 ratings based on VOC (EPA Method 24) content levels.
 - .2 Where indoor air quality (odour) is a problem, use only MPI listed materials having a minimum E2 rating.
- 1.5 INSPECTION REQUIREMENTS
- .1 Interior painting and decorating work shall be inspected by a Paint Inspection Agency (inspector) acceptable to the specifying authority and local Painting Contractor's Association. Painting contractor shall notify Paint Inspection Agency a minimum of one week prior to commencement of work and provide a copy of project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.
 - .2 Interior surfaces requiring painting shall be inspected by Paint Inspection Agency who shall notify Departmental Representative and General Contractor in writing of defects or problems, prior to commencing painting work, or after prime coat shows defects in substrate.
 - .3 Where "special" painting, coating or decorating system applications (i.e. elastomeric coatings) or non-MPI listed products or systems are to be used, paint or coating manufacturer shall provide as part of this work, certification of surfaces and
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- 1.5 INSPECTION REQUIREMENTS (Cont'd) .3 (Cont'd)
conditions for specific paint or coating system application as well as on site supervision, inspection and approval of their paint or coating system application as required at no additional cost to Departmental Representative.
- 1.6 SCHEDULING OF WORK .1 Submit work schedule for various stages of painting to Departmental Representative for approval. Submit schedule minimum of 48 hours in advance of proposed operations.
- .2 Obtain written authorization from Consultant for any changes in work schedule.
- .3 Schedule painting operations to prevent disruption of occupants in and about the building.
- 1.7 SUBMITTALS .1 Submit product data and manufacturer's installation/application instructions for each paint and coating product to be used in accordance with Section 01 11 01.
- .2 Submit WHMIS MSDS.- Material Safety Data Sheets in accordance with Section 01 11 01.
- .3 Upon completion, submit records of products used. List products in relation to finish system and include the following:
- .1 Product name, type and use.
 - .2 Manufacturer's product number.
 - .3 Colour numbers.
 - .4 MPI Environmentally Friendly classification system rating.
 - .5 Manufacturer's Material Safety Data Sheets (MSDS).
- 1.8 SAMPLES .1 Submit full range colour sample chips in accordance with Section 01 11 01. Indicate where colour availability is restricted.
- .2 Submit duplicate 200 x 300 mm sample panels of each paint with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards
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- 1.8 SAMPLES
(Cont'd)
- .2 (Cont'd)
submitted on the following substrate materials:
- .1 3 mm plate steel for finishes over metal surfaces.
 - .2 13 mm birch plywood for finishes over wood surfaces.
 - .3 50 mm concrete block for finishes over concrete or concrete masonry surfaces.
 - .4 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.
- .3 When approved, sample panels shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.
- 1.9 QUALITY CONTROL
- .1 Provide mock-up in accordance with Section 01 11 01.
 - .2 When requested by Departmental Representative, prepare and paint designated surface, area, room or item (in each colour scheme) to requirements specified herein, with specified paint or coating showing selected colours, gloss/sheen, textures and workmanship to MPI Painting Specification Manual standards for review and approval. When approved, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar on-site work.
- 1.10 EXTRA MATERIALS
- .1 Submit maintenance materials in accordance with Section 01 11 01.
 - .2 Submit one - four litre can of each type and colour of primer and finish coating. Identify colour and paint type in relation to established colour schedule and finish system.
 - .3 Deliver to Contractor and store where directed.
- 1.11 DELIVERY, HANDLING AND STORAGE
- .1 Deliver, store and handle materials in accordance with Section 01 11 01.
-

1.11 DELIVERY,
HANDLING AND
STORAGE
(Cont'd)

- .2 Labels shall clearly indicate:
 - .1 Manufacturer's name and address.
 - .2 Type of paint or coating.
 - .3 Compliance with applicable standard.
 - .4 Colour number in accordance with established colour schedule.
- .3 Remove damaged, opened and rejected materials from site.
- .4 Provide and maintain dry, temperature controlled, secure storage.
- .5 Observe manufacturer's recommendations for storage and handling.
- .6 Store materials and supplies away from heat generating devices.
- .7 Store materials and equipment in a well ventilated area with temperature range 7°C to 30°C.
- .8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
- .9 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Consultant. After completion of operations, return areas to clean condition to approval of Departmental Representative.
- .10 Remove paint materials from storage only in quantities required for same day use.
- .11 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
- .12 Fire Safety Requirements:
 - .1 Provide one [9 kg] [Type ABC] [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.

1.12 SITE
REQUIREMENTS

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

1.12 SITE
REQUIREMENTS
(Cont'd)

- .2 (Cont'd)
 - .2 (Cont'd)
 - .2 15% for wood.
 - .3 12% for plaster and gypsum board.
 - .3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".
 - .4 Test concrete, masonry and plaster surfaces for alkalinity as required.
- .3 Surface and Environmental Conditions:
 - .1 Apply paint finish only in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint only to adequately prepared surfaces and to surfaces within moisture limits noted herein.
 - .3 Apply paint only when previous coat of paint is dry or adequately cured.
- .4 Additional Interior Application Requirements:
 - .1 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.
 - .2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

1.13 WASTE
MANAGEMENT AND
DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 11 01.
 - .2 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.,) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.
 - .3 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
 - .4 Place materials defined as hazardous or toxic waste, including used sealant and adhesive
-

1.13 WASTE
MANAGEMENT AND
DISPOSAL
(Cont'd)

- .4 (Cont'd)
tubes and containers, in containers or areas designated for hazardous waste.
- .5 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 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
 - .5 Empty paint cans are to be dry prior to disposal or recycling (where available).
- .6 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.
- .7 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Paint materials for paint systems shall be products of a single manufacturer.
- .3 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:
 - .1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
 - .2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess

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- 2.1 MATERIALS
(Cont'd)
- .3 (Cont'd)
.2 (Cont'd)
of 15 mg/L to a natural watercourse or a
sewage treatment facility lacking secondary
treatment.
- .4 Water-borne paints and stains, recycled
water-borne surface coatings and water borne
varnishes must meet a minimum "Environmentally
Friendly" E2 rating.
- .5 Recycled water-borne surface coatings must
contain 50% post-consumer material by volume.
- .6 Recycled water-borne surface coatings must
not contain:
.1 Lead in excess of 600.0 ppm
weight/weight total solids.
.2 Mercury in excess of 50.0]ppm
weight/weight total product.
.3 Cadmium in excess of 1.0 ppm
weight/weight total product.
.4 Hexavelant chromium in excess of 3.0 ppm
weight/weight total product.
.5 Organochlorines or polychlorinated
biphenyls (PCBS) in excess of 1.0 ppm
weight/weight total product.
- .7 The following must be performed on each batch
of consolidated post-consumer material before
surface coating is reformulated and canned.
These tests must be performed at a laboratory
or facility which has been accredited by the
Standards Council of Canada.
.1 Lead, cadmium and chromium are to be
determined using ICP-AES (Inductively Coupled
Plasma - Atomic Emission Spectroscopy)
technique no. 6010 as defined in EPA SW-846.
.2 Mercury is to be determined by Cold
Vapour Atomic Absorption Spectroscopy using
Technique no. 7471 as defined in EPA SW-846.
.3 Organochlorines and PCBs are to be
determined by Gas Chromatography using
Technique no. 8081 as defined in EPA SW-846.
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- 2.2 COLOURS
- .1 Refer to Wall Finishes Legend for selected
colour references.
- .2 Second coat in a three coat system to be
tinted slightly lighter colour than top coat
to show visible difference between coats.
-

2.3 MIXING AND
TINTING

- .1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed only with Departmental Representative's written permission.
- .2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.
- .3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.
- .4 Thin paint for spraying according in strict accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Departmental Representative.
- .5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN
RATINGS

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

| Gloss Level Category | Units @ 60° | Units @ 85° |
|------------------------|-------------|-------------|
| G1 - matte finish | 0 to 5 | max. 10 |
| G2 - velvet finish | 0 to 10 | 10 to 35 |
| G3 - eggshell finish | 10 to 25 | 10 to 35 |
| G4 - satin finish | 20 to 35 | min. 35 |
| G5 - semi-gloss finish | 35 to 70 | |
| G6 - gloss finish | 70 to 85 | |
| G7 - high gloss finish | > 85 | |
- .2 Gloss level ratings of painted surfaces shall be as noted on Wall Finishes Schedule.

2.5 INTERIOR
PAINTING SYSTEMS

- .1 Concrete Vertical Surfaces: including horizontal soffits
 - .1 INT 3.1A Latex finish (over sealer).
 - .2 INT 3.1B Latex aggregate/latex finish.
 - .3 INT 3.1C High performance architectural latex finish.
 - .4 INT 3.1D Alkyd finish.
 - .5 INT 3.1E Latex finish.
 - .6 INT 3.1F Epoxy (tile-like) finish.
 - .7 INT 3.1G Waterborne epoxy (tile-like) finish.
 - .8 INT 3.1H Multicolour finish.
- .2 Plaster and Gypsum Board: gypsum wallboard, drywall, "sheet rock type material", etc., and textured finishes
 - .1 INT 9.2A Latex G3, G4 and G5 finish (over latex sealer).

PART 3 - EXECUTION

3.1 GENERAL

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

3.2 EXISTING
CONDITIONS

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.
- .2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Departmental Representative. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- .3 Maximum moisture content as follows:
 - .1 Stucco, Plaster and Gypsum Board: 12%.
 - .2 Concrete: 12%.
 - .3 Wood: 15%.

3.3 PROTECTION

- .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces as directed by Departmental Representative.
- .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .3 Protect factory finished products and equipment.
- .4 Protect building occupants and general public in and about the building.
- .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 by General Contractor. Items shall be securely stored and re-installed after painting is completed by General Contractor.
- .6 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
- .7 As painting operations progress, place "WET PAINT" signs in occupied areas to approval of Departmental Representative.

3.4 CLEANING AND PREPARATION

- .1 Clean and prepare surfaces in accordance with MPI Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
 - .1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.
 - .2 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.
 - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .4 Allow surfaces to drain completely and allow to dry thoroughly.
 - .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

3.4 CLEANING AND
PREPARATION
(Cont'd)

- .1 (Cont'd)
 - .6 Use trigger operated spray nozzles for water hoses.
 - .7 Many water-based paints cannot be removed with water once dried. However, minimize the use of kerosene or any such 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 Where possible, prime surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
 - .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
 - .2 Apply wood filler to nail holes and cracks.
 - .3 Tint filler to match stains for stained woodwork.
 - .4 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
 - .5 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes.
 - .6 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.
 - .7 Do not apply paint until prepared surfaces have been accepted by Departmental Representative.
-

3.5 APPLICATION

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

3.6 MECHANICAL/
ELECTRICAL
EQUIPMENT

- .1 Unless otherwise specified, paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.
- .2 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.
- .3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.
- .4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .5 Do not paint over nameplates.
- .6 Keep sprinkler heads free of paint.
- .7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.
- .8 Paint fire protection piping red.
- .9 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .10 Paint natural gas piping yellow.
- .11 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.
- .12 Do not paint interior transformers and substation equipment.

3.7 FIELD QUALITY
CONTROL

- .1 Field inspection of painting operations to be carried out by independent inspection firm as designated by Departmental Representative.
- .2 Advise Departmental Representative when surfaces and applied coating is ready for

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- 3.7 FIELD QUALITY CONTROL
(Cont'd)
- .2 (Cont'd)
inspection. Do not proceed with subsequent coats until previous coat has been approved.
- .3 Co-operate with inspection firm and provide access to areas of work.
- 3.8 RESTORATION
- .1 Clean and re-install all hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust to approval of Departmental Representative. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Departmental Representative.

PART 1 - GENERAL

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI/HPVA HP-1-2009, American National Standard for Hardwood and Decorative Plywood.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM E90-09, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-11.3-M87, Hardboard.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA O151-09, Canadian Softwood Plywood.
- .5 Underwriters Laboratories' of Canada (ULC)
 - .1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 DESIGN REQUIREMENTS

- .1 Design and fabricate folding partitions with minimum STC of 52 tested to ASTM E90.
- .2 Use full height markerboard for covering on both sides.
- .3 Folding panel partitions to be 102 mm thick single panel, manually operated, acoustically sealed partition.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 11 01.
 - .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit WHMIS MSDS - Material Safety Data Sheets.
-

1.3 SUBMITTALS
(Cont'd)

- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .1 Indicate installation requirements including dimensions, head and jamb conditions, track layout, stacking arrangement, switching, hardware, finish and colour, operating mechanism, and location.
- .4 Samples:
 - .1 Submit duplicate 300 x 300 mm samples of partition finish for each colour selected.
- .5 Submit required letters, calculations, spreadsheets and templates prepared by Departmental Representative for submitting to CaGBC for Credit Interpretation Requests.
- .6 Submit Project Materials and Cost Data: provide statement for total cost for building materials used for project.
 - .1 Include statement indicating total cost of mechanical and electrical components.
- .7 Quality assurance/control submittals: submit following in accordance with Section 01 11 01.
 - .1 Test reports: submit certified test reports for folding panel partitions from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 Submit test data indicating compliance with design requirements regarding sound transmission and fire hazard classification.
 - .3 Submit acoustical test data to ASTM E90 and ensure construction details and weight are provided.
 - .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .8 Closeout Submittals:
 - .1 Provide operation and maintenance data for folding panel partitions for incorporation into manual specified in Section 01 78 00.

- 1.4 WASTE MANAGEMENT AND DISPOSAL .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

- 2.1 MATERIALS .1 Panel core: steel frame complete with horizontal steel reinforcement and protective panel edge manufacturer's standard fabrication.
- .2 Markerboard: Manufacturers standard white markerboard finish.
- 2.2 COMPONENTS .1 Overhead suspension system:
- .1 Track: manufacturer's standard painted cold rolled steel channel housing designed to support partitions.
- .1 Equip track with integral brackets for hanger attachment.
- .2 Provide threaded steel rods and nuts type hangers and stabilizers.
- .2 Trolley: steel wheels with ball bearings, equipped with thrust bearing and steel pendant bolt at each wheel assembly for height adjustment.
- .2 Hardware:
- .1 Equip partition with manufacturer's standard hardware. Hardware finish selected from manufacturer's standard finishes.
- .3 Sound seals:
- .1 Provide fixed sound seals to manufacturer's standard.
- .2 Use floor retractable seals and fixed sweep strip at head type floor and head seals.
- .3 Design retractable seals to secure panel in position.
- .4 Use manufacturer's standard astragal inserts for jamb and panel joint seal.
- 2.3 ACCESSORIES .1 Provide manufacturer's standard hinged closure panel, with lever operator.
-

PART 3 - EXECUTION

- 3.1 MANUFACTURER'S INSTRUCTIONS .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.
- 3.2 INSTALLATION .1 Secure and level track.
- .2 Install folding partitions in accordance with manufacturer's printed instructions.
- .3 Touch up damaged finishes, repair damage to partitions to match original finish.
- .4 Clean folding partition system and protect from damage.
- .5 Adjust and leave partitions in smooth operating condition.
- 3.3 CLEANING .1 Proceed in accordance with Section 01 11 01.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

PART 1 - GENERAL

- 1.1 PRODUCT DATA SHEETS .1 Submit product data sheets of each item specified, in accordance with Section 0 11 01.

PART 2 - PRODUCTS

- 2.1 MATERIAL .1 Aluminium: extrusions to Aluminium Association Designation AA 6063.
- 2.2 FABRICATION .1 Entrance mats:
.1 Frame: extruded aluminium to Aluminium Association Designation AA 6063-T5, clear anodized finish to DAF 45-2003(R2009).
.2 Tread rails: extruded aluminium to Aluminium Association Designation AA 6063-T52, mill finish.
.3 Key lock bars: extruded aluminium to Aluminium Association Designation AA 6061-T6, mill finish.
.4 Tread inserts: Fusion-bonded carpet fiber and monofilament to rigid two-ply backing, anti-static fibers with antimicrobial additive. carpet weight to be 33 oz/yd2.

PART 3 - EXECUTION

- 3.1 INSTALLATION .1 Supply templates, components and instructions for items built into work of other sections.
- .2 Install items plumb, straight and level to a tolerance of 1:500.
- .3 Securely fix items in place with concealed fasteners.

PART 1 - GENERAL

- 1.1 EQUIPMENT LIST .1 Complete list of equipment and materials to be used on this project and forming part of bid documents by adding manufacturer's name, model number and details of materials, and submit for approval.
- .2 Submit for approval within 10 days after Award of Contract.
- 1.2 TRIAL USAGE .1 Departmental Representative Owner may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- 1.3 PROTECTION OF OPENINGS .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.
- 1.4 PAINTING .1 Prime and touch up marred finished paintwork to match original.
- .2 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.
- 1.5 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS .1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .2 Where specified elsewhere in Mechanical Divisions, manufacturers to provide demonstrations and instructions.
- .3 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.
-

- 1.5 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS
(Cont'd)
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Where deemed necessary, Departmental Representative Owner may record these demonstrations on video tape for future reference.
- 1.6 CLOSEOUT SUBMITTALS
- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 11 01.
- .2 Operation and maintenance manual to be approved by, and final copies deposited with, Departmental Representative before final inspection.
- .3 Operation data to include:
- .1 Control schematics for each system including environmental controls.
 - .2 Description of each system and its controls.
 - .3 Description of operation of each system at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for each system and each component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
- .4 Maintenance data shall include:
- .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
- .1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified elsewhere.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93.
-

1.6 CLOSEOUT
SUBMITTALS
(Cont'd)

- .6 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless so directed by Departmental Representative.
 - .2 Make changes as required and re-submit as directed by Departmental Representative.

- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.

1.7 SHOP DRAWINGS
AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 11 01.

- .2 Shop drawings and product data shall show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances. eg. access door swing spaces.

- .3 Shop drawings and product data shall be accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify as to current model production.
 - .5 Certification of compliance to applicable codes.

- .4 In addition to transmittal letter referred to in Section 01 11 01: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.8 CLEANING

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

1.9 AS-BUILT
DRAWINGS

- .1 Site records:
 - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of the work. Mark there on all changes as work progresses and as changes occur. This shall include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection at all times.
 - .2 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing (TAB), finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 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 Departmental Representative for approval and make corrections as directed.
 - .4 TAB to be performed using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
 - .3 Submit copies of as-built drawings for inclusion in final TAB report.
 - .4 as-built drawings for inclusion in final TAB report.
 - .5 As-built drawings shall be all converted to AutoCAD with PWGSC layering system.
 - .6 Submit as-built AutoCAD and PDF CD/DVD/Flash Drive. Allow for minimum two (2) sets.
 - .7 All TAB reports shall be in PDF format and copied to CD/DVD/Flash Drive and folder prints.
-

1.10 WASTE
MANAGEMENT AND
DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 11 01.
- .2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.
- .3 Dispose of unused paint material at official hazardous material collections site approved by Departmental Representative.
- .4 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in other locations where it will pose health or environmental hazard.
- .5 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .6 Dispose of corrugated cardboard, polystyrene, plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.11 EXAM SITE

- .1 Examine the site and the local conditions and Conditions affecting the work during tender process. Examine carefully the Architectural, Structural, and Mechanical, Electrical and all other drawings and the complete specifications to ensure that the work can be satisfactorily carried out as shown.
- .2 Before commencing work, examine the work of the other Divisions and report at once any defect or interference affecting the work, the completion, or the guarantee of the work of this Division. No allowance will be made later for any expenses incurred through the failure to make these examinations or to report any such discrepancies in writing to the Department Representative.

1.12 CODES, PERMITS
FEES ANC CONNECTIONS

- .1 Conform to Federal, Provincial and Municipal regulations and perform work in accordance with requirements of By Laws and Regulations in force in area where the building is to be erected.
 - .2 Apply for, obtain, and pay for permits, fees and service connections for the work of this
-

1.12 CODES, PERMITS .2
FEES ANC CONNECTIONS
(Cont'd)

- (Cont'd)
Division and the inspections required by Authorities having jurisdiction in the area where the building is to be erected.
- .3 For information, a specific code or standard might be mentioned. This information must not be taken as the only code or standard applicable.
 - .4 When part of equipment does not bear the required UL label, the contractor shall obtain UL approval on site, when that part of the equipment is an electric component, a special approval shall be obtained and the Contractor shall pay the applicable fees.
 - .5 Furnish necessary certificates as evidence that the work installed conforms with laws and regulations of Authorities having jurisdiction. Changes in work requested by an Authority having jurisdiction shall be carried out without charge.
 - .6 Apply to TSSA for high pressure application. Ensure all systems are tested to TSSA satisfaction.

1.13 INSTALLATION .1
OF WORK

- .1 Coordinate with other trades and schedule all work to suit the date for the substantial performance established in the construction contract.
 - .2 Furnish items to be "built up" in ample time and give necessary information and assistance in connection with the building in of the same.
 - .3 Provide drawings showing all sleeving and openings required. Notify the Construction Manager of the size and location of recesses, openings and chases before walls, floors, etc., are erected.
 - .4 Proceed with the work as quickly as practical so that construction may be completed in as short a time as possible and in accordance with the building schedule. Ensure that all health, safety and environmental conditions are maintained.
-

1.13 INSTALLATION .4 (Cont'd)
OF WORK
(Cont'd)

- .5 Ensure that all equipment and material is ordered in time to meet the building schedule. Provide a schedule of equipment deliveries to the Construction Manager within the time limit stipulated.
- .6 Furnish promptly information required for the construction schedule.
- .7 Manufactured products supplied with instructions for their installation shall be installed in strict accordance with those instructions.

1.14 WORK IN
EXISTING BUILDINGS

- .1 Refer to section 01 11 01 for requirement.
- .2 Mechanical contractor to provide temporary filters for existing return air intake on each floor. Replace as required during construction
- .3 Prior to working on any of exiting systems, contact building operators and provide with at least 5 working days days notice
- .4 Do not disturb any hydraulic piping without through examination to ensure it is safe and empty. Ensure isolating valves are operational prior to carrying out any work.
- .5 Freeze lines if required to make required connections.

1.15 SLEEVES

- .1 Use cast iron sleeve or steel pipe sleeves with annular fin continuously welded at midpoint.
 - .2 For pipes passing through roofs, use cast iron sleeves with caulking recess and flashing clamp device. Anchor sleeves in roof construction;
-

1.15 SLEEVES
(Cont'd)

- .2 (Cont'd)
caulk between sleeve recess and pipe; fasten roof flashing to clamp device; make water tight durable joint.
- .3 Fill voids around pipes
 - .1 For sleeves and pipe in foundation walls and below grade floors, provide "link seal@ clamp manufactured by Thunderline or Innerlynx.
 - .2 Where sleeves pass through walls or floors, caulk space between insulation and sleeve or between pipe (duct) and sleeve with waterproof fire retardant non hardening mastic. Seal space at each end of sleeve with waterproof, fire retardant, non hardening mastic.
 - .3 Ensure no contact between copper tube or pipe and ferrous sleeve.
 - .4 Fill future use sleeves with easily removable fire stop filler.
 - .5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint.
- .4 All sleeves shall be as detailed on drawings.
- .5 All sleeve locations including dimensions shall be submitted to the Department Representative.

1.16 TESTS

- .1 Do not insulate or conceal work until tested and approved. Follow construction schedule and arrange for tests.
 - .2 Inform the Department Representative when tests will be conducted. All tests are to be documented test results submitted and included in the maintenance manuals. Refer to attached Appendix A for the format to be utilized for the test reports.
 - .3 Bear costs including retesting and making good.
 - .4 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures.
-

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 CURBS AND SLEEPERS

.1 Prefabricated curbs for mechanical equipment will be provided by Mechanical contractor. Built up curbs and sleepers will be supplied and installed under work of other sections, except as specified herein and noted on the drawings

.2 It shall be the responsibility of the Mechanical Trade to supply detailed requirements for curbs, including their locations, sizes and materials to be used, and loads imposed on the curbs.

.3 Curbs are required for roof mounted equipment, surrounding holes where groups of pipes and/or ducts pass through equipment room floors, and where indicated on the Drawings.

.4 Roof curbs shall be minimum 300 mm height above finished roof.

.5 Curbs around holes in equipment room floors shall be concrete or steel, extending at least 150 mm above finished floor. Make watertight connection between curb and floor.

.6 Fill spaces between curbs and pipes and ducts with glass fibre material. Caulk with fire resistant waterproof compound to make watertight connection.

.7 Sleepers shall be provided for the equipment installed outdoor without a roof curb. Sleepers shall be constructed of pressure treated lumber and shall be covered by 18-gauge steel cladding, primed and painted unless otherwise noted on the drawings.

3.2 CUTTING AND
PATCHING

- .1 Cutting and patching shall be in accordance with General and Supplementary Conditions and the following:
- .1 No openings shall be permitted through the completed structure without the written approval of the Department Representative. Any openings which are required through the completed structure must be clearly and accurately shown on a copy of the structural drawings. Exact locations, elevations and size of the proposed opening must be identified and submitted to the Department Representative for review, well in advance of doing the work.
- .2 All cutting and patching shall be done by the trades specializing in the materials to be cut and is covered by the appropriate Divisions of this specification. Prepare drawings in conjunction with all trades concerned, showing sleeves and openings for passage through structure and all insert sizes and locations. Where this information is not furnished in time, the Subtrades contractor for this Division shall bear the cost of all sleeving, provision for inserts, cutting and patching.
- .3 Should any cutting and/or repairing of finished surfaces be required, the Subtrades contractor for this Division shall employ the particular trades engaged on the site for this type of work to do such cutting and/or repairing. Obtain the approval of the Department Representative before doing any cutting. In the event that tradesmen required for particular cutting and/or repairing are not already on the site, bring to the site tradesmen to do this work. Refer to front end document for scope of work associated with cutting and patching.
- .4 Supporting members of any floor, wall or the building structure shall be cut only in such a location and manner as approved by the Department Representative in writing.
- .5 Contractor to submit detail location of all cores drilling prior to start of the work.

PART 1 - GENERAL

- 1.1 REFERENCES .1 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.181-99, Ready-Mixed Organic
Zinc-Rich Coating.
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS .1 Provide submittals in accordance with Section
01 11 01.
- 1.3 DELIVERY, STORAGE AND HANDLING .1 Deliver, store and handle in accordance with
Section 01 11 01.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

- 3.1 APPLICATION .1 Manufacturer's Instructions: comply with
manufacturer's written recommendations,
including product technical bulletins, handling,
storage and installation instructions, and
datasheets.
- 3.2 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.
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- 3.3 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.
- 3.4 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 Pipe each drain valve discharge separately to above floor drain. Discharge to be visible.
 - .4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.
- 3.5 AIR VENTS
- .1 Install manual air vents at high points in piping systems.
 - .2 Install isolating valve at each automatic air valve.
 - .3 Install drain piping to approved location and terminate where discharge is visible.
- 3.6 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.
-

3.7 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 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.
 - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .9 Ream pipes, remove scale and other foreign material before assembly.
- .10 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .11 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless otherwise indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.

3.8 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.
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- 3.8 SLEEVES
(Cont'd)
- .3 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .4 Installation:
- .1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
- .2 Other floors: terminate 25 mm above finished floor.
- .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.
- 3.9 PREPARATION
FOR FIRE STOPPING
- .1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to Section 07 84 00.
- .2 Uninsulated unheated pipes not subject to movement: No special preparation.
- .3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging fires topping material or installation.
- .4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.
- 3.10 PRESSURE
TESTING OF
EQUIPMENT AND
PIPEWORK
- .1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.
- .2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning work.
- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.
- .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 Departmental Representative.
- .6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.
-

3.10 PRESSURE
TESTING OF
EQUIPMENT AND
PIPEWORK
(Cont'd)

- .7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

3.11 EXISTING
SYSTEMS

- .1 Connect into existing piping systems at times approved by Departmental Representative.
- .2 Request written approval 10 days minimum, prior to commencement of work.
- .3 Be responsible for damage to existing plant by this work.
- .4 Ensure daily clean-up of existing areas.
- .5 Ensure existing isolating valves do hold. Allow for freezing the pipes where required

3.12 CLEANING

- .1 Clean in accordance with Section 01 11 01.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B1.20.1-1983(R2006), Pipe Threads, General Purpose (Inch).
 - .2 ASME B16.18-2001, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .2 ASTM International
 - .1 ASTM A276-10, Standard Specification for Stainless Steel Bars and Shapes.
 - .2 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .3 ASTM B283/B283M-11a, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
 - .4 ASTM B505/B505M-11, Standard Specification for Copper-Base Alloy Continuous Castings.
 - .3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
 - .1 MSS SP-25-2008, Standard Marking System for Valves, Fittings, Flanges and Unions.
 - .2 MSS SP-110-2010, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Provide submittals in accordance with Section 01 11 01.
 - .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit WHMIS MSDS - Material Safety Data Sheets.
 - .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Submit data for valves specified in this Section.
-

1.3 CLOSEOUT
SUBMITTALS .1 Provide maintenance data for incorporation into
manual specified in Section 01 78 00.

1.4 DELIVERY,
STORAGE AND
HANDLING .1 Deliver, store and handle materials in
accordance with Section 01 11 01 and with
manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MATERIALS .1 Sustainable Requirements:
.1.
.2 Valves:
.1 Except for specialty valves, to be single
manufacturer.
.2 Products to have CRN registration numbers.
.3 End Connections:
.1 Connection into adjacent piping/tubing:
.1 Steel pipe systems: screwed ends to
ANSI/ASME B1.20.1.
.2 Copper tube systems: solder ends
grooved ends to ASME B16.18.
.4 Ball Valves:
.1 NPS 2 and under:
.1 Body and cap: cast high tensile
bronze to ASTM B62.
.2 Pressure rating: Class125 2760-kPa
CWP 4140-kPa CWP, 860 kPa steam.
.3 Connections: screwed ends to ASME
B1.20.1 and with hexagonal shoulders solder
ends to ANSI.
.4 Stem: tamperproof ball drive.
.5 Stem packing nut: external to body.
.6 Ball and seat: replaceable stainless
steel hard chrome solid ball and Teflon
seats.
.7 Stem seal: TFE with external packing
nut.
.8 Operator: removable lever handle.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Install rising stem valves in upright position with stem above horizontal.
 - .2 Remove internal parts before soldering.
 - .3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.
- 3.2 CLEANING
- .1 Clean in accordance with Section 01 11 01.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B31.1-2012, Power Piping.
 - .2 ASTM International
 - .1 ASTM A125-96(2007), Standard Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307-10, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A563-07a, Standard Specification for Carbon and Alloy Steel Nuts.
 - .3 Canada Green Building Council (CaGBC)
 - .1 LEED Canada For New Construction and Major Renovations 2009.
 - .2 LEED Canada For Core and Shell 2009.
 - .3 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
 - .4 Factory Mutual (FM)
 - .5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP 58-2009, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - .2 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)
 - .1 CAN/ULC-
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Provide submittals in accordance with Section 01 11 01.
 - .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.
-

1.3 CLOSEOUT
SUBMITTALS .1 Provide maintenance data for incorporation into
manual specified in Section 01 11 01.

1.4 DELIVERY,
STORAGE AND
HANDLING .1 Deliver, store and handle materials in
accordance with Section 01 11 01 and with
manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 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 ASME B31.1 or MSS SP 58.
.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.

2.2 GENERAL .1 Fabricate hangers, supports and sway braces in
accordance with MSS SP 58 and ASME B31.1.
.2 Use components for intended design purpose
only. Do not use for rigging or erection
purposes.

2.3 PIPE HANGERS .1 Finishes:
.1 Pipe hangers and supports: galvanized or
painted with zinc-rich paint after manufacture.
.2 Use electro-plating galvanizing process
shot dipped galvanizing process.
.3 Ensure steel hangers in contact with
copper piping are copper plated or epoxy coated.
.2 Upper attachment structural: suspension from
lower flange of I-Beam:

2.3 PIPE HANGERS
(Cont'd)

- .2 Upper attachment structural:(Cont'd)
 - .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.
 - .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, UL listed FM approved to MSS-SP 58 and MSS-SP 69.
- .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, UL listed FM approved to MSS SP 69.
 - .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 UL listed FM approved.
- .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 UL listed FM approved to MSS SP 69.
- .5 Hanger rods: threaded rod material to MSS SP 58:
 - .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.
- .6 Pipe attachments: material to MSS SP 58:
 - .1 Attachments for steel piping: carbon steel black galvanized.
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 Use insulation shields for hot pipework.
 - .4 Oversize pipe hangers and supports.

- 2.4 INSULATION PROTECTION SHIELDS .1 Insulated cold piping:
.1 64 kg/m³ density insulation plus insulation protection shield to: MSS SP 69, 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 SP 69.

- 2.5 EQUIPMENT SUPPORTS .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23. Submit calculations with shop drawings.

- 2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES .1 Provide templates to ensure accurate location of anchor bolts.

- 2.7 OTHER EQUIPMENT SUPPORTS .1 Provide support for air cooled condenser on the roof to manufacturer's recommendation.

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 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .3 Use approved constant support type hangers where:
.1 Vertical movement of pipework is 13 mm or more,
-

- 3.2 INSTALLATION (Cont'd) .3 (Cont'd)
- .2 Transfer of load to adjacent hangers or connected equipment is not permitted.
 - .4 Use variable support spring hangers where:
 - .1 Transfer of load to adjacent piping or to connected equipment is not critical.
 - .2 Variation in supporting effect does not exceed 25 % of total load.
- 3.3 HANGER SPACING .1 Copper piping: up to NPS 1/2: every 1.5 m.
- .2 Within 300 mm of each elbow.

| Maximum Pipe Size : NPS | Maximum Spacing Steel | Maximum Spacing Copper |
|-------------------------|-----------------------|------------------------|
| up to 1-1/4 | 2.4 m | 1.8 m |
 - .3 Pipework greater than NPS 12: to MSS SP 69.
- 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 FINAL ADJUSTMENT .1 Adjust hangers and supports:
- .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.
 - .2 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
 - .3 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.
-

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-B149.1-10, Natural Gas and Propane Installation Code.
 - .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.
- 1.2 SUBMITTALS
- .1 Product Data: submit product data for each item specified.
 - .2 Submittals: in accordance with Section 01 11 01.

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
- .1 Colours:
 - .1 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.
-

2.2 SYSTEM
(Cont'd)

- .3 Sizes:
.1 Conform to following table:

| Size # | mm | Sizes (mm) | No. of Lines | Height of 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 Identification for PWGSC Preventive Maintenance Support System (PMSS):
.1 Use arrangement of Main identifier, Source identifier, Destination identifier.
.2 Equipment in Mechanical Room:
.1 Main identifier: size #9.
.2 Source and Destination identifiers: size #6.
.3 Terminal cabinets, control panels: size #5.
.3 Equipment elsewhere: sizes as appropriate.

2.3 EXISTING IDENTIFICATION SYSTEMS

- .1 Apply existing identification system to new work.
.2 Where existing identification system does not cover for new work, use identification system specified this section.
.3 Before starting work, obtain written approval of identification system from Departmental Representative.

2.4 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB-24.3 except where specified otherwise.
.2 Pictograms:
.1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.

2.4 IDENTIFICATION .3
OF PIPING SYSTEMS
(Cont'd)

Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB-24.3.

.4 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.6 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 Other pipes: pressure sensitive plastic-coated cloth vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.

.7 Colours and Legends:

.1 Where not listed, obtain direction from Departmental Representative.

.2 Colours for legends, arrows: to following table:

| <u>Background colour:</u> | <u>Legend, arrows:</u> |
|---------------------------|------------------------|
| Yellow | BLACK |
| Green | WHITE |
| Red | WHITE |

.3 Background colour marking and legends for piping systems:

| <u>Contents</u> | <u>Background colour marking</u> | <u>Legend</u> |
|--------------------------|----------------------------------|----------------|
| City water | Green | CITY WATER |
| Hot water heating supply | Yellow | HEATING SUPPLY |
| Hot water heating return | Yellow | HEATING RETURN |
| Refrigeration suction | Yellow | REF. SUCTION |
| Refrigeration liquid | Yellow | REF. LIQUID |
| Refrigeration hot gas | Yellow | REF. HOT GAS |

- 2.5 IDENTIFICATION
DUCTWORK SYSTEMS .1 50 mm high stencilled letters and directional
arrows 150 mm long x 50 mm high.
- .2 Colours: black, 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.

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 and 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 in open areas in boiler rooms, equipment 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 VALVES,
CONTROLLERS

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Number valves in each system consecutively.

PART 1 - GENERAL

- 1.1 GENERAL .1 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.
- 1.2 QUALIFICATIONS OF TAB PERSONNEL .1 Names of personnel it is proposed to perform TAB to be submitted to and approved by Departmental Representative Consultant within 90 days of award of contract.
- 1.3 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 so as to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- 1.4 EXCEPTIONS .1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.
- 1.5 CO-ORDINATION .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as 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.
- 1.6 PRE-TAB REVIEW .1 Review contract documents before project construction is started and confirm in writing to Departmental Representative Consultant adequacy of provisions for TAB and other aspects
-

- 1.6 PRE-TAB REVIEW .1 (Cont'd)
(Cont'd) of design and installation pertinent to success
of TAB.
- 1.7 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 15.
- 1.8 OPERATION OF .1 Operate systems for length of time required for
SYSTEMS DURING TAB TAB and as required by Departmental
Representative for verification of TAB reports.
- 1.9 START OF TAB .1 Notify Departmental Representative 7 days prior
to start of TAB.
.2 Start TAB when building is essentially
completed, including:
.3 Installation of ceilings, doors, windows, other
construction affecting TAB.
.4 Application of weatherstripping, sealing,
caulking.
.5 All provisions for TAB installed and
operational.
- 1.10 APPLICATION .1 Do TAB to following tolerances of design
TOLERANCES values:
.1 HVAC systems: plus 5%, minus 5 %.
- 1.11 ACCURACY .1 Measured values to be accurate to within plus
TOLERANCES or minus 5% of actual values.
- 1.12 INSTRUMENTS .1 Prior to TAB, submit to Departmental
Representative list of instruments to be used
together with serial numbers.
-

- 1.12 INSTRUMENTS (Cont'd) .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 Departmental Representative.
- 1.13 SUBMITTALS .1 Submit, prior to commencement of TAB:
- .2 Proposed methodology and procedures for performing TAB if different from referenced standard.
- 1.14 PRELIMINARY TAB REPORT .1 Submit for checking and approval of Departmental Representative Consultant, 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.
- 1.15 TAB REPORT .1 Format to be in accordance with referenced standard.
- .2 TAB report to show results in SI units and to include:
- .1 Project record drawings.
- .2 System schematics.
- .3 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in English in D-ring binders, complete with index tabs.
- 1.16 VERIFICATION .1 Reported results subject to verification by Departmental Representative.
- .2 Provide manpower and instrumentation to verify all 30% reported results.
- .3 Bear costs to repeat TAB as required to satisfaction of Departmental Representative.
-

- 1.17 SETTINGS .1 After TAB is completed to satisfaction of Departmental 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. Markings not to be eradicated or covered in any way.
- 1.18 COMPLETION OF TAB .1 TAB to be considered complete when final TAB Report received and approved by Departmental Representative.
- 1.19 AIR SYSTEMS .1 Standard: TAB to be to most stringent of this section or TAB standards of AABC NEBB SMACNA.
- .2 Review specified standards and report to Departmental Representative in writing all proposed procedures which vary from standard.
- .3 Pre-demolition: Visit site and prepare a "pre-construction status for areas" included in the renovation work. The report shall be submitted to the Department Representative prior to start of the work, TAB contractor to measure unit flows at following locations:
- .1 Immediately after the fan
- .2 Status of pressure drops in the air handler as described in 1.19.6. Simulate design conditions by running air handlers at full load.
- .3 Filter status
- .4 Flows in main branches feeding the areas included in this project.
- .4 Post-Construction
- .1 Balance VAV boxes and diffusers as per mechanical drawings.
- .2 Repeat TAB measurement carried out during pre-demolition mode.
- .3 Provide commentary on main changes such as filter status etc.
- .5 During construction coordinate location and installation of TAB devices, equipment, accessories, measurement parts and fittings.
-

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

PART 1 - GENERAL

- 1.1 REFERENCES .1 Definitions:
- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - means "not concealed" as previously defined.
 - .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.
 - .2 TIAC Codes:
 - .1 CRD: Code Round Ductwork,
 - .2 CRF: Code Rectangular Finish.
- .2 Reference Standards:
- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IES 90.1-2010, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.
 - .2 ASTM International Inc.
 - .1 ASTM B209M-10, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
 - .2 ASTM C411-11, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .3 ASTM C449-07, Standard Specification for Mineral Fiber-Hydraulic- Setting Thermal Insulating and Finishing Cement.
 - .4 ASTM C547-11, Standard Specification for Mineral Fiber Pipe Insulation.
 - .5 ASTM C553-11, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .6 ASTM C612-10, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS .1 Provide submittals in accordance with Section 01 11 01.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for duct insulation,
-

PART 2 - PRODUCTS

- 2.1 SUSTAINABLE REQUIREMENTS .1 Materials and products in accordance with Section 01 47 15.
- 2.2 FIRE AND SMOKE RATING .1 To CAN/ULC-S102:
.1 Maximum flame spread rating: 25.
.2 Maximum smoke developed rating: 50.
- 2.3 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 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 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.
- 2.4 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 Tape: self-adhesive, aluminum, or reinforced, 50 mm wide minimum.
.4 Contact adhesive: quick-setting
.5 Tie wire: 1.5 mm stainless steel.
.6 Banding: 19 mm wide, 0.5 mm thick stainless steel.
-

2.4 ACCESSORIES .7 Fasteners: 4 mm diameter pins with 35 mm
(Cont'd) diameter clips, length to suit thickness of
insulation.

PART 3 - EXECUTION

3.1 APPLICATION .1 Manufacturer's Instructions: comply with
manufacturer's written recommendations,
including product technical bulletins, handling,
storage and installation instructions, and
datasheets.

3.2 INSTALLATION .1 Install in accordance with TIAC National
Standards.
.2 Apply materials in accordance with
manufacturers instructions and as indicated.
.3 Use 2 layers with staggered joints when
required nominal thickness exceeds 75 mm.
.4 Maintain uninterrupted continuity and integrity
of vapour retarder jacket and finishes.
.1 Ensure hangers, and supports are outside
vapour retarder jacket.
.5 Hangers and supports in accordance with Section
23 05 29.
.6 Fasteners: install at 300 mm on centre in
horizontal and vertical directions, minimum 2
rows each side.

3.3 DUCTWORK .1 Insulation types and thicknesses: conform to
INSULATION SCHEDULE following table:

| | TIAC Code | Vapour Retarder | Thickness (mm) |
|---|-----------|-----------------|----------------|
| Rectangular cold and dual temperature supply air ducts | C-1 | yes | 50 |
| Round cold and dual temperature supply air ducts | C-2 | yes | 50 |
| Acoustically lined ducts | none | | |

3.4 CLEANING

- .1 Clean in accordance with Section 01 11 01.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 11 01.
- .3 Repair existing insulation where new work has been carried out. Replace damaged insulation.

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Thermal insulation for piping and piping accessories in commercial type applications.
 - .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE Standard 90.1-2007, Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI approved; IESNA co-sponsored).
 - .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C335/C335M-10e1, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .2 ASTM C547-07e1, Standard Specification for Mineral Fiber Pipe Insulation.
 - .3 ASTM C921-10, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
 - .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.
 - .4 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA), 1992, c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
 - .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
 - .6 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): Mechanical Insulation Best Practice Guide(Revised 2005).
-

- 1.2 REFERENCES (Cont'd)
- .7 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.
 - .2 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .3 CAN/ULC-S702-09, Thermal Insulation, Mineral Fibre, for Buildings
 - .4 ULC-S702.2-10, Standard for Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.
- 1.3 DEFINITIONS
- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as specified.
 - .2 TIAC ss:
 - .1 CRF: Code Rectangular Finish.
 - .2 CPF: Code Piping Finish.
- 1.4 SUBMITTALS
- .1 Submittals: in accordance with Section 01 33 00.
 - .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00. Include product characteristics, performance criteria, and limitations.
 - .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 11 01.
- 1.5 QUALITY ASSURANCE
- .1 Qualifications:
 - .1 Installer: specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, qualified to standards member of TIAC.
 - .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06.
-

- 1.6 DELIVERY,
STORAGE AND
HANDLING
- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 11 01.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
 - .2 Storage and Protection:
 - .1 Protect from weather, construction traffic.
 - .2 Protect against damage.
 - .3 Store at temperatures and conditions required by manufacturer.
 - .3 Waste Management and Disposal:
 - .1 Refer to Section 01 11 01.

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 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 A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702 ASTM C547.
 - .2 Maximum "k" factor: to CAN/ULC-S702.
 - .4 TIAC Code A-6: flexible unicellular tubular elastomer.
- 2.3 INSULATION
SECUREMENT
- .1 Tape: self-adhesive, aluminum, plain reinforced, 50 mm wide minimum.
 - .2 Contact adhesive: quick setting.
-

| | | |
|---|----|--|
| <u>2.3 INSULATION SECUREMENT (Cont'd)</u> | .3 | Canvas adhesive: washable. |
| | .4 | Tie wire: 1.5 mm diameter stainless steel. |
| | .5 | Bands: stainless steel, 19 mm wide, 0.5 mm thick. |
| <u>2.4 VAPOUR RETARDER LAP ADHESIVE</u> | .1 | Water based, fire retardant type, compatible with insulation. |
| <u>2.5 INDOOR VAPOUR RETARDER FINISH</u> | .1 | Vinyl emulsion type acrylic, compatible with insulation. |
| <u>2.6 OUTDOOR VAPOUR RETARDER FINISH</u> | .1 | Vinyl emulsion type acrylic, compatible with insulation. |
| | .2 | Reinforcing fabric: fibrous glass, untreated 305 g/m ² . |
| <u>2.7 JACKETS</u> | .1 | Polyvinyl Chloride (PVC): .1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required. .2 Colours: to match adjacent finish paint by Departmental Representative. .3 Minimum service temperatures: -20 degrees C. .4 Maximum service temperature: 65 degrees C. .5 Moisture vapour transmission: 0.02 perm. .6 Thickness: mm. .7 Fastenings: .1 Use solvent weld adhesive compatible with insulation to seal laps and joints. .2 Tacks. .3 Pressure sensitive vinyl tape of matching colour. .8 Special requirements: .1 Indoor:. .2 Outdoor: UV rated material at least 0.5 mm thick. |
| | .2 | ABS Plastic: .1 One-piece moulded type and sheet with pre-formed shapes as required. .2 Colours: to match adjacent finish paint by Departmental Representative. |

- 2.7 JACKETS (Cont'd) .2 ABS Plastic:(Cont'd)
- .3 Minimum service temperatures: -40 degrees C.
 - .4 Maximum service temperature: 82 degrees C.
 - .5 Moisture vapour transmission: 0.012 perm.
 - .6 Thickness: 0.75 mm.
 - .7 Fastenings:
 - .1 Solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.
 - .8 Locations:
 - .1 For outdoor use ONLY.

- 2.8 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS .1 Caulking to: Section 07 92 10.

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

- 3.3 INSTALLATION .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and this specification.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
-

- 3.3 INSTALLATION
(Cont'd)
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Install hangers, supports 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.
- 3.4 REMOVABLE,
PRE-FABRICATED,
INSULATION AND
ENCLOSURES
- .1 Application: at expansion joints, valves, primary flow measuring elements flanges and unions at equipment.
 - .2 Design: to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.
 - .3 Insulation:
 - .1 Insulation, fastenings and finishes: same as system.
 - .2 Jacket: aluminum SS PVC ABS high temperature fabric.
- 3.5 INSTALLATION OF
ELASTOMERIC
INSULATION
- .1 Insulation to remain dry. Overlaps to manufacturers instructions. Ensure tight joints.
 - .2 Provide vapour retarder as recommended by manufacturer.
- 3.6 PIPING
INSULATION
SCHEDULES
- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
 - .2 TIAC Code: A-1.
 - .1 Securements: SS wire bands Tape at 300 mm on centre.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code 1501-H.
 - .3 TIAC Code: A-3.
 - .1 Securements: SS wire bands Tape at 300 mm on centre.
 - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
-

3.6 PIPING
 INSULATION
 SCHEDULES
 (Cont'd)

- .4 TIAC Code: A-6.
 - .1 Insulation securements:.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code:.
- .5 TIAC Code: C-2 with without vapour retarder jacket.
 - .1 Insulation securements:.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .6 TIAC Code: A-2.
 - .1 Insulation securements:.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-H.
- .7 Thickness of insulation 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.

| Application | Temp degrees C | TIAC Code | Pipe sizes (NPS) (mm) | and insulation thickness |
|-------------|-------------------|--------------|--------------------------|--------------------------------|
|-------------|-------------------|--------------|--------------------------|--------------------------------|

| | | | | | |
|------------------------------------|----------|------|---------|------|-------|
| | | | Run out | to 1 | 1-1/4 |
| Hot water Heating | 60 - 94 | A- 1 | 25 | 38 | 38 |
| Hot water Heating | up to 59 | A- 1 | 25 | 25 | 25 |
| Refrigerant hot gas liquid suction | 4 - 13 | A- 6 | 25 | 25 | 25 |

3.6 PIPING .7 (Cont'd)
INSULATION .2 (Cont'd)
SCHEDULES
(Cont'd)

| | | | | | |
|--|-------|------|----|----|----|
| Refrigerant below gas liquid suction | below | A- 6 | 25 | 25 | 38 |
|--|-------|------|----|----|----|

-
- .8 Finishes:
 .1 Exposed indoors: canvas aluminum SS PVC jacket.
 .2 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
 .3 Outdoors: water-proof ABS jacket.
 .4 Finish attachments: SS screws bands, at 150 mm on centre. Seals: wing closed.
 .5 Installation: to appropriate TIAC code CRF/1 through CPF/5.

- 3.7 FIELD QUALITY CONTROL .1 Verification requirements in accordance with Section 01 47 17, include:
 .1 Materials and resources.
 .2 Storage and collection of recyclables.
 .3 Construction waste management.
 .4 Resource reuse.
 .5 Recycled content.
 .6 Local/regional materials.
 .7 Certified wood.
 .8 Low-emitting materials.

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

PART 1 - GENERAL

- 1.1 SUMMARY .1 Section Includes:
.1 Copper piping valves and fittings for hydronic systems.
- 1.2 REFERENCES .1 American National Standards Institute (ANSI)/American Welding Society (AWS)
.1 ANSI/AWS A5.8/A5.8M-2011, Specification Filler Metals for Brazing and Bronze Welding.
.2 American Society of Mechanical Engineers (ASME)
.1 ANSI/ASME B16.4-2006, Gray Iron Threaded Fittings.
.2 ANSI/ASME B16.15-2006, Cast Bronze Threaded Fittings.
.3 ANSI B16.18-2001(R2005), Cast Copper Alloy, Solder Joint Pressure Fittings.
.4 ANSI/ASME B16.22-2001(R2005), Wrought Copper and Copper-Alloy Solder Joint Pressure Fittings.
.3 American Society for Testing and Materials International (ASTM)
.1 ASTM B32-08, Standard Specification for Solder Metal.
.2 ASTM B61-08, Standard Specification for Steam or Valve Bronze Castings.
.3 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.
.4 ASTM B88M-05, Standard Specification for Seamless Copper Water Tube Metric.
- 1.3 SUBMITTALS .1 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00. Include product characteristics, performance criteria, and limitations.
.2 Shop Drawings:
.1 Submit shop drawings in accordance with Section 01 11 01.
.3 Closeout Submittals:
.1 Provide maintenance data for incorporation into manual specified in Section 01 11 01.
-

PART 2 - PRODUCTS

- 2.1 FITTINGS
- .1 Cast bronze threaded fittings: to ANSI/ASME B16.15.
 - .2 Wrought copper and copper alloy solder joint pressure fittings: to ANSI/ASME B16.22, minimum 64% recycled content.
 - .3 Cast iron threaded fittings: to ANSI/ASME B16.4, minimum 25% recycled content.
 - .4 Cast copper alloy solder joint pressure fittings: to ANSI B16.18, minimum 64% recycled content.
- 2.2 JOINTS
- .1 Solder, tin-antimony, 95:5: to ASTM B32, lead free.
 - .2 Silver solder BCUP: to ANSI/AWS A5.8.
 - .3 Brazing: as indicated.
- 2.3 VALVES
- .1 Connections:
 - .1 NPS 2 and smaller: ends for soldering.
 - .2 NPS 2 1/2 and larger: flanged grooved ends.
 - .2 Balancing, for TAB:
 - .1 Sizes: calibrated balancing valves, as specified.
 - .2 NPS 2 and under:
 - .1 Elsewhere: as specified Section 23 05 23.01.
 - .3 Drain valves: gate, Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 23.01.
 - .4 Ball valves:
 - .1 NPS 2 and under: as specified Section 23 05 23.01.
-

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 PIPING INSTALLATION
- .1 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.
 - .2 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping where ever practical.
 - .3 Slope piping in direction of drainage and for positive venting.
 - .4 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.
 - .5 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.
 - .6 Assemble piping using fittings manufactured to ANSI standards.
- 3.3 CIRCUIT BALANCING VALVES
- .1 Install flow measuring stations and flow balancing valves as indicated.
 - .2 Remove handwheel after installation and TAB is complete.
 - .3 Tape joints in prefabricated insulation on valves installed in chilled water mains.
- 3.4 FLUSHING AND CLEANING
- .1 Flush after pressure test for a minimum of 4h.
 - .2 Fill with solution of water and non-foaming, phosphate-free detergent 3% solution by weight. Circulate for minimum of 8h.
-

-
- 3.4 FLUSHING AND CLEANING
(Cont'd)
- .3 Refill system with clean water. Circulate for at least 4h. Clean out strainer screens/baskets regularly. Then drain.
- .4 Refill system with clean water. Circulate for at least 2h. Clean out strainer screens/baskets regularly. Then drain.
- .5 Drainage to include drain valves, dirt pockets, strainers, low points in system.
- .6 Re-install strainer screens/baskets only after obtaining Departmental Representative's approval.
- 3.5 FILLING OF SYSTEM
- .1 Refill system with clean water adding water treatment as specified glycol.
- 3.6 FIELD QUALITY CONTROL
- .1 Testing:
- .1 Test system in accordance with Section 21 05 01.
- .2 Balancing:
- .1 Balance water systems to within plus or minus 5 % of design output.
- .2 Refer to Section for applicable procedures.

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME-04(2007), Boiler and Pressure Vessel Code.
 - .2 ASTM International Inc.
 - .1 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .3 Canadian Standards Association (CSA International)
 - .1 CSA B51-09, Boiler, Pressure Vessel, and Pressure Piping Code.
 - .2 CSA B51-09, Boiler, Pressure Vessel, and Pressure Piping Code, Supplement #1.
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Provide submittals in accordance with Section 01 11 01.
 - .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for expansion tanks, air vents, separators, valves, and strainers, and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.3 CLOSEOUT SUBMITTALS
- .1 Submit maintenance and operation data in accordance with Section 01 11 01.
- 1.4 DELIVERY, STORAGE AND HANDLING
- .1 Deliver, store and handle in accordance with Section 01 11 01.
 - .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
-

PART 2 - PRODUCTS

- 2.1 PIPE LINE STRAINER .1 NPS 1/2 to 2: bronze body to ASTM B62, solder end screwed connections, Y pattern.
- .2 Working pressure: 860 kPa.

PART 3 - EXECUTION

- 3.1 APPLICATION .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.
- 3.2 GENERAL .1 Maintain adequate clearance to permit service and maintenance.
- 3.3 STRAINERS .1 Install in horizontal or down flow lines.
- .2 Ensure clearance for removal of basket.

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B16.22 2005, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .2 ASME B16.24 02, 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 2001, Refrigeration Piping and Heat Transfer Components.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A307 04, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM B280 03, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA B52 2005, 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.

1.2 SUBMITTALS

- .1 Submittals in accordance with Section 01 11 01 - Submittal Procedures.
 - .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.
 - .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 of the specification.
 - .2 The routing of the refrigerant piping is shown on the drawings with approximate sizing for coordination purposes only.
-

1.2 SUBMITTALS
(Cont'd)

.3 Shop Drawings:(Cont'd)

.3 The Refrigeration Sub-Contractor shall be responsible for final designing of the refrigeration piping system as follows;

.1 Ensure that, as a minimum, oil is returned to the compressor at the same rate as it is leaving.

.2 Design discharge and suction lines to maximum 1.2 deg C change in saturation temperature corresponding to the associated pressure drop for the provided refrigerant. Include calculations with the shop drawings.

.3 Design liquid lines to maximum 0.6 deg C change in saturation temperature corresponding to the associated pressure drop for the provided refrigerant. Include calculations with the shop drawings.

.4 Multi-stage compressor and/or multi-compressor machines shall have suction and discharge piping sized adequately to ensure oil return at minimum load conditions. Include calculations with the shop drawings.

.5 Design discharge and suction piping to a maximum of 4000fpm velocity. Minimum discharge velocity of 5 m/s - 7.62 m/s for vertical up-flow risers, a double riser can be introduced should the pressure drop in the vertical riser increase the beyond acceptable range. Double risers shall be trapped at the bottom and an inverted trap at the top of the large riser only.

.6 Minimum velocity for horizontal discharge lines shall be 2.54 m/s, and shall be sloped min 1% in the direction of refrigerant flow. Show refrigerant velocities on the schematic drawing to be submitted with the shop drawing.

.7 Design liquid line piping with minimum pressure drop to avoid the formation of flash gas. Velocity in liquid lines should not exceed 1.52 m/s. Provide a solenoid valve before the evaporator to prevent liquid siphoning into the evaporator during system shut-down. Show refrigerant velocities on the schematic drawing to be submitted with the shop drawing.

.8 The Mechanical Contractor shall submit isometric drawings showing the

1.2 SUBMITTALS
(Cont'd)

- .3 Shop Drawings:(Cont'd)
.3 (Cont'd)

refrigerant pipe sizes, lengths, velocities and accompanying calculations. Revision to the pipe sizing from the sizes shown on the drawings shall be at no cost to the project.

- .4 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

- .5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

- .6 Instructions: submit manufacturer's installation instructions.

1.3 CLOSEOUT
SUBMITTALS

- .1 Closeout submittals: Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 11 01.
.2 Include detailed as-built conditions.
.3 Test certificates.

1.4 QUALITY
ASSURANCE

- .1 Pre-Installation Meeting:
.1 onvene pre-installation meeting prior to beginning work of this Section in accordance with Construction Schedule.
-

1.5 DELIVERY, STORAGE
AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 11 01 - Common Product Requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Materials and resources in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

2.2 TUBING

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

2.3 TRAPS

.1 Service: design pressure 4137 kPa and temperature 121°C.
.2 Construction: Wrought copper P-Traps.

2.4 FITTINGS

.1 Service: design pressure 4147 kPa and temperature 121 degrees C.
.2 Brazed:
.1 Fittings: wrought copper to ASME B16.22.
.2 Joints: silver solder, 15% Ag 80% Cu-5%P or copper phosphorous, 95% Cu 5%P and non corrosive flux.
.3 Flanged:
.1 Bronze or brass, to ASME B16.24, Class 300.
.2 Gaskets: non-metallic, suitable for service.
.3 Bolts, nuts and washers: to ASTM A307, heavy series.

- 2.4 FITTINGS .4 Flared:
(Cont'd) .1 Bronze or brass, for refrigeration, to ASME B16.26.
- 2.5 PIPE SLEEVES .1 Hard copper or steel, sized to provide 6 mm clearance around between sleeve and un-insulated pipe or between sleeve and insulation.
- 2.6 REFRIGERATION ACCESSORIES .1 Supply and install all necessary refrigeration accessories in the refrigeration piping, including, but not limited to the following.
.1 Vibration absorbers shall be provided to isolate compressor vibration from the discharge and suction piping. Absorbers shall be all bronze bellows construction with braided wire exterior jacket. Clamp the refrigerant piping to a secure surface upstream of the suction absorber(s) and downstream of the discharge absorber(s). All refrigerant lines shall be secured with uni-strut type channel and neoprene sleeved clamps.
.2 Liquid line filter drier adequately sized to prevent flash gas and/or excessive pressure drop. Filter drier shall be removable core type for liquid lines 22mm and larger.
.3 Liquid line sight glass shall be full size in liquid lines 50 mm and smaller and installed as close as practical to the condenser or receiver and preferably in a vertical portion of piping. By-pass sight glasses in liquid lines 50 mm and smaller will not be accepted. Sight Glasses shall have integral moisture indicator.
- 2.7 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.
-

- 2.7 VALVES
(Cont'd)
- .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.

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.
- .2 All labour on system shall be by certified refrigeration mechanics.

- 3.2 GENERAL
- .1 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5.

- 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 General:
- .1 Soft annealed copper tubing: bend without crimping or constriction Hard drawn copper tubing: do not bend. Minimize use of fittings.
- .2 Horizontal suction lines shall be sloped toward compressor to insure oil return.
- .3 Install 10 mm diameter shraeder valves in the refrigeration piping in mechanical room, on the suction, discharge and liquid lines for servicing purposes use.
- .4 All field installed refrigeration piping shall be brazed. Dry Nitrogen shall be used to purge the piping prior to and during brazing to avoid oxidization within the refrigeration piping.
- .5 Ensure valves and accessories are protected during brazing as to not be damaged by the heat required for brazing. Improperly
-

3.4 PIPING
INSTALLATION
(Cont'd)

- .1 General:(Cont'd)
 - .5 (Cont'd)
protected and damaged accessories and valves will be removed and replaced.
 - .6 95-5 Sil-fos or equal shall be used to braze refrigerant piping. Lead based soft solder will not be accepted.
 - .7 Provide hangers, vibration isolators and seismic bracing in accordance with Section 23 05 48.

- .2 Hot gas lines:
 - .1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
 - .2 Provide trap at base of risers greater than 2400 mm 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 above.
 - .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 2MPa and 1MPa on high and low sides respectively for minimum of 24 hours. Test Procedure: build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure.

- .3 Under no circumstances shall the refrigerant compressor be used to evacuate the system. The evacuation shall be accomplished by the use of a vacuum pump at an ambient temperature not less than 35°F (1.7°C) to ensure removal of all moisture and non condensable gases.

- .4 Test each joint in the refrigeration piping for leaks using at least one of the following methods;
 - .1 Bubble test
 - .2 Electronic leak detector

3.5 PRESSURE AND
LEAK TESTING
(Cont'd)

- .4 (Cont'd)
 - .3 Halide leak detector
 - .4 Ultrasonic leak detector
- .5 Repair all leaks and repeat the pressure test until the system holds pressure.

3.6 FIELD QUALITY
CONTROL

- .1 Site Tests/Inspection:
 - .1 Close service valves on factory charged equipment.
 - .2 Ambient temperatures to be at least 13 degrees C for at least 12 hours before and during dehydration.
 - .3 Use copper lines of largest practical size to reduce evacuation time.
 - .4 Use two stage vacuum pump with gas ballast on 2nd stage capable of pulling 5Pa absolute and filled with dehydrated oil.
 - .5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.
 - .6 Triple evacuate 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 test results to Departmental Representative.
 - .7 Charging:
 - .1 Charge system through filter drier and charging valve on high side. Low side charging not permitted.
 - .2 Liquid charging the system to initially charge the system is acceptable. Only liquid charge the system through the liquid line valve.
 - .3 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.
-

3.6 FIELD QUALITY CONTROL
(Cont'd)

- .7 Charging:(Cont'd)
- .4 Re purge charging line if refrigerant container is changed during charging process.
 - .5 All refrigerant required for re charging the system shall be new, non-recovered refrigerant, provided by the mechanical contractor. Certified recycled refrigerant is acceptable.
- .8 Checks:
- .1 Make checks and measurements as per manufacturer's operation and maintenance instructions.
 - .2 Record and report measurements to Departmental Representative.
- .9 Manufacturer's Field Services:
- .1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.
 - .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, at stages listed:
 - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
 - .2 Four times
 - .1 One at the start-up, one during progress of Work at 25% and 60% complete.
 - .2 And one upon completion of the Work, after cleaning is carried out.
 - .4 Obtain reports, within one of review, and submit, immediately, to Departmental Representative.
- .10 Insulate liquid and suction lines in their entirety. The insulation shall be continuous through all pipe supports and fittings to provide a vapour seal. Refer to Section 23 07 15.
-

3.6 FIELD QUALITY CONTROL .10 (Cont'd)
(Cont'd)

3.7 TSSA INSPECTION .1 The mechanical contractor shall arrange for and pay for the cost of TSSA inspection if required

3.8 DEMONSTRATION .1 Instructions:
.1 Post instructions in frame with glass cover in accordance with Section 01 78 00 Closeout Submittals and CSA B52.

3.9 CLEANING .1 Proceed in accordance with Section 01 11 01 .
.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.10 FIELD QUALITY CONTROL .1 Manufacturer's Field Services:
.1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

PART 1 - GENERAL

- 1.1 SUMMARY .1 Section Includes:
- .1 Materials and installation of low-pressure metallic ductwork, joints and accessories.
- 1.2 REFERENCES .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 ASTM International.
 - .1 ASTM A480/A480M-11b, 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, Carbon, Hot Rolled.
 - .3 ASTM A653/A653M-11, 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 90A-2012, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B-2012, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
 - .3 NFPA 96-2011, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
 - .6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition 2005.
 - .2 SMACNA HVAC Air Duct Leakage Test Manual, 1985, 1st Edition.
 - .3 SMACNA IAQ Guidelines for Occupied Buildings Under Construction 2nd edition 2007; ANSI/SMACNA 008-2008.
-

1.2 REFERENCES .7 Transport Canada (TC).
 (Cont'd) .1 Transportation of Dangerous Goods Act
 (TDGA), 1992, c. 34.

1.3 SUBMITTALS .1 Submit shop drawings and product data in
 accordance with Section 01 11 01.

.2 Product Data: submit WHMIS MSDS - Material
 Safety Data Sheets for the following:
 .1 Sealants.
 .2 Tape.
 .3 Proprietary Joints.

1.4 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.
 .2 During construction meet or exceed the
 requirements of SMACNA IAQ Guidelines for
 Occupied Buildings under Construction.

PART 2 - PRODUCTS

2.1 SEAL CLASSIFICATION .1 Classification as follows:

| Maximum Pressure Pa | SMACNA Seal Class |
|---------------------|-------------------|
| 500 | C |
| 250 | C |
| 125 | C |

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

2.2 SEALANT .1 Sealant: oil resistant, water borne, polymer
 type flame resistant duct sealant. Temperature
 range of minus 30°C to plus 93°C.

- 2.3 TAPE .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.
- 2.4 DUCT LEAKAGE .1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.
- 2.5 FITTINGS .1 Fabrication: to SMACNA.
- .2 Radiused elbows.
- .1 Rectangular: standard radius radius with single thickness turning vanes Centreline radius: 1.5 times width of duct.
- .2 Round: smooth radius. Centreline radius: 1.5 times diameter.
- .3 Branches:
- .1 Rectangular main and branch: with radius on branch 1.5 times width of duct 45 degrees entry on branch.
- .2 Round main and branch: enter main duct at 45 degrees with conical connection.
- .3 Provide volume control damper in branch duct near connection to main duct.
- .4 Main duct branches: with splitter damper.
- .4 Transitions:
- .1 Diverging: 20 degrees maximum included angle.
- .2 Converging: 30 degrees maximum included angle.
- .5 Offsets:
- .1 Full radiused elbows as indicated.
- 2.6 GALVANIZED STEEL .1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating, minimum 30% recycled content.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA.
-

2.7 HANGERS AND SUPPORTS

- .1 Hangers and Supports: in accordance with Section 23 05 29.
- .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.
- .1 Maximum size duct supported by strap hanger: 500.
- .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 |

- .4 Upper hanger attachments:
- .1 For concrete: manufactured concrete inserts.
- .2 For steel joist: manufactured joist clamp.
- .3 For steel beams: manufactured beam clamps:

PART 3 - EXECUTION

3.1 GENERAL

- .1 Do work in accordance with NFPA 90A, NFPA 90B ASHRAE and SMACNA.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
- .1 Insulate strap hangers 100 mm beyond insulated duct. Ensure diffuser is fully seated

3.2 HANGERS

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

3.2 HANGERS
(Cont'd)

.3 Hanger spacing:(Cont'd)

| <u>Duct Size</u> | <u>Spacing</u> |
|------------------|----------------|
| (mm) | (mm) |
| to 1500 | 3000 |

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
one coat of sealant to manufacturers
recommendations.

PART 1 - GENERAL

- 1.1 REFERENCES .1 Sheet Metal and Air Conditioning National Association (SMACNA)
.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-2005.
- 1.2 PRODUCT DATA .1 Submit product data in accordance with Section 01 11 01.
- 1.3 WASTE MANAGEMENT AND DISPOSAL .1 Refer to Section 01 11 01.

PART 2 - PRODUCTS

- 2.1 GENERAL .1 Manufacture to SMACNA standards.
- 2.2 SPLITTER DAMPERS .1 Of same material as duct but one sheet metal thickness heavier, with appropriate stiffening.
.2 Single thickness construction.
.3 Control rod with locking device and position indicator.
.4 Rod configuration to prevent end from entering duct.
.5 Pivot: piano hinge.
.6 Folded leading edge.
- 2.3 SINGLE BLADE DAMPERS .1 Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
.2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm.
.3 Locking quadrant with shaft extension to accommodate insulation thickness.
-

- 2.3 SINGLE BLADE .4 Inside and outside nylon end bearings.
DAMPERS
(Cont'd) .5 Channel frame of same material as adjacent
duct, complete with angle stop.
- PART 3 - EXECUTION
- 3.1 INSTALLATION .1 Install where indicated and required for
balancing.
- .2 Install in accordance with recommendations of
SMACNA and in accordance with manufacturer's
instructions.
- .3 For supply, return and exhaust systems, locate
balancing dampers in each branch duct.
- .4 Runouts to registers and diffusers: install
single blade damper located as close as possible
to main ducts.
- .5 All dampers to be vibration free.
- .6 Ensure damper operators are observable and
accessible.

PART 1 - GENERAL

- 1.1 REFERENCES .1 National Fire Protection Association (NFPA)
.1 NFPA 90A-2012, Installation of Air Conditioning and Ventilating Systems.
.2 NFPA 90B-2012, Installation of Warm Air Heating and Air Conditioning Systems.
- .2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2005.
- .3 Underwriter's Laboratories of Canada (ULC)
.1 CAN/ULC-S110-07, Fire Tests for Air Ducts.
.2 UL 181-2005, Factory Made Air Ducts and Connectors.
- 1.2 PRODUCT DATA .1 Submit product data in accordance with Section 01 11 01.
- .2 Indicate the following:
.1 Thermal properties.
.2 Friction loss.
.3 Acoustical loss.
.4 Leakage.
.5 Fire rating.
- 1.3 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.
- 1.4 WASTE MANAGEMENT AND DISPOSAL .1 Refer to Section 01 11 01.
-

PART 2 - PRODUCTS

- 2.1 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.

- 2.2 METALLIC ACOUSTIC INSULATED
- .1 Type 5: Spiral wound, flexible perforated aluminum with factory applied 37 mm thick flexible glass fibre thermal insulation and sleeved by aluminum foil and Type M vapour barrier.
 - .2 Performance:
 - .1 Factory tested to 3 kPa without leakage.
 - .2 Maximum relative pressure drop coefficient: 3.
 - .3 Acoustical performance: Minimum attenuation (dB/m) to following table:

| Duct Diam: | Frequency (Hz) | | | | |
|---------------|----------------|-----|-----|------|------|
| | 125 | 250 | 500 | 1000 | 2000 |
| 100 | 0.6 | 3 | 12 | 27 | 0 |
| 150 | 1.2 | 3 | 12 | 22 | 27 |
| 200 | 2.0 | 5 | 12 | 19 | 20 |
| 300 | 2.4 | 5 | 12 | 16 | 15 |

PART 3 - EXECUTION

- 3.1 DUCT INSTALLATION
- .1 Install in accordance with: CAN/ULC S110, UL 181 NFPA 90A, NFPA 90B and SMACNA.
 - .2 Use type 5 throughout.
 - .3 Connections:
 - .1 Duct Sizes 300 mm and Under:
 - .1 Provide a minimum of three (3) #8 sheet metal screws equally spaced to hold the flexible duct.

3.1 DUCT
INSTALLATION
(Cont'd)

- .3 Connections:(Cont'd)
 - .2 Duct sizes above 300 mm:
 - .1 Provide a minimum of five (5) #8 sheet metal screws equally spaced to hold the flexible duct.
 - .3 Screws shall be located at least 12 mm from the end of the duct.
 - .4 The collar to which the flexible duct is attached shall be a minimum 50 mm in length.
 - .5 Cover entire joint with tape and seal as specified in 23 33 00 Air Duct Accessories.
 - .4 Supports:
 - .1 Support shall be in accordance with SMACNA.
 - .2 The maximum amount of sag for flexible duct shall not exceed 12 mm per foot. Provide additional supports as required.
 - .5 Length:
 - .1 Maximum length of flexible duct: 3000 mm.
 - .2 Minimum length of flexible duct connecting to ceiling diffusers shall be 1800 mm.

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 American National Standards Institute (ANSI)
 - .1 ANSI/ASHRAE 51-2007/AMCA 210-07, Laboratory Methods of Testing Fans for Rating.
 - .2 National Fire Protection Association (NFPA)
 - .1 NFPA 90A-12, Installation of Air Conditioning and Ventilating Systems.
 - .3 International Organization of Standardization (ISO)
 - .1 ISO 3741:2010, Acoustics-Determination of Sound Power Levels of Noise Sources Using Sound Pressure - Precision Methods for Reverberation Rooms.
 - .4 Underwriter's Laboratories (UL)
 - .5 UL 181-2008, Factory-Made Air Ducts and Air Connectors.
- 1.2 SHOP DRAWINGS AND PRODUCT DATA
- .1 Submit shop drawings and product data in accordance with Section 01 11 01.
 - .2 Indicate the following:
 - .1 Capacity.
 - .2 Pressure drop.
 - .3 Noise rating.
 - .4 Leakage.
- 1.3 TEST REPORTS
- .1 To ANSI/ASHRAE 51/AMCA 210. Submit published test data on DIN (Direct Internal Noise), in accordance with ISO 3741 made by independent testing agency for 0, 2.5 and 6 m/s branch velocity or inlet velocity. Sound power level with minimum inlet pressure of 0.5 kPa in accordance with ISO 3741 for 2nd through 7th octave band, also made by independent testing agency. Pressure loss through silencer shall not exceed 60% of inlet velocity pressure maximum.
-

1.4 CLOSEOUT SUBMITTALS .1 Provide maintenance data for incorporation into manual specified in Section 01 11 00.

1.5 CERTIFICATION .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from certified ADC (Air Diffusion Council) testing agency signifying adherence to codes and standards.

1.6 WASTE MANAGEMENT AND DISPOSAL .1 Refer to Section 01 11 01.

1.7 EXTRA MATERIALS .1 Provide maintenance materials in accordance with Section 01 78 00.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS .1 Terminal units of the same type to be product of one manufacturer.

2.2 ELECTRONIC VARIABLE AIR VOLUME BOXES .1 Terminal units of the same type to be product of one manufacturer

.2 Units: Pressure independent volume regulator type.

.3 Low pressure systems of single duct type with variable volume control and housed within sound attenuating box.

.4 Casing: 0.89 mm minimum thickness galvanized steel insulated with minimum of 25 mm thick thermal foil faced and acoustic insulation which complies with UL-181 and NFPA 90A. Any cut edges of fiberglass exposed to the airstream shall be covered with metal angles and end caps so there is no exposed fiberglass in the air stream

.5 The primary air valve damper shall be heavy gauge metal, with peripheral gasket, pivoted in self-lubricating bearings. In full closed position, air leakage past the closed damper

2.2 ELECTRONIC
VARIABLE AIR VOLUME
BOXES
(Cont'd)

- .5 (Cont'd)
shall not exceed 2% of the nominal catalog rating at 747 Pa inlet static pressure, as rated by ARI Standard 880. An opposed blade primary air damper and DDC motor operator shall vary primary air in response to a signal. Damper operation shall be demonstrated to be closed to minimum position before heating is activated. No overlap under any circumstances shall be allowed. Damper shall be located inside unit. Damper connection to operating shaft shall be a positive mechanical connection.
- .6 The air flow sensor shall be of cross configuration located at the inlet of the assembly. The sensor shall have twelve total pressure sensing ports and a centre averaging chamber designed to accurately average the flow across the inlet of the assembly. Sensor shall provide accuracy within 5% with a 90 deg sheet metal elbow directly at the inlet of the assembly. The air flow sensor shall amplify the sensed air flow signal.
- .7 Factory preset maximum and minimum air volume setting being field adjustable, and duct collars. Leakage through casing not to exceed 2% of design volume with 750 kPa upstream and 0 kPa downstream of regulator while maintaining flow regulation within 5% of setting as rated by ARI Standard 880.
- .8 At an inlet velocity of 10.2 m/s pressure drop for cfm range of box shall not exceed 27 Pa.
.1 Radiated: 35 NC.
.2 Discharge: 36 NC. Based on room absorption of 10 db, and an inlet static pressure of 375 Pa.
- .9 Provide minimum 915mm attenuator for discharge of every box. Attenuator shall have interior lining as previously specified, of 25 mm for its entire length.
- .10 Provide terminal units with air volumes of 900 cfm or more with additional 600mm silencer section.
-

2.2 ELECTRONIC
VARIABLE AIR VOLUME
BOXES
(Cont'd)

- .11 In fully closed position, air leakage through damper shall not exceed 2% of catalogued rating at 750 Pa.
- .12 Schedule: as indicated on the drawings.
- .13 All digital controls including motor, transducer, controller, etc. to be supplied and installed by the BAS/ EMCS Control Contractor on site.
- .14 Existing units are all manufactured by E.H. Price model number SDV5000. . New units provided shall provide same level of performance as existing terminal boxes.
- .15 Acceptable Materials: E.H.Price, Titus, Tuttle and Baily,

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install in accordance with manufacturers recommendations.
- .2 Support independently of ductwork.
- .3 Install with at least 1000 mm of flexible inlet ducting and minimum of four duct diameters of straight inlet duct, same size as inlet.
- .4 Locate so that controls, dampers and access panels are easily accessible.

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Door grilles: Section 08 90 00 - Louvres and Vents.
- 1.2 PRODUCT DATA .1 Submit product data in accordance with Section 01 33 00.
- .2 Indicate the following:
- .1 Capacity.
 - .2 Throw and terminal velocity.
 - .3 Noise criteria.
 - .4 Pressure drop.
 - .5 Neck velocity.
- 1.3 CERTIFICATIONS .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.
- 1.4 WASTE MANAGEMENT AND DISPOSAL .1 Refer to Section 01 11 01.

PART 2 - PRODUCTS

- 2.1 GENERAL .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- .2 Frames:
- .1 Full perimeter gaskets.
 - .2 Plaster frames where set into plaster or gypsum board and as specified.
 - .3 Concealed fasteners.
- .3 Concealed manual volume control damper operators.
- .4 Colour: To match existing.
-

- 2.2 MANUFACTURED UNITS .1 Grilles, registers and diffusers of same generic type to be product of one manufacturer.
- 2.3 RETURN AND EXHAUST GRILLES AND REGISTERS .1 General: with opposed blade dampers.
.2 Type RB: steel aluminum, 25 mm border, single 0 45° deflection, vertical face bars.
.3 Egg crate shall be suitable for T-bar lay-in. Supplied units shall match existing in colour and appearance.
.4 Type RC: steel aluminum, 25 mm border, 25 x 25 mm egg crate type face bars. Finish: Off-white.
- 2.4 DIFFUSERS .1 General: volume control dampers with flow straightening devices and blank-off quadrants and gaskets.
.2 Steel, square multi-pattern lay-in and or surface mounted. Finish: off-white.
.3 Diffusers to match existing in shape and colour existing ones are E.H.Price 610 x 610, SCDA-B12 - Type 3 frame; suitable for narrow (15 mm) T.
- 2.5 LINEAR GRILLES .1 Bar core type with margin as indicated no margin.
.2 Plaster frame, mitred end, sealing strip and accessories as indicated. Finish: off-white.
.3 Air volume control damper with concealed adjustment.
.4 Prior to ordering, visit the site to ensure new diffusers match existing ones and are suitable for type of T-bar being supplied.
.5 Diffusers to match existing in shape and colour existing ones. E.H.Price Model SDS-B12.
-

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install in accordance with manufacturers instructions.
- .2 Refer to Architectural and Electrical drawings and coordinate with drawing , electrical and architectural drawings..

PART 1 - GENERAL

- 1.1 REFERENCES .1 American National Standards Institute/Air Conditioning and Refrigeration Institute (ANSI/ARI)
.1 ANSI/ARI 210/240-2003, Unitary Air Conditioning and Air-Source Heat Pump Equipment.
- .2 American National Standards Institute/American Society of Heating, Refrigeration and Air Conditioning Engineers (ANSI/ASHRAE)
.1 ANSI/ASHRAE Standard 15 2010, Safety Standard for Refrigeration Systems.
- .3 Air Conditioning and Refrigeration Institute (ARI)
.1 ARI 320 1998, Standard for Water Source Heat Pumps.
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
.1 Indicate on drawings:
.1 Dimension
.2 Fan
.3 Capacity
.4 Electrical and control drawings.
- .4 Submit in accordance with Section 01 11 01.
- .5 Operation and Maintenance Data: submit operation and maintenance data for heat pumps for incorporation into manual.
- 1.3 DELIVERY, STORAGE AND HANDLING .1 Deliver, store and handle materials in accordance with Section 01 11 01 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
-

1.3 DELIVERY,
STORAGE AND
HANDLING
(Cont'd)

- .3 Storage and Handling Requirements:
- .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect heat pumps from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 DESCRIPTION

- .1 The units shall be listed by Electrical Laboratories (ETL) and bear the cETL label.
- .2 The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.

2.2 REFRIGERANTS

- .1 Type of Refrigerant: R-410A.

2.3 SYSTEM
DESCRIPTION

- .1 The variable capacity air conditioning system shall be Inverter Driven (heat / cool) split system as specified. The system shall consist of an indoor evaporator exclusively matched to an outdoor variable speed rotary compressor condensing unit.
 - .2 The outdoor unit shall be configured for horizontal discharge airflow and complete with a variable speed condenser fan using a single phase power supply.
 - .3 Typical cooling mode operation range shall be between -10 deg C DB and 46 deg C DB, and -15 deg C DB to 25 deg C DB for the heating mode.
 - .4 Provide an ultra-low ambient kit to permit unit operation in cooling mode down to -40 deg C.
 - .5 The system shall be designed to operate with a maximum refrigerant pipe length of 98.4 feet, with 65.6 feet maximum vertical difference, and without any oil traps or additional equipment.
-

2.3 SYSTEM
DESCRIPTION
(Cont'd)

- .6 Maximum noise of the indoor unit shall not exceed NC 30 operating at high speed.
- .7 Standard of Acceptance: Daikin Model FTXN (indoor) and RKN (outdoor), Mitsubishi and or approved equal.

2.4 INDOOR UNIT

- .1 The indoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. Both liquid and suction lines must be individually insulated between the outdoor and indoor units.
 - .2 The indoor unit shall have a white, "flat screen" finish.
 - .3 The drain and refrigerant piping on wall mounted units shall be accessible from six (6) positions for flexible installation (right side, right back, and right bottom; and left side, left back, and left bottom).
 - .4 The cabinet shall include an "intelligent-eye" motion sensor capable of setting back the set point temperature for energy savings. This feature may be disengaged on the wireless remote controller.
 - .5 The evaporator fan shall be statically and dynamically balanced. Motor shall have permanent lubricated bearings and offer up to five speed settings.
 - .6 Auto-swing louver shall automatically adjustable the air flow pattern (both vertically and horizontally).
 - .7 The filter shall be mildew proof, washable.
 - .8 The evaporator coil shall be nonferrous, with aluminum fin on a copper tube heat exchanger. All tube joints shall be brazed with silver alloy or phoscopper. All coils shall be factory pressure tested. A condensate pan shall be provided under the coil with a drain connection.
 - .9 Provide a condensate pump (shipped loose) for field installation.
-

2.5 CONDENSING
UNIT

- .1 The outdoor unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.
- .2 The fan shall be a direct drive, propeller type fan. The motor shall be inverter driven with permanently lubricated bearings
- .3 A fan guard shall be provided on the outdoor unit to prevent contact with fan operation.
- .4 The outdoor coil shall have nonferrous construction with a corrugated fin tube.
- .5 The compressor shall be rotary swing inverter-driven compressor. Compressor safeties shall include internal thermal overload protection. Refrigeration specialties shall include an accumulator, refrigerant metering device and a four-way reversing valve.

2.6 ELECTRICAL

- .1 The outdoor unit shall be powered with 208-230 volts, 1 phase, 60 hertz power. The indoor unit shall receive 208-230 volt, 1 phase, 60 hertz power fed from the outdoor unit.

2.7 CONTROLS

- .1 The unit shall be provided with a wired wall mounted thermostat. It shall be configurable for Automatic Operation, Dry Operation and Fan Only Operation.
 - .2 The controller shall be native BACnet. The intent is to control the unit as a supplementary cooling unit via BAS system. AS a minimum the BAS shall be able to turn the unit ON/OFF. Refer to drawings and section 159001 for details.
 - .3 The controller shall consist of an On/Off power switch, mode selector, silent button (for outdoor unit), fan setting, swing louver, On/Off timer setting, temperature adjustment, metric or imperial temperature display, "Intelligent Eye"
-

- 2.7 CONTROLS .3 (Cont'd)
 (Cont'd)
- .4 Silent operation shall reduce the sound level of the outdoor unit by slowing down the inverter driven condenser fan.
- .5 High power mode shall provide rapid cool down or heating to achieve maximum desired temperature in the shortest allowable time period.
- .6 The indoor unit microprocessor shall receive and process commands via wall mounted/ return air temperature and indoor coil temperature sensors enabled by commands from BAS and/or wall mounted thermostat.

- 2.8 ACCESSORIES .1 Unit shall be provided with a condensate pump (shipped loose) for field installation the following field installed accessories.

PART 3 - EXECUTION

- 3.1 EXAMINATION .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for heat pumps installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

- 3.2 INSTALLATION .1 Install where indicated and in accordance with manufacturer's instructions.
- .2 Installation shall be carried out by trained and manufactures' approved technician.
-

3.2 INSTALLATION
(Cont'd)

- .3 Install outdoor units on roof on concrete pavers or as directed by the manufacturer.
- .4 Secure with hold-down bolts in accordance with manufacturer's recommendations.
- .5 Level unit with fans running.
- .6 Make piping connections. Nothing to obstruct ready access to components or to prevent removal of components for servicing.
- .7 For ceiling hung installations, provide a reinforced steel framework to adequately support all unit sections.
- .8 Provide certified wiring schematics to the electrical division for associated equipment and controls.
- .9 Provide all necessary control wiring as recommended by the manufacturer. Carry out all control wiring between the outdoor condenser and indoor unit, and between the indoor unit and thermostat
- .10 High/low pressure gas line, liquid and suction lines must be individually insulated between the outdoor and indoor units.
- .11 The unit supplier shall size all refrigerant piping. No additional monies will be paid for upsizing the line sizes shown on the drawings.
- .12 2 Mechanical contractor shall provide any additional refrigerant required over and beyond the initial charge.

3.3 DRAIN PANS

- .1 Install so that no water can accumulate. Arrange easy access for cleaning.
 - .2 Include internal or external trap for proper draining as per manufacture's recommendation.
 - .3 Install condensate line to closest rain water leader in the building.
-

- 3.4 START-UP AND COMMISSIONING
- .1 Have manufacturer certify installation.
 - .2 Have manufacturer present during start-up tests and start up units and certify performance.
 - .3 Submit written start-up and commissioning reports to Departmental Representative.
 - .4 Refer to front end document for third party commissioning.
- 3.5 CLOSEOUT ACTIVITIES
- .1 Manufacturer to deliver verbal, and written instructions to operating personnel.
- 3.6 CLEANING
- .1 Progress Cleaning: clean in accordance with Section 01 11 01.
- 3.7 PROTECTION
- .1 Protect installed products and components from damage during construction.
 - .2 Repair damage to adjacent materials caused by heat pumps installation.

PART 1 - GENERAL

- 1.1 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Submit in accordance with Section 01 11 00.
 - .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for forced air heaters and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.2 CLOSEOUT SUBMITTALS
- .1 Submit in accordance with Section 01 11 01.
 - .2 Operation and Maintenance Data: submit operation and maintenance data for forced air heaters for incorporation into manual.
- 1.3 DELIVERY, STORAGE AND HANDLING
- .1 Deliver, store and handle materials in accordance with Section 01 11 01 and with manufacturer's written instructions.

PART 2 - PRODUCTS

- 2.1 FORCED AIR HEATERS
- .1 Forced air heaters, ducted ceiling mounted commercial type as follows:
 - .1 Enclosure:
 - .1 Steel, 1.2 mm thick.
 - .2 Knockouts for 12 mm diameter conduit left, right, bottom and rear.
 - .2 Elements and Fan:
 - .1 Mineral insulated or Nickel chromium alloy.
 - .2 Motor: totally enclosed, shaded pole, impedance protected motor.
 - .2 Controls:
 - .1 Capacity as indicated on schedule.
-

PART 3 - EXECUTION

- 3.1 INSTALLATION .1 Install heaters in accordance with manufacturer's written recommendations.
.2 Make power and control connections.
- 3.2 FIELD QUALITY CONTROL .1 Perform tests in accordance with Section 26 05 00.
- 3.3 CLEANING .1 Progress Cleaning: clean in accordance with Section 01 11 01.
.1 Leave Work area clean at end of each day.
- 3.4 PROTECTION .1 Protect installed products and components from damage during construction.
.2 Repair damage to adjacent materials caused by forced air heaters installation.

PART 1 - GENERAL

- 1.1 REFERENCES .1 Hydronic Institute of Boiler and Radiator Manufacturers (IBR)
- 1.2 SHOP DRAWINGS .1 Submit shop drawings in accordance with Section 01 11 01.
- .2 Indicate:
- .1 Equipment, capacity, piping, and connections.
- .2 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.
- 1.3 CLOSEOUT SUBMITTALS .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.
- 1.4 WASTE MANAGEMENT AND DISPOSAL .1 Refer to Section 01 11 01.

PART 2 - PRODUCTS

- 2.1 CAPACITY .1 As indicated, based on 93°C average water temperature, 11°C temperature drop and 18°C at entering air temperature.
- 2.2 FINNED TUBE RADIATION .1 Heating elements: 32 mm seamless copper tubing, 1.2 mm minimum wall thickness, mechanically expanded into flanged collars of evenly spaced aluminum fins, 100 x 100 mm nominal, 130 fins per metre suitable for sweat fittings.
- .2 Element hangers: ball bearings plastic lined cradle type providing unrestricted longitudinal movement on enclosure brackets. Space brackets 900 mm centres maximum.
-

2.2 FINNED TUBE
RADIATION
(Cont'd)

- .3 Enclosures: 1.6 mm thick steel complete with components for wall-to-wall or complete with die formed end caps having no knock-outs, with inside corners, outside corners, as indicated. Provide full length channel and sealer strip at top of wall edge. Height as indicated. Joints and filler pieces to be flush with cabinet. Support rigidly top and bottom, on wall mounted brackets. Joints and filler pieces to be clear of grilles located to provide easy access to valves and vents. Provide access doors for valves vents. Finish cabinet with factory applied baked primer coat.
- .4 New cabinet to match existing. Refer to drawings M510 and M-520.
- .5 Existing louver is manufactured by Engineered Air and is Model WF-1A.
- .5 Dimensions for enclosures: measure site conditions. Do not scale from drawing.
- .6 Provide for noiseless expansion of all components.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Install in accordance with piping layout and reviewed shop drawings.
- .3 Provide for pipe movement during normal operation.
- .4 Maintain sufficient clearance to permit performance of service maintenance.
- .5 Valves
 - .1 Install valves with stems upright or horizontal unless approved otherwise.
- .6 Venting:
 - .1 Install screwdriver vent, terminating flush with surface of cabinet..
- .7 Clean finned tubes and comb straight.

PART 1 - GENERAL

- 1.1 WORK INCLUDED
- .1 Provide as an extension to the existing system a Siemens Buildings Technologies Building Automation System (BAS) utilizing Distributed Digital Control (DDC) to serve new mechanical and associated systems as described on the drawings and in this specification.
 - .2 Provide all labour, materials, products, equipment and services to supply, install and commission the electronic control and monitoring system with electronic as specified in this Section of the Specification.
 - .3 Provide all computer hardware and software, operator input/output communication devices, communication units, communication interface to digital system controllers, field sensors and controls as required to meet the specified performance.
 - .4 Supply and install controllers for new variable terminal units. Refer to Section 23 36 00.
 - .5 Provide all wiring, labour, including calibration, commissioning, software programming and data base generation, generation of colour graphics and additional work necessary to provide a complete and fully operating system.
 - .6 Provide 120 Volt, 20 amp circuits to field panels and other devices requiring a main supply from circuits supplied by Division 26.
 - .7 Install and wire control wiring associated with split unit. Refer to Section 23 81 40.1.
- 1.2 GENERAL SYSTEM REQUIREMENTS
- .1 Provide a single architecture common data base microprocessor based electronic control and monitoring BAS system for air handling equipment, heating and cooling and other specified systems employing distributed processing and direct digital control (DDC) with electronic sensing and electronic actuation to conform with the specification requirements. The BAS shall consist of the following:
 - .1 DDC Controllers
 - .2 Application Specific Controllers.
-

1.3 SHOP DRAWINGS .1 Submit within 4 weeks of contract award, all Shop Drawings, diagrams, schedules and equipment and software data sheets as may be deemed necessary by the Departmental Representative in order to ensure the intention of the Specification and schedule of work are being met.

1.4 DOCUMENTATION .1 Provide prior to project completion 3 sets of maintenance documentation of a standard which would enable the Owner to undertake planned maintenance, repair, calibration and other adjustments as may be necessary from time to time, on any component provided under this Contract without additional documentation being required and without assistance from others.

PART 2 - PRODUCTS

2.1 TEMPERATURE SENSORS .1 All space sensors shall be RTD or thermistor type temperature detectors. Sensors shall be provided with vented protective covers, mounted 1500mm from floor level.

2.2 DIFFERENTIAL PRESSURE SENSORS .1 Differential pressure sensors shall be provided for water differential pressure air and static pressure applications. The differential pressure range shall be selected to match the application. Select materials suitable for the measured variable, i.e. water and air, and to withstand a minimum of twice the normal pressure.

.2 Each sensor shall be provided with an industry standard 4-20mA transmitter, mounted at the sensor. The transmitter and sensor shall have a combined accuracy of <+/- 1.0% full scale. Setra C-264 or equivalent is acceptable.

2.3 CURRENT SWITCHES.1 Provide solid state current DC switches with LED which operate when the level sensed by an internal current transformer exceeds the threshold value set by a four-turn adjustment.

2.3 CURRENT SWITCHES.2
(Cont'd)

The switch shall be capable of open-collector transistor outputs, capable of 150 mA dc continuous, 500 mA momentary. Maximum permissible voltage between output and common in off state is 30 VDC. Maximum voltage drop at 150 mA is 0.8 volts.

2.4 NAMEPLATES .1 Duct and pipe mounted sensors and panels shall be provided with minimum size 75x25x3.2 mm lamacoid nameplates, clearly identifying the equipment and functions with letter and number designation. Nameplates shall be mechanically secured and listed in the Operating and Maintenance manual.

2.5 NETWORKING .1 The design of BAS shall allow the co-existence
COMMUNICATIONS of new BACnet DDC Controllers with existing Siemens Apogee DDC Controllers in the same network.

2.6 DDC CONTROLLER .1 This level communication shall support a family
FLOOR LEVEL NETWORK of application specific controllers and shall communicate with the peer-to-peer network through BACnet DDC Controllers for transmission of global data.

2.7 DDC CONTROLLERS .1 HVAC DDC Controllers shall be a 32-bit stand-alone, multi tasking, multi user, real time digital control processors consisting of modular hardware with plug in enclosed processors.

.2 Each HVAC DDC Controller shall have sufficient memory to support its own operating system and databases, including:

.1 Control processes

.3 Energy management applications

.4 Alarm management applications including custom alarm messages for each level alarm for each point in the system.

.5 Historical/trend data for points specified

.6 Maintenance support applications

- 2.7 DDC CONTROLLERS .7 HVAC DDC Controllers shall provide a RS 232C serial data communication port for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals.
(Cont'd)
- .8 HVAC DDC Controllers shall provide local LED status indication for each digital input and output for constant, up to date verification of all point conditions without the need for an operator I/O device.
- 2.8 APPLICATION SPECIFIC CONTROLLER .1 Each DDC Controller shall be able to extend its performance and capacity through the use of emote application specific controllers (ASCs) through Floor Level LAN Device Networks.
- 2.9 TERMINAL EQUIPMENT CONTROLLERS .1 Provide for control of each piece of equipment, including, but not limited to, the following:
.1 Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Analog outputs shall be industry standard signals such as 24V floating control, allowing for interface to a variety of modulating actuators. Terminal controllers utilizing proprietary control signals and actuators shall not be acceptable. As an alternative, provide DDC Controllers or other TEC's with industry standard outputs for control of all terminal equipment.
.2 Each controller performing space temperature control shall be provided with a matching room temperature sensor. The sensor may be either RTD or thermistor type providing the minimum performance requirements of +/- .6 deg. C accuracy, operating in the range of 2 to 46 deg.C , adjustable between 2 to 30 deg. C.
- 2.10 OPERATOR WORKSTATION .1 Tie-in any new controllers to the existing Apogee Insight Server. Distribute all new graphics and software to the existing Operator Workstation.
.2 Follow the existing format of graphics and interface new and relocated space terminal units.
-

PART 3 - EXECUTION

3.1 SEQUENCING

- .1 General
 - .1 Sequencing of operations for new systems will be as described in this section, and control drawings.
- .2 VAV BOXES - Typical
 - .1 Sequence of operation remains the same.
- .3 VAV boxes with Supplementary Cooling
 - .1 The supplementary cooling units are provided with controllers which are BACnet and shall be connected to the BAS system
 - .2 The intent is to initiate unit start-up when the VAV box is at its maximum position and room is not maintained.
 - .3 BAS shall initiate the unit start-up and unit controller shall maintain space temp. set point.
 - .1 Upon initiation of the supplementary cooling operation, the terminal units associated with the space remains 100% open.
 - .2 If the supplementary cooling is not operational for a period of 10 minutes (operator adjustable); BAS shall modulate VAV box controller to maintain room temperature. There shall be a lag of 10 minutes prior to start-up of the supplementary cooling unit.
 - .3 Under other conditions heating mode and when the room is satisfied; VAV box and perimeter heating sequence of operation remains status quo.

3.2 FORCE FLOW UNITS.1

- General
 - .1 Force flows indicated as FF-xx is to replace existing door heater. Reuse control point to monitor and control the force flow heater.
 - .2 Sequence of operation remains same as the door heater.
 - .3 Re-use existing thermostat and install as indicated on the drawings.
 - .4 Update graphics.
-

- 3.3 DEMOLITION .1 Remove and relocate existing thermostats, controllers and associated wiring as indicated on the drawings.
- 3.4 INSTALLATION .1 Cooperate with the air and water balance technicians during the balancing of the system.
- .2 Install equipment so as to allow for easy maintenance access and such that it does not interfere in any way with access to adjacent equipment and personnel traffic in the surrounding space.
- 3.5 CONTROL WIRING .1 Supply and install wiring as required for the automatic control system. Install wiring in EMT conduit in mechanical rooms and other areas susceptible to damage where exposed. Plenum cable is acceptable in concealed spaces such as ceilings. Control wiring must comply with all requirements of Division 26
- 3.6 TRAINING .1 The Contractor shall provide 2 hours training during normal working hours, a competent instructor to give full instruction to designated personnel in the adjustment, operation and maintenance of the system installed
- 3.7 ADJUSTMENTS
SERVICE & WARRANTY .1 Adjust and set thermostats, temperature sensors, damper operators, relays and other components to proper settings to give required performance. Cooperate with other sections during testing and balancing of each mechanical system to ensure each total system operates to approval.
- .2 Temperature control system and specified herein shall be warranted free from defects in materials and workmanship and shall be serviced without charge (except for damage from lack of maintenance of other causes) for one year after date of start of lien period. If, within this period, any equipment herein described is proved to be defective in workmanship or materials, it shall be replaced or repaired without charge.
-

3.7 ADJUSTMENTS .3 For third part commissioning refer to Section
SERVICE & WARRANTY 01 11 01.
(Cont'd)

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 Adhere to the latest Canadian Standards Association (CSA International)
 - .1 CSA-C22.1-12, Canadian Electrical Code, Part 1 (21st Edition), Safety Standard for Electrical Installations.
 - .2 CAN3-C235-83, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
 - .2 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
 - .3 The Ontario Electrical Safety Code, and all bulletins (Ontario).
 - .4 Electrical Safety Authority (ESA) requirements and local applicable codes and regulations.
- 1.2 DESIGN REQUIREMENTS
- .1 Operating voltages: to CAN3-C235.
 - .2 Control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
 - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
 - .3 Language operating requirements: provide identification nameplates and labels for control items in English.
- 1.3 SUBMITTALS
- .1 Submittals: in accordance with Section 01 11 01.
 - .2 Product Data: submit WHMIS MSDS.
 - .3 Shop drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario.
 - .2 Submit 6 number of copies of drawings and product data to authority having jurisdiction.
 - .3 If changes are required, notify Departmental Representative of these changes before they are made.
-

1.3 SUBMITTALS
(Cont'd)

- .4 Quality Control: in accordance with Section 01 11 01.
 - .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of contract. Pay associated fees. Departmental Representative will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.
 - .5 Submit, upon completion of Work, load balance report as described in PART 3 - Load Balance.
 - .6 Submit certificate of acceptance from Electrical Safety Authority having jurisdiction upon completion of Work to Departmental Representative.

1.4 QUALITY
ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 11 01.
 - .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices as per the conditions of Provincial Act respecting manpower vocational training and qualification.
 - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
 - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
 - .3 Site Meetings:
 - .1 In accordance with Section 01 32 17 and Section 01 32 18.
 - .4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.
-

1.5 DELIVERY, STORAGE AND HANDLING .1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.

.2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 11 01.

1.6 SYSTEM STARTUP .1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.

PART 2 - PRODUCTS

2.1 SUSTAINABLE REQUIREMENTS .1 Materials and products in accordance with Section 01 11 01.

2.2 MATERIALS AND EQUIPMENT .1 Provide material and equipment in accordance with Section 01 11 01.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - Submittals.

.3 Factory assemble control panels and component assemblies.

2.3 WARNING SIGNS .1 Warning signs: in accordance with requirements of authority having jurisdiction.

2.4 WIRING TERMINATIONS .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.5 EQUIPMENT
IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
.1 Nameplates: plastic laminate 3 mm thick plastic engraving sheet, matt white finish face, black core, mechanically attached with self tapping screws.
.2 Sizes as follows:

| | | | |
|--------|-------------|---------|--------------------|
| Size 1 | 10 x 50 mm | 1 line | 3 mm high letters |
| Size 2 | 12 x 70 mm | 1 line | 5 mm high letters |
| Size 3 | 12 x 70 mm | 2 lines | 3 mm high letters |
| Size 4 | 20 x 90 mm | 1 line | 8 mm high letters |
| Size 5 | 20 x 90 mm | 2 lines | 5 mm high letters |
| Size 6 | 25 x 100 mm | 1 line | 12 mm high letters |
| Size 7 | 25 x 100 mm | 2 lines | 6 mm high letters |

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY No. " as directed by Departmental Representative.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.
- .9 Transformers: indicate capacity, primary and secondary voltages.

2.6 WIRING
IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA-C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.7 CONDUIT AND
CABLE
IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20mm wide auxiliary colour.

| | <u>Prime</u> | <u>Auxiliary</u> |
|--------------------------|--------------|------------------|
| up to 250 V | Yellow | |
| up to 600 V | Yellow | Green |
| Telephone | Green | |
| Other | Green | Blue |
| Communication Systems | | |
| Fire Alarm | Red | |
| Emergency Voice | Red | Blue |

2.8 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

2.9 DISTRIBUTION
SYSTEM

- .1 120/208V, 3 phase, 4W, 60 Hz.
- .2 Inform other Divisions of electrical system characteristics.

- 2.10 WIRING SYSTEM .1 Power and lighting circuits in EMT and/or described in other sections.
- .2 Use heavy wall rigid conduit where required by codes.
- .3 RW-90, XLPE insulated wire for panel feeder and branch circuits, GTF insulated wire for final fixture connection.
- .4 #12 AWG minimum wire size, #10 AWG or larger shall be stranded.
- .5 Copper conductors.
- .6 Size branch circuits and panel feeders for maximum 2% voltage drop.
- .7 Provide insulated green ground conductor in all EMT conduits.
- .8 Provide nylon insulated bushings on the ends of all conduits in junction boxes, pullboxes, panelboards, etc.
- .9 Minimum size conduit for lighting and power circuits is 21 mm.
- 2.11 GROUNDING .1 Ground equipment with approved conductors and connectors.
- .2 Make tests required by code and authorities having jurisdiction.
- 2.12 MOTOR AND CONTROL WIRING .1 Provide wiring and connections for motors and electrical equipment supplied under other Divisions.
- .2 Mechanical Divisions shall wire control circuits 50 volts and under.
- 2.13 PANELBOARD .1 Provide panelboard of the circuit breaker type.
- .2 Install branch circuit breakers shown on panel schedule.
- .3 Panel to be in dead front metal cabinet with hinged door and catches.
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- 2.13 PANELBOARD (Cont'd)
- .4 Breakers: toggle type, bolt-on, quick-make, quick-break, 40°C ambient temperature compensated and trip-free of operating handles on overloads.
 - .5 Lock-on handle devices for breakers not controlling lighting. 2P and 3P breakers to be with single handle common trip type.
 - .6 Typed directory card showing load supplied by each circuit, mounted inside cabinet door.
 - .7 Mount panel at 1500 mm above finished floor with the top of panel not higher than 2000 mm.
 - .8 Copper bus with neutral of same ampere rating as mains.
 - .9 Provide two 27 mm spare empty conduits from recessed panels into ceiling space above panel and terminate in an accessible location.
- 2.14 OUTLET BOXES
- .1 Light fixture outlet boxes: standard, octagonal or square as required.
 - .2 Switch outlet boxes: standard, single or ganged as required.
 - .3 Receptacle outlet boxes: standard.
 - .4 Steel construction.
 - .5 Standard FS conduit fittings for surface mounted outlets in exposed areas.
- 2.15 SWITCHES
- .1 Specification grade, toggle type, 20 amps, 120V back and side wired, chrome plated yoke, silver cadmium oxide contacts, switch mechanism on neoprene cushion.
 - .2 Locate switches on latch side of door, 1.5 m above finished floor unless noted otherwise.
- 2.16 RECEPTACLES
- .1 Specification grade, 15 amp, 125 volt, AC, 'U' ground parallel blade slots, triple wiping contacts, double grounding terminals, break-off feature for separate feeds, built-in strap in
-

- 2.22 DISCONNECT SWITCHES
- .1 Heavy duty, quick-make, quick-break.
 - .2 Enclosure EEMAC 1R for interiors.
- 2.23 TELEPHONE SYSTEM
- .1 Empty conduit system and outlets.
 - .2 E.M.T. conduit from terminal board/telephone closet to outlets unless indicated otherwise.
 - .3 Fish wire in each conduit.
 - .4 Co-ordinate with the Owner.
- 2.24 FIRE ALARM SYSTEMS
- .1 Refer to Section 28 31 00.
- 2.25 DATA SYSTEM
- .1 Empty conduit system and outlets.
 - .2 E.M.T. conduit from terminal board/data closet to outlets unless indicated otherwise.
 - .3 Fish wire in each conduit.
 - .4 Co-ordinate with the Owner.
- 2.26 WORK IN EXISTING BUILDING
- .1 The Work of the specification shall be read in conjunction with and be governed by the requirements with this section.
 - .2 Maintain life safety systems to all existing buildings at all times during construction.
 - .3 Maintain electrical continuity to all portions of existing building during all work. Submit letter to Owner requesting off-hours shut-down. Provide all temporary power and wiring required to achieve this.
-

PART 3 - EXECUTION

3.1 GENERAL

- .1 Turnover all existing equipment that is no longer required to the Owner. Remove from site any equipment that the Owner may decide upon. Package all HID fixtures individually.
- .2 Protect all removed (to be retained) equipment from damage. Replace damaged equipment.
- .3 Provide temporary power feeder from new electrical room to existing 600A service until permanent feeder is installed.

PART 1 - GENERAL

- 1.1 REFERENCES .1 CSA International
.1 CAN/CSA-C22.2 No.18 - 98 (R2003), Outlet Boxes, Conduit Boxes and Fittings.
.2 CAN/CSA-C22.2 No.65-03 (R2008), Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
.1 EEMAC 1Y-2- (1961), Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS .1 Submit in accordance with Section 01 33 00.
.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.3 CLOSEOUT SUBMITTALS .1 Submit in accordance with Section 01 78 00.
.2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.
- 1.4 DELIVERY, STORAGE AND HANDLING .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
.3 Storage and Handling Requirements:
.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
-

1.4 DELIVERY,
STORAGE AND
HANDLING
(Cont'd)

- .3 Storage and Handling Requirements:(Cont'd)
 - .2 Store and protect wire and box connectors from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for stranded copper conductors.
 - .2 Clamp for stranded copper conductors.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors.
 - .5 Sized for conductors as indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and cables and:
-

-
- 3.2 INSTALLATION .1 (Cont'd)
- (Cont'd)
- .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
 - .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.
 - .3 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.
 - .4 Install bushing stud connectors in accordance with EEMAC 1Y-2.
-
- 3.3 CLEANING .1 Progress Cleaning: clean in accordance with Section 01 74 11.
- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11g.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 and 01 35 21.
- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

PART 1 - GENERAL

- 1.1 PRODUCT DATA .1 Provide product data in accordance with Section 01 33 00.
- 1.2 DELIVERY, STORAGE AND HANDLING .1 Packaging Waste Management: remove for reuse and return of packaging materials in accordance with Section 01 74 21.

PART 2 - PRODUCTS

- 2.1 BUILDING WIRES .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
.1 Copper conductors: size as indicated, with 600V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE RWU90 XLPE, Jacketted Non Jacketted.
.2 Copper conductors: size as indicated, with thermoplastic insulation type T90 Nylon rated at 600 V.
- 2.2 ARMOURED CABLES .1 Conductors: insulated, copper size as indicated.
.2 Type: AC90.
.3 Armour: interlocking type fabricated from galvanized steel strip.
.4 Type: ACWU90 jacket over thermoplastic armour and compliant to applicable Building Code classification for this project.
.5 Connectors: anti short connectors.
- 2.3 CONTROL CABLES .1 Type: LVT: soft annealed copper conductors, sized as indicated:
.1 Insulation: thermoplastic.
.2 Sheath : armour of closely wound aluminum wire.
-

- 2.3 CONTROL CABLES (Cont'd)
- .2 Type: low energy 300 V control cable: stranded annealed copper conductors sized as indicated
LVT: soft annealed copper conductors, sized as indicated:
 - .1 Insulation: TWH.
 - .2 Shielding: tape coated with paramagnetic material over each conductors.
 - .3 Overall covering: polyethylene jackets.
 - .3 Type: 600 V stranded annealed copper conductors, sizes as indicated:
 - .1 Insulation: RW90.
 - .2 Shielding: magnetic tape conductors.
 - .3 Overall covering: thermoplastic jacket.

PART 3 - EXECUTION

- 3.1 FIELD QUALITY CONTROL
- .1 Perform tests in accordance with Section 26 05 01.
 - .2 Perform tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
 - .3 Perform tests before energizing electrical system.
- 3.2 GENERAL CABLE INSTALLATION
- .1 Terminate cables in accordance with Section 26 05 20.
 - .2 Cable Colour Coding: to Section 26 05 01.
 - .3 Conductor length for parallel feeders to be identical.
 - .4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
 - .5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
 - .6 Branch circuit wiring for surge suppression receptacles and permanently wired computer and
-

- 3.2 GENERAL CABLE INSTALLATION (Cont'd) .6 (Cont'd)
electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .7 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.
- 3.3 INSTALLATION OF BUILDING WIRES .1 Install wiring as follows:
.1 In conduit systems in accordance with Section 26 05 34.
- 3.4 INSTALLATION OF TECK90 CABLE (0-1000 V) .1 Group cables wherever possible on channels.
.2 Install cable concealed, securely supported by hangers.
- 3.5 INSTALLATION OF MINERAL-INSULATED CABLES .1 Install cable concealed, securely supported by hangers.
.2 Make cable terminations by using factory-made kits.
.3 Cable terminations: use thermoplastic sleeving over bare conductors.
.4 Do not splice cables unless indicated.
- 3.6 INSTALLATION OF ARMOURED CABLES .1 Group cables wherever possible on channels.
- 3.7 INSTALLATION OF ALUMINUM SHEATHED CABLE .1 Group cables wherever possible on channels.
- 3.8 INSTALLATION OF CONTROL CABLES .1 Install control cables in conduit.
.2 Ground control cable shield.
-

PWGSC Ontario
Region Project
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WIRES AND CABLES
(0-1000V)

Section 26 05 21
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PART 1 - GENERAL

- 1.1 SECTION INCLUDES .1 Materials and installation for connectors and terminations.
- 1.2 RELATED SECTIONS .1 Section 26 05 33 - Raceway and Boxes for Electrical Systems.
- 1.3 REFERENCES .1 Canadian Standards Association
.1 CSA C22.2 No.41-07, Grounding and Bonding Equipment.
- 1.4 PRODUCT DATA .1 Submit product data in accordance with Section 01 33 00.
- 1.5 WASTE MANAGEMENT AND DISPOSAL .1 Separate and recycle waste materials in accordance with Section 01 74 20.
.2 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.

PART 2 - PRODUCTS

- 2.1 CONNECTORS AND TERMINATIONS .1 Copper compression connectors to CSA C22.2 as required sized for conductors.
.2 Junction boxes with respective pothead for conductor cables in accordance with Section 26 05 33.
-

PART 3 - EXECUTION

3.1 INSTALLATION .1 Bond and ground as required to CSA C22.2 No.41.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Section 26 05 01.
- 1.2 REFERENCES .1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)
.1 ANSI/IEEE 837, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.
- 1.3 ACTION AND INFORMATIONAL .1 Submit in accordance with Section 01 33 00.
- SUBMITTALS .2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.4 CLOSEOUT SUBMITTALS .1 Submit in accordance with Section 01 78 00.
.2 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.
- 1.5 DELIVERY, STORAGE AND HANDLING .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
.3 Storage and Handling Requirements:
.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect grounding equipment.
-

- 1.5 DELIVERY,
STORAGE AND
HANDLING
(Cont'd)
- .3 Storage and Handling Requirements:(Cont'd)
.3 Replace defective or damaged materials
with new.

PART 2 - PRODUCTS

- 2.1 EQUIPMENT
- .1 Clamps for grounding of conductor: size as
required to electrically conductive underground
water pipe.
- .2 Copper conductor: minimum 6 m long for each
concrete encased electrode, bare, stranded, soft
annealed, size as required.
- .3 Grounding conductors: bare stranded copper,
soft annealed, size as required.
- .4 Insulated grounding conductors: green, copper
conductors, size as required.
- .5 Ground bus: copper, size as required, complete
with insulated supports, fastenings, connectors.
- .6 Non-corroding accessories necessary for
grounding system, type, size, material as
indicated, including but not necessarily limited
to:
- .1 Grounding and bonding bushings.
.2 Protective type clamps.
.3 Bolted type conductor connectors.
.4 Thermit welded type conductor connectors.
.5 Bonding jumpers, straps.
.6 Pressure wire connectors.

PART 3 - EXECUTION

- 3.1 EXAMINATION
- .1 Verification of Conditions: verify that
conditions of substrate previously installed
under other Sections or Contracts are acceptable
for grounding equipment installation in
accordance with manufacturer's written
instructions.
- .1 Visually inspect substrate in presence of
Departmental Representative.
.2 Inform Departmental Representative of
unacceptable conditions immediately upon
discovery.
-

- 3.1 EXAMINATION
(Cont'd)
- .1 (Cont'd)
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
- 3.2 INSTALLATION
GENERAL
- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Install bonding wire for flexible conduit, connected at both one ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .7 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .8 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- 3.3 EQUIPMENT
GROUNDING
- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Frames of motors, starters, control panels, panels.
- 3.4 FIELD QUALITY
CONTROL
- .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 Departmental Representative and
-

- 3.4 FIELD QUALITY CONTROL (Cont'd)
- .2 (Cont'd)
local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- 3.5 CLEANING
- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
.1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

PART 1 - GENERAL

1.1 WASTE
MANAGEMENT AND
DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 20.
- .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 Departmental Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 SUPPORT
CHANNELS

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Secure equipment to masonry, tile and plaster surfaces with lead anchors.
 - .2 Secure equipment to poured concrete with expandable inserts.
 - .3 Secure equipment to hollow masonry walls 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
-

- 3.1 INSTALLATION .5 (Cont'd)
(Cont'd)
- .6 Fasten exposed conduit or cables to building construction or support system using straps.
.1 One-hole malleable iron steel straps to secure surface conduits and cables 50 mm and smaller.
.2 Two-hole steel straps for conduits and cables larger than 50 mm.
.3 Beam clamps to secure conduit to exposed steel work.
- .7 Suspended support systems.
.1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
.2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .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 Departmental Representative.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

PART 1 - GENERAL

- 1.1 REFERENCES .1 Canadian Standards Association (CSA International)
.1 CSA C22.1-09, Canadian Electrical Code, Part 1.
- 1.2 SUBMITTALS .1 Provide submittals in accordance with Section 01 11 01.
.2 Product Data:
.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.3 DELIVERY, STORAGE AND HANDLING .1 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling in accordance with Section 01 11 01 01 74 20.

PART 2 - PRODUCTS

- 2.1 JUNCTION AND PULL BOXES .1 Construction: welded steel enclosure.
.2 Covers Flush Mounted: 25 mm minimum extension all around.
.3 Covers Surface Mounted: screw-on flat edge covers.
-

PART 3 - EXECUTION

3.1 SPLITTER
INSTALLATION

- .1 Mount plumb, true and square to building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

- 3.2 JUNCTION, PULL
BOXES AND CABINETS
INSTALLATION
- .1 Install pull boxes in inconspicuous but accessible locations.
 - .2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.
 - .3 Install terminal block as indicated in Type T cabinets.
 - .4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.
- 3.3 IDENTIFICATION
- .1 Equipment Identification: to Section 26 05 00.
 - .2 Identification Labels: size 2 nameplate.

PART 1 - GENERAL

- 1.1 REFERENCES .1 Canadian Standards Association (CSA International)
.1 CSA C22.1-(09), Canadian Electrical Code, Part 1, 21st Edition.
- 1.2 SUBMITTALS .1 Provide submittals in accordance with Section 01 11 01.
.2 Submit samples for floor box in accordance with Section 01 11 01.
- 1.3 DELIVERY, STORAGE AND HANDLING .1 Deliver, store and handle materials in accordance with Section 01 11 01.
.2 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

- 2.1 OUTLET AND CONDUIT BOXES GENERAL .1 Size boxes in accordance with CSA C22.1.
.2 102 mm square or larger outlet boxes as required.
.3 Gang boxes where wiring devices are grouped.
.4 Blank cover plates for boxes without wiring devices.
.5 Combination boxes with barriers where outlets for more than one system are grouped.
- 2.2 GALVANIZED STEEL OUTLET BOXES .1 One-piece electro-galvanized construction.
.2 Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
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- 2.2 GALVANIZED STEEL OUTLET BOXES (Cont'd)
- .3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
 - .4 102 mm square or octagonal outlet boxes for lighting fixture outlets.
 - .5 Extension and plaster rings for flush mounting devices in finished walls.
- 2.3 CONDUIT BOXES
- .1 Cast FS or FD boxes with factory-threaded hubs and mounting feet for surface wiring of devices.
- 2.4 FITTINGS - GENERAL
- .1 Bushing and connectors with nylon insulated throats.
 - .2 Knock-out fillers to prevent entry of debris.
 - .3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.
 - .4 Double locknuts and insulated bushings on sheet metal boxes.
- PART 3 - EXECUTION
- 3.1 INSTALLATION
- .1 Support boxes independently of connecting conduits.
 - .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
 - .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
 - .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.
 - .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
 - .6 Identify systems for outlet boxes as required.

PART 1 - GENERAL

- 1.1 REFERENCES .1 Adhere to the latest Canadian Standards Association (CSA International)
- .1 CAN/CSA-C22.2 No. 18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CAN/CSA-C22.2 NO. 18.1, Metallic Outlet Boxes.
 - .3 CAN/CSA-C22.2 No. 18.3, Conduit, Tubing, and Cable Fittings (Tri-National standard, with ANCE NMX-J-017 and UL 514B).
 - .4 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .5 CSA C22.2 No. 83, Electrical Metallic Tubing.
- 1.2 SUBMITTALS .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
 - .1 Submit cable manufacturing data.
 - .3 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.
 - .2 Instructions: submit manufacturer's installation instructions.
- 1.3 WASTE MANAGEMENT AND DISPOSAL .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21.
- .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.
-

PART 2 - PRODUCTS

- 2.1 CONDUITS
- .1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
 - .2 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.
- 2.2 CONDUIT FASTENINGS
- .1 One hole steel straps to secure surface conduits 50 mm and smaller.
 - .1 Two hole steel straps for conduits larger than 50 mm.
 - .2 Beam clamps to secure conduits to exposed steel work.
 - .3 Channel type supports for two or more conduits at 3 m on centre.
 - .4 Threaded rods, 6 mm diameter, to support suspended channels.
- 2.3 CONDUIT FITTINGS
- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.
 - .2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.
 - .3 Watertight connectors and couplings for EMT.
 - .1 Set-screws are not acceptable.
- 2.4 EXPANSION FITTINGS FOR RIGID CONDUIT
- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 200 mm linear expansion.
 - .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.
 - .3 Weatherproof expansion fittings for linear expansion at entry to panel.
-

2.5 FISH CORD .1 Polypropylene.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.

.3 Surface mount conduits on existing concrete wall and columns.

.4 Use rigid galvanized steel threaded conduit except where specified otherwise.

.5 Use electrical metallic tubing (EMT) above 2.4 m not subject to mechanical injury.

.6 Use flexible metal conduit for connection to motors in dry areas connection to recessed fixtures without prewired outlet box connection to recessed fluorescent fixtures, work in movable metal partitions.

.7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.8 Install conduit sealing fittings in hazardous areas.
.1 Fill with compound.

.9 Minimum conduit size for lighting and power circuits: 19 mm.

.10 Bend conduit cold:
.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.11 Mechanically bend steel conduit over 19 mm diameter.

3.2 INSTALLATION
(Cont'd)

- .12 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .13 Install fish cord in empty conduits.
- .14 Run 2-25 mm spare conduits up to ceiling space and 2-25 mm spare conduits down to ceiling space from each flush panel.
 - .1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.
- .15 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .16 Dry conduits out before installing wire.

3.3 SURFACE
CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended 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.

3.4 CONCEALED
CONDUITS

- .1 Run parallel or perpendicular to building lines.
 - .2 Do not install horizontal runs in masonry walls.
 - .3 Do not install conduits in terrazzo or concrete toppings.
-

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

PART 1 - GENERAL

- 1.1 REFERENCES .1 Adhere to the latest Canadian Standards Association (CSA)
- .2 Electrical and Electronic Manufacturers' Association of Canada
- .1 EEMAC M1-6 1978.
- .2 EEMAC M1-1 rated.
- 1.2 PRODUCT DATA .1 Submit product data in accordance with Section 01 33 00.
- .2 Submit WHMIS MSDS - Material Safety Data Sheets. WHMIS acceptable to Labour Canada, and Health and Welfare Canada.
- .3 Submit product data sheets for motors. Include product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.
- 1.3 SHOP DRAWINGS .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Indicate dimensions, recommended installation procedure, wiring diagrams, sizes and location of mounting bolt holes and recommended support method.
- 1.4 CLOSEOUT SUBMITTALS .1 Provide maintenance data for fractional horsepower motors for incorporation into manual specified in Section 01 78 00.
- 1.5 WASTE MANAGEMENT AND DISPOSAL .1 Separate and recycle waste materials in accordance with Section 01 74 21.
- .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.
-

1.5 WASTE
MANAGEMENT AND
DISPOSAL
(Cont'd)

- .4 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with the Waste Management Plan.
- .5 Fold up metal banding, flatten and place in designated area for recycling.
- .6 Collect, package and store expired motors for either recycling or rebuilding and return to recycler or rebuilder.

PART 2 - PRODUCTS

2.1 FRACTIONAL
HORSEPOWER MOTOR

- .1 Non-hazardous locations: to CSA C22.2 No. 100 and EEMAC M1-6.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install wiring, flexible connections and grounding.
- .2 Check rotation before coupling to driven equipment.

PART 1 - GENERAL

- 1.1 SYSTEM DESCRIPTION .1 Low voltage control system "is existing" and **designed to provide** remote switching of lighting loads by use of:
- .1 Low voltage momentary contact switches (to match existing as required).
 - .2 Low voltage relays (to match existing as required).
 - .3 Control transformers (to match existing as required).
 - .4 Low voltage rectifiers (to match existing as required).
- .2 Low voltage lighting control system shall be part of Delta DDC control and be connected to the existing Delta DDC control system by Delta Contractor.
- 1.2 SHOP DRAWINGS .1 Submit shop drawings for new equipment/devices as required in accordance with Section 01 33 00.
- 1.3 CLOSEOUT SUBMITTALS .1 Submit maintenance data in accordance with Section 01 78 00.
- 1.4 WASTE MANAGEMENT AND DISPOSAL .1 Separate and recycle waste materials in accordance with Section 01 74 21, and with Waste Reduction Workplan.
- .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.
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PART 2 - PRODUCTS

- 2.1 MATERIALS .1 Control system: by one manufacturer and assembled from compatible components.
- 2.2 REMOTE CONTROL SWITCHES .1 Single pole, double throw, momentary contact, standard duty, rated 20A, 25V, double push-button action.
- 2.3 CONTROL TRANSFORMER .1 Low voltage power Class 2, input 120, AC, 60Hz, output 20VA at 24V.
- 2.4 MANUAL CONTROL .1 Provide remote control switches as indicated.

PART 3 - EXECUTION

- 3.1 INSTALLATION .1 Locate and install equipment in accordance with manufacturer's recommendations and as indicated.
- 3.2 TESTS .1 Perform tests in accordance with Section 26 05 01.
- .2 Actuate control units in presence of Departmental Representative to demonstrate lighting circuits are controlled as designated.

PART 1 - GENERAL

| | | |
|---|----|---|
| <u>1.1 RELATED REQUIREMENTS</u> | .1 | Section 26 05 01. |
| | .2 | Section 26 28 16.02. |
| <u>1.2 REFERENCES</u> | .1 | CSA International .1 CSA C22.2 No.29 -(11), Panelboards and Enclosed Panelboards. |
| <u>1.3 ACTION AND INFORMATIONAL</u> | .1 | Submit in accordance with Section 01 33 00. |
| <u>SUBMITTALS</u> | .2 | Product Data: .1 Submit manufacturer's instructions, printed product literature and data sheets for panelboards and include product characteristics, performance criteria, physical size, finish and limitations. |
| | .3 | Shop Drawings: .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada. .2 Include on drawings: .1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension. |
| <u>1.4 CLOSEOUT SUBMITTALS</u> | .1 | Submit in accordance with Section 01 78 00. |
| | .2 | Operation and Maintenance Data: submit operation and maintenance data for panelboards for incorporation into manual. |
| <u>1.5 DELIVERY, STORAGE AND HANDLING</u> | .1 | Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions. |
| | .2 | Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address. |

1.5 DELIVERY,
STORAGE AND
HANDLING
(Cont'd)

- .3 Storage and Handling Requirements:
- .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect panelboards from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 PANELBOARDS

- .1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
- .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 250V panelboards: bus and breakers rated for 10KA (symmetrical) interrupting capacity or as indicated.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Minimum of 2 flush locks for each panel board.
- .6 Two keys for each panelboard and key panelboards alike.
- .7 Copper bus with neutral of double ampere rating of mains.
- .8 Mains: suitable for bolt-on breakers.
- .9 Trim with concealed front bolts and hinges.
- .10 Trim and door finish: baked enamel.
-

- 2.2 BREAKERS
- .1 Breakers: to Section 26 28 16.02.
 - .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
 - .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
 - .4 Lock-on devices for exit and night light circuits.

- 2.3 EQUIPMENT IDENTIFICATION
- .1 Provide equipment identification in accordance with Section 26 05 01.
 - .2 Nameplate for each panelboard Size 4 engraved.
 - .3 Nameplate for each circuit in distribution panelboards size 2 engraved.
 - .4 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

PART 3 - EXECUTION

- 3.1 EXAMINATION
- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for panelboards installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

- 3.2 INSTALLATION
- .1 Locate recessed panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
 - .2 Mount panelboards to height specified in Section 26 05 01 or as indicated.
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- 3.2 INSTALLATION (Cont'd)
- .3 Connect loads to circuits.
 - .4 Connect neutral conductors to common neutral bus with respective neutral identified.
- 3.3 CLEANING
- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
 - .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- 3.4 PROTECTION
- .1 Protect installed products and components from damage during construction.
 - .2 Repair damage to adjacent materials caused by panelboards installation.

PART 1 - GENERAL

- 1.1 REFERENCES .1 CSA International
- .1 CSA C22.2 No.42 - (10), General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CAN/CSA-C22.2 No.42.1 - 00 (R2009), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA C22.2 No.55 - M1986 (2008), Special Use Switches.
 - .4 CSA C22.2 No.111 - (10), General-Use Snap Switches (Bi-national standard, with UL 20).
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.3 CLOSEOUT SUBMITTALS .1 Submit in accordance with Section 01 78 00.
- .2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.
- 1.4 DELIVERY, STORAGE AND HANDLING .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
- .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wiring devices from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
-

PART 2 - PRODUCTS

- 2.1 SWITCHES
- .1 15A, 120V, single pole, double pole, three-way, switches to: CSA C22.2 No.55 and CSA C22.2 No.111.
 - .2 Manually-operated general purpose AC switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine moulding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 Ivory on drywall and Brown on existing concrete walls toggle.
 - .3 Toggle operated fully rated for tungsten filament, LED, and fluorescent lamps, and up to 80% of rated capacity of motor loads.
 - .4 Switches of one manufacturer throughout project.
- 2.2 RECEPTACLES
- .1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.42 with following features:
 - .1 Ivory Brown urea moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight back wired entrances, four side wiring screws.
 - .5 Triple wipe contacts and rivetted grounding contacts.
 - .2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:
 - .1 Ivory in drywalls and Brown in concrete walls urea moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Four back wired entrances, 2 side wiring screws.
 - .3 Other receptacles with ampacity and voltage as indicated.
-

- 2.2 RECEPTACLES .4 Receptacles of one manufacturer throughout
(Cont'd)
- 2.3 COVER PLATES .1 Cover plates for wiring devices to: CSA C22.2
No.42.1.
- .2 Sheet steel utility box cover for wiring
devices installed in surface-mounted utility
boxes.
- .3 Stainless steel, vertically brushed, 1 mm thick
cover plates for wiring devices mounted in
flush-mounted outlet box.
- .4 Sheet metal cover plates for wiring devices
mounted in surface-mounted FS or FD type conduit
boxes.
- 2.4 SOURCE QUALITY .1 Cover plates from one manufacturer throughout
CONTROL

PART 3 - EXECUTION

- 3.1 EXAMINATION .1 Verification of Conditions: verify that
conditions of substrate previously installed
under other Sections or Contracts are acceptable
for wiring devices installation in accordance
with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of
Departmental Representative.
- .2 Inform Departmental Representative of
unacceptable conditions immediately upon
discovery.
- .3 Proceed with installation only after
unacceptable conditions have been remedied and
after receipt of written approval to proceed
from Departmental Representative.
- 3.2 INSTALLATION .1 Switches:
- .1 Install single throw switches with handle
in "UP" position when switch closed.
- .2 Install switches in gang type outlet box
when more than one switch is required in one
location.
-

-
- 3.2 INSTALLATION (Cont'd)
- .1 Switches:(Cont'd)
 - .3 Mount toggle switches at height in accordance with Section 26 05 01.
 - .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Mount receptacles at height in accordance with Section 26 05 01.
 - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
 - .4 Install GFI type receptacles as indicated.
 - .3 Cover plates:
 - .1 Install suitable common cover plates where wiring devices are grouped.
 - .2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
- 3.3 CLEANING
- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
 - .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- 3.4 PROTECTION
- .1 Protect installed products and components from damage during construction.
 - .2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
 - .3 Repair damage to adjacent materials caused by wiring device installation.

PART 1 - GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 11 00 and 01 33 00.
- .2 Product Data:
 - .1 Provide fuse performance data characteristics for each fuse type and size. Performance data to include: average melting time-current characteristics.
- .3 Shop Drawings:
 - .1 Provide shop drawings in accordance with Section 01 11 00 and 01 33 00.
 - .2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

1.3 DELIVERY,
STORAGE AND
HANDLING

- .1 Ship fuses in original containers.
- .2 Do not ship fuses installed in switchboard.
- .3 Store fuses in original containers in storage cabinet moisture free location.
- .4 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 11 00 and 01 74 21.

1.4 MAINTENANCE
MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 11 00 and 01 78 00.
 - .2 Three spare fuses of each type and size installed.
-

PART 2 - PRODUCTS

- 2.1 FUSE TYPES
- .1 Class L fuses.
 - .1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .2 Type L2, fast acting.
 - .2 Class J fuses.
 - .1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .2 Type J2, fast acting.
 - .3 Class R -R fuses.
 - .1 Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for 10 s minimum, to meet UL Class RK1 maximum let-through limits.
 - .2 Type R2, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Install fuses in mounting devices immediately before energizing circuit.
 - .2 Ensure correct fuses fitted to physically matched mounting devices.
 - .1 Install rejection clips for Class R fuses.
 - .3 Ensure correct fuses fitted to assigned electrical circuit.
 - .4 Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.
 - .5 Install spare fuses in fuse storage cabinet.

PART 1 - GENERAL

- 1.1 REFERENCES .1 CSA International (CSA)
.1 CSA C22.2 No. 5-(09), Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS .1 Submit in accordance with Section 01 33 00.
.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.3 DELIVERY, STORAGE AND HANDLING .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
.3 Storage and Handling Requirements:
.1 Store circuit breakers in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect circuit breakers.
.3 Replace defective or damaged materials with new.
-

PART 2 - PRODUCTS

- 2.1 BREAKERS
GENERAL .1 Moulded-case circuit breakers, and ground-fault
circuit-interrupters: to CSA C22.2 No. 5.
- .2 Bolt-on moulded case circuit breaker: quick-
make, quick-break type, for manual and automatic
operation with temperature compensation for 40
degrees C ambient.
- 2.2 THERMAL
MAGNETIC BREAKERS
DESIGN A .1 Moulded case circuit breaker to operate
automatically by means of thermal and magnetic
tripping devices to provide inverse time current
tripping and instantaneous tripping for short
circuit protection.
- 2.3 ENCLOSURE .1 Sprinkler-proof: NEMA 1R.

PART 3 - EXECUTION

- 3.1 EXAMINATION .1 Verification of Conditions: verify that
conditions of substrate previously installed
under other Sections or Contracts are acceptable
for installation in accordance with
manufacturer's written instructions.
.1 Visually inspect substrate in presence of
Departmental Representative.
.2 Inform Departmental Representative of
unacceptable conditions immediately upon
discovery.
.3 Proceed with installation only after
unacceptable conditions have been remedied and
after receipt of written approval to proceed
from Departmental Representative.
- 3.2 INSTALLATION .1 Install circuit breakers as required.
- 3.3 CLEANING .1 Progress Cleaning: clean in accordance with
Section 01 74 11.
.1 Leave Work area clean at end of each day.
-

3.3 CLEANING
(Cont'd)

- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

PART 1 - GENERAL

- 1.1 PAYMENT .1 Payment for field testing of ground fault equipment performed by equipment manufacturer in accordance with Section 01 29 83.
- 1.2 REFERENCES .1 Canada Green Building Council (CaGBC)
.1 LEED Canada For New Construction and Major Renovations.
.2 LEED Canada, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For Design and Construction.
.3 LEED Canada-CI Version 1.0, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
.4 LEED Canada-EBOM, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Existing Buildings: Operations and Maintenance.
- .2 CSA International
.1 CAN/CSA-C22.2 No.144, Ground Fault Circuit Interrupters.
- .3 National Electrical Manufacturers Association (NEMA)
.1 NEMA PG 2.2, Application Guide for Ground Fault Protection Devices for Equipment.
- 1.3 ACTION AND INFORMATIONAL .1 Submit in accordance with Section 01 33 00.
- SUBMITTALS .2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for ground fault circuit interrupters and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
-

SUBMITTALS (Cont'd) .4 Test and Evaluation Reports: submit test report for field testing of ground fault equipment to Departmental Representative and certificate that system as installed meets criteria specified.

1.4 CLOSEOUT SUBMITTALS .1 Submit in accordance with Section 01 78 00.
.2 Operation and Maintenance Data: submit operation and maintenance data for ground fault circuit interrupters for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
.3 Storage and Handling Requirements:
.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect ground fault circuit interrupters.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS .1 Equipment and components for ground fault circuit interrupters (GFCI): to CAN/CSA-C22.2 No.144.
.2 Components comprising ground fault protective system to be of same manufacturer.

2.2 BREAKER TYPE GROUND FAULT INTERRUPTER .1 Single or Two pole ground fault circuit interrupter for 15 or 20A, 120V, 1 phase circuit c/w test and reset facilities.

PART 3 - EXECUTION

- 3.1 EXAMINATION .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for ground fault circuit interrupters installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
- 3.2 FIELD QUALITY CONTROL .1 Perform tests in accordance with Section 26 05 00 and co-ordinate with Section 01 45 00 if required.
- .2 Arrange for field testing of ground fault equipment by ground fault equipment manufacturer before commissioning service.
 - .3 Demonstrate simulated ground fault tests.
- 3.3 CLEANING .1 Progress Cleaning: clean in accordance with Section 01 74 11.
- .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
 - .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

PART 1 - GENERAL

1.1 PRODUCT DATA .1 Submit product data in accordance with Section 01 33 00.

1.2 WASTE MANAGEMENT AND DISPOSAL .1 Separate and recycle waste materials in accordance with Section 01 74 21.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES .1 Non-fusible, disconnect switch in CSA Enclosure 1R, size as indicated.
.2 Provision for padlocking in off switch position by locks.
.3 Mechanically interlocked door to prevent opening when handle in ON position.
.4 Fuses: size as indicated, to Section 26 28 14.
.5 Fuseholders: relocatable and suitable without adaptors, for type and size of fuse indicated, if applicable.
.6 Quick-make, quick-break action.
.7 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION .1 Provide equipment identification in accordance with Section 26 05 01.
.2 Indicate name of load controlled on Size 4 nameplate.

PART 3 - EXECUTION

3.1 INSTALLATION .1 Install disconnect switches complete with fuses
if applicable.

PART 1 - GENERAL

- 1.1 REFERENCES .1 CSA International
.1 CSA C22.2 No.14-(10), Industrial Control Equipment.
- .2 National Electrical Manufacturers Association (NEMA)
.1 NEMA ICS 2-2000 (R2005), Controllers, Contactors and Overload Relays Rated 600 V.
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for contactors and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.3 CLOSEOUT SUBMITTALS .1 Submit in accordance with Section 01 78 00.
- .2 Operation and Maintenance Data: submit operation and maintenance data for contactors for incorporation into manual.
- .3 Include operating information required for start-up, synchronizing and shut-down of generating units.
- 1.4 DELIVERY, STORAGE AND HANDLING .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect contactors from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.
-

PART 2 - PRODUCTS

- 2.1 CONTACTORS
- .1 Contactors: to CSA C22.2 No.14.
 - .2 Electrically held controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.
 - .3 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.
 - .4 Mount in NEMA Enclosure 1R unless otherwise indicated.
 - .5 Include following options in cover:
 - .1 Red and Green indicating lamp.
 - .2 Stop-Start pushbutton.
 - .3 Hand-Off-Auto selector switch.
 - .4 On-Off selector switch.
 - .6 Control transformer: in accordance with Section 26 29 03, factory wired and installed in contactor enclosure.
- 2.2 EQUIPMENT IDENTIFICATION
- .1 Identify equipment in accordance with Section 26 05 00.
 - .2 Size 4 nameplate indicating name of load controlled.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Install contactors and connect power wires and auxiliary control devices.
 - .2 Identify contactors with nameplates or labels indicating panel and circuit number.
 - .3 Test contactors in accordance with 26 05 00.
- 3.2 CLEANING
- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.
-

- 3.2 CLEANING
(Cont'd)
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
 - .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- 3.3 PROTECTION
- .1 Protect installed products and components from damage during construction.
 - .2 Repair damage to adjacent materials caused by contactor installation.

PART 1 - GENERAL

- 1.1 REFERENCES .1 International Electrotechnical Commission (IEC)
.1 IEC 60947-4-1, Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters.
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS .1 Provide submittals in accordance with Section 01 33 00.
.2 Product Data:
.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
.3 Shop Drawings:
.1 Provide shop drawings: in accordance with Section 01 33 00.
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.2 Provide shop drawings for each type of starter to indicate:
.1 Mounting method and dimensions.
.2 Starter size and type.
.3 Layout and components.
.4 Enclosure types.
.5 Wiring diagram.
.6 Interconnection diagrams.
- 1.3 CLOSEOUT SUBMITTALS .1 Provide maintenance materials in accordance with Section 01 78 00.
.2 Submit operation and maintenance data for each type and style of motorstarter for incorporation into maintenance manual.
.3 Extra Materials:
.1 Provide listed spare parts for each different size and type of starter.
.1 3 contacts, stationary.
.2 3 contacts, movable.
.3 1 contacts, auxiliary.
.4 1 control transformers.
.5 1 operating coil.
.6 2 fuses.
-

1.3 CLOSEOUT .3 Extra Materials:(Cont'd)
SUBMITTALS .1 (Cont'd)
(Cont'd) .7 10 % indicating lamp bulbs used.

1.4 DELIVERY, .1 Deliver, store and handle in accordance with
STORAGE AND Section 01 61 00.
HANDLING .2 Deliver materials to site in original factory
packaging, labelled with manufacturer's name,
address.
.3 Packaging Waste Management: remove for reuse
and return by manufacturer of pallets crates
padding and packaging materials in accordance
with Section 01 74 21.

PART 2 - PRODUCTS

2.1 MATERIALS .1 Starters: to IEC 60947-4-1 with AC4 utilization
category.

2.2 FULL VOLTAGE .1 Magnetic and combination magnetic starters of
MAGNETIC STARTERS size, type, rating and enclosure type as
indicated with components as follows:
.1 Contactor solenoid operated, rapid action
type.
.2 Motor overload protective device in each
phase, manually reset from outside enclosure.
.3 Wiring and schematic diagram inside
starter enclosure in visible location.
.4 Identify each wire and terminal for
external connections, within starter, with
permanent number marking identical to diagram.
.2 Combination type starters to include fused
disconnect switch motor circuit interrupter
circuit breaker with operating lever on outside
of enclosure to control disconnect motor circuit
interrupter circuit breaker, and provision for:
.1 Locking in "OFF" position with up to 3
padlocks.
.2 Independent locking of enclosure door.
.3 Provision for preventing switching to "ON"
position while enclosure door open.

- 2.2 FULL VOLTAGE
MAGNETIC STARTERS
(Cont'd) .3 Accessories:
- .1 Pushbuttons Selector switches: standard heavy duty oil tight labelled as indicated.
 - .2 Indicating lights: standard heavy duty oil tight type and color as indicated.
 - .3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.
- 2.3 CONTROL
TRANSFORMER .1 Single phase, dry type, control transformer with primary voltage as indicated and 120V secondary, complete with secondary fuse, installed in with starter as indicated.
- .2 Size control transformer for control circuit load plus 20% spare capacity.
- 2.4 ACCESSORIES .1 Pushbutton: heavy duty, oil tight as required.
- .2 Selector switches: heavy duty, oil tight as required.
 - .3 Indicating lights: heavy duty, oil tight, type and colour as indicated.
- 2.5 FINISHES .1 Apply finishes to enclosure in accordance with Section 26 05 00.
- 2.6 EQUIPMENT
IDENTIFICATION .1 Provide equipment identification in accordance with Section 26 05 00.
- .2 Magnetic starter designation label, white plate, black letters, size as required engraved as indicated.
-

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Install starters and control devices in accordance with manufacturer's instructions.
 - .2 Install and wire starters and controls as indicated.
 - .3 Ensure correct fuses installed.
 - .4 Confirm motor nameplate and adjust overload device to suit.
- 3.2 FIELD QUALITY CONTROL
- .1 Perform tests in accordance with Section 26 05 00 and manufacturer's instructions.
 - .2 Operate switches and contactors to verify correct functioning.
 - .3 Perform starting and stopping sequences of contactors and relays.
 - .4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.
- 3.3 CLEANING
- .1 Clean in accordance with Section 01 74 11.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
 - .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21.

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 American National Standards Institute (ANSI)
 - .1 ANSI C82.1, American National Standard for Lamp Ballasts - Line Frequency Fluorescent Lamp Ballasts.
 - .2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE C62.41-(1991), Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
 - .3 ASTM International Inc.
 - .1 ASTM F1137-00 (2006), Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
 - .4 Canadian Standards Association (CSA International)
 - .5 ICES-005-(07), Radio Frequency Lighting Devices.
 - .6 Underwriters' Laboratories of Canada (ULC)
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Provide submittals in accordance with Section 01 33 00.
 - .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Departmental Representative.
 - .3 Photometric data to include: VCP Table where applicable.
 - .3 Samples:
 - .1 Provide samples as indicated. Install sample fixtures in mock-up ceiling. Include cost of mock-up in project price.
-

1.2 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)

.4 Quality assurance submittals: provide following in accordance with Section 01 45 00.
.1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.3 QUALITY ASSURANCE

.1 Provide mock-ups in accordance with Section 01 45 00 where required.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse and return of pallets and packaging materials in accordance with Section 01 74 20.

.4 Divert unused metal materials from landfill to metal recycling facility.

.5 Disposal and recycling of fluorescent lamps as per local regulations.

.6 Disposal of old PCB filled ballasts.

PART 2 - PRODUCTS

2.1 LAMPS

.1 Incandescent lamps to be - clear, A19, 100W with 1000 hour lamp life, rough-service rated; or as indicated.

.2 Tungsten halogen lamps to be - clear, T-3, 300 Watt, RSC base, 2000 hour lamp life, 5000 lumens; or as indicated.

.3 Fluorescent lamps to be - T8, 32 Watt, medium bi-pin, rapid-start, 4100K, 30,000 hour lamp life, 2950 initial lumens, CRI 85; or as indicated.

.4 Metal halide lamps to be - clear, BT37, 400 Watt, mogul base, horizontal burn, 4100 K, 15,000 hour lamp life, 36,000 initial lumens,

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- 2.1 LAMPS (Cont'd) .4 (Cont'd)
CRI 85, open or enclosed type to suit the luminaire; or as indicated.
- .5 Compact fluorescent lamps to be - 18 Watt, G24q-2 base, 12,000 hour lamp life, 12,000 initial lumens, 4100K, CRI 85 or as indicated.
- 2.2 BALLASTS .1 Fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic; IC electronic dimmable.
- .1 Rating: voltage as indicated, for use with 2-32W, rapid start lamps or as indicated.
- .2 Totally encased and designed for 40 degrees Celsius ambient temperature.
- .3 Power factor: minimum 95% with 95% of rated lamp lumens.
- .4 Current crest factor: 1.7 maximum.
- .5 Harmonics: 10% maximum THD.
- .6 Operating frequency of electronic ballast: 20kHz minimum.
- .7 Total circuit power: 62 Watts.
- .8 Ballast factor: greater than 0.90.
- .9 Sound rated: Class A.
- .10 Mounting: integral with luminaire.
- .2 Metal halide ballast:
- .1 Rating: voltage as indicated, for use with 1-400V metal halide lamp. Provide circuitry for quartz re-strike standby light where indicated.
- .2 Totally encased and designed for 40 degrees Celsius ambient temperature.
- .3 Power factor: minimum 95% with 95% of rated lamp lumens.
- .4 Type: constant wattage autotransformer.
- .5 Input voltage range: plus or minus 10% of nominal.
- .6 Minimum starting temperature: minus 30 degrees Celsius at 90% line voltage.
- .7 Mounting: integral with luminaire.
- .8 Current crest factor: 1.7 maximum current.
- 2.3 FINISHES .1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.
-

2.4 OPTICAL CONTROL DEVICES .1 As indicated in luminaire schedule.

2.5 LUMINAIRES .1 As indicated in luminaire schedule.

PART 3 - EXECUTION

3.1 INSTALLATION .1 Locate and install luminaires as indicated.
.2 Provide adequate support to suit ceiling system.

3.2 WIRING .1 Connect luminaires to lighting circuits:
.1 Install flexible or rigid conduit for luminaires as indicated.

3.3 LUMINAIRE SUPPORTS .1 For suspended ceiling installations support luminaires independently of ceiling.

3.4 LUMINAIRE ALIGNMENT .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 CLEANING .1 Clean in accordance with Section 01 74 11.
.1 Remove surplus materials, excess materials, rubbish, tools and equipment.
.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21.

PART 1 - GENERAL

- 1.1 REFERENCES .1 CSA International
.1 CSA C22.2 No.141-10, Emergency Lighting Equipment.
- 1.2 ACTION AND INFORMATIONAL .1 Submit in accordance with Section 01 33 00.
- SUBMITTALS .2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for emergency lighting and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.3 CLOSEOUT SUBMITTALS .1 Submit in accordance with Section 01 78 00.
.2 Operation and Maintenance Data: submit operation and maintenance data for emergency lighting for incorporation into manual.
- 1.4 DELIVERY, STORAGE AND HANDLING .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
.3 Storage and Handling Requirements:
.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect emergency lighting from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.
.4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 35 21.
-

1.4 DELIVERY, STORAGE AND HANDLING (Cont'd)

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 and Section 01 35 21.

1.5 WARRANTY

.1 For batteries in this Section 26 52 00 - Emergency Lighting, 12 months warranty period is extended to 120 months.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: 120 V, AC.

.3 Output voltage: 6 12 24 V DC. (to match existing).

.4 Operating time: 30 60 120 minutes.

.5 Battery: sealed, maintenance free.

.6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.

.7 Solid state transfer circuit.

.8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.9 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.

.10 Lamp heads: integral on unit remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: quartz halogen LED, 12 W, minimum 200 lumen minimum output.

.11 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

-
- 2.1 EQUIPMENT
(Cont'd)
- .12 Finish: to match existing.
 - .13 Auxiliary equipment:
 - .1 Ammeter.
 - .2 Voltmeter.
 - .3 Test switch.
 - .4 Time delay relay.
 - .5 Battery disconnect device.
 - .6 AC input and DC output terminal blocks inside cabinet.
 - .7 Shelf Bracket.
 - .8 Cord and single twist-lock plug connection for AC.
 - .9 RFI suppressors.
-
- 2.2 WIRING OF REMOTE HEADS
- .1 Conduit: type EMT, in accordance with Section 26 05 34.
 - .2 Conductors: RW90 type in accordance with Section 26 05 21, sized as indicated in accordance with manufacturer's recommendations.
-
- PART 3 - EXECUTION
-
- 3.1 EXAMINATION
- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for emergency lighting installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
-
- 3.2 INSTALLATION
- .1 Install unit equipment and remote mounted fixtures.
 - .2 Direct heads.
 - .3 Connect exit lights to unit equipment.
-

-
- 3.3 CLEANING
- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
 - .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 and 01 35 21.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- 3.4 PROTECTION
- .1 Protect installed products and components from damage during construction.
 - .2 Repair damage to adjacent materials caused by emergency lighting installation.

PART 1 - GENERAL

1.1 REFERENCES

- .1 Adhere to the latest Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.141, Unit Equipment for Emergency Lighting.
 - .2 CAN/CSA-C860, Performance of Internally Lighted Exit Signs.
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 101, Life Safety Code.
- .3 Underwriters Laboratories of Canada (ULC)
 - .1 ULC/ORD-924, Standard for Emergency Lighting and Power Equipment.
 - .2 CAN/ULC-S572, First Edition Standard for Photoluminescent and Self-Luminous Exit Signs and Path Marking Systems.

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
 - .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .3 Submit WHMIS MSDS - Material Safety Data Sheets.
 - .4 Quality Assurance Submittals: submit following in accordance with Section 01 45 00.
 - .1 Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.
 - .5 Submit manufacturer's written material warranty for lumination of photo-luminescent exit signs. For the Work of this Section 26 53 00 - Exit Lights, the 12 months warranty period prescribed in subsection GC 3.13 of General Conditions is extended to 25 years.
-

- 1.3 WASTE MANAGEMENT AND DISPOSAL .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21.

PART 2 - PRODUCTS

- 2.1 STANDARD UNITS .1 Exit lights: to CSA C22.2 No.141 and CSA C860.
.2 Housing: Die-cast aluminum semi-recessed back box for mounting on ceiling and/or wall.
.3 Face and back plates: Clear acrylic panel with pictogram legend.
.4 Lamps: one strip LED-2.5W module 120V, 50,000 hours.
.5 Operation: designed for 50,000 hours of continuous operation without relamping.
.6 Downlight: translucent acrylic in bottom of unit.
.7 Face plate to remain captive for relamping.
- 2.2 DESIGN X1 .1 Ceiling recessed mounting.
.2 Double face with edge-lit face plate to remain captive for relamping.
.3 Arrow: See drawing for detail.

PART 3 - EXECUTION

- 3.1 MANUFACTURER'S INSTRUCTIONS .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.
- 3.2 INSTALLATION .1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.
.2 Connect fixtures to exit light circuits.
-

- 3.2 INSTALLATION .3 Ensure that exit light circuit breaker is
(Cont'd)
- 3.3 CLEANING .1 Proceed in accordance with Section 01 74 11.
- .2 Clean photoluminescent sign face with a
 non-abrasive cloth dampened with water. Do not
 use any chemical solvents.
- .3 On completion and verification of performance
 of installation, remove surplus materials,
 excess materials, rubbish, tools and equipment.

PART 1 - GENERAL

| | | |
|---|----|---|
| <u>1.1 RELATED REQUIREMENTS</u> | .1 | Section 26 05 01. |
| | .2 | Section 26 05 34. |
| <u>1.2 REFERENCES</u> | .1 | Latest CSA Standard Electro Metallic Tubing (EMT) shall conform to CSA C22.2 No. 83. |
| <u>1.3 ACTION AND INFORMATIONAL</u> | .1 | Submit in accordance with Section 01 33 00. |
| <u>SUBMITTALS</u> | .2 | Product Data: .1 Submit manufacturer's instructions, printed product literature and data sheets for communication raceway systems and include product characteristics, performance criteria, physical size, finish and limitations. |
| <u>1.4 DELIVERY, STORAGE AND HANDLING</u> | .1 | Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions. |
| | .2 | Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address. |
| | .3 | Storage and Handling Requirements: .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area. .2 Store and protect communication raceway systems. .3 Replace defective or damaged materials with new. |

PART 2 - PRODUCTS

- 2.1 SYSTEM DESCRIPTION
- .1 Empty telecommunications raceways system consists of outlet boxes, cover plates, cabinets, conduits, cable trays, pull boxes, sleeves and caps, fish wires, service poles, service fittings, concrete encased ducts.
 - .2 Overhead distribution system.
- 2.2 MATERIAL
- .1 Conduits: in accordance with Section 26 05 34.
 - .2 Junction boxes, cabinets type E and T: in accordance with Section 26 05 31.
 - .3 Outlet boxes, conduit boxes, and fittings: in accordance with Section 26 05 31.
 - .4 Indoor service poles: in accordance with Section 26 27 23.
 - .5 Fish wire: polypropylene type.

PART 3 - EXECUTION

- 3.1 EXAMINATION
- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for communication raceway systems installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.
- 3.2 INSTALLATION
- .1 Install empty raceway system, including underfloor overhead distribution system, fish wire, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cable tray, service poles,
-

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for "**existing**" **fire alarm** systems as required.
 - .2 Description of existing control panel and any required modifications to facilitate the renovation to carry out fire alarm and protection functions including receiving alarm signals, initiating general two-stage alarm, supervising system continuously, actuating zone annunciators, and initiating trouble signals.
 - .3 Update existing FACP, annunciator(s) and active graphic on fire alarm PC to reflect all the changes under this renovation.
 - .1 Trouble signal devices
 - .2 Power supply facilities.
 - .3 Manual alarm stations.
 - .4 Automatic alarm initiating devices.
 - .5 Audible signal devices.
 - .6 End-of-line devices.
 - .7 Annunciators.
 - .8 Visual alarm signal devices.
 - .9 Ancillary devices.
- .2 Related Sections:
 - .1 Section 26 05 01.

1.2 REFERENCES

- .1 Government of Canada
 - .1 TB OSH Chapter 3-03, (1997-01-28), Treasury Board of Canada, Occupational Safety and Health, Chapter 3-03, Standard for Fire protection Electronic Data Processing Equipment.
 - .2 TB OSH Chapter 3-04, (1994-12-22), Treasury Board of Canada, Occupational Safety and Health, Chapter 3-04, Standard for Fire Alarm Systems.
 - .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
 - .3 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S524-(06), Standard for the Installation of Fire Alarm Systems.
 - .2 CAN/ULC-S525-(07), Audible Signal Device for Fire Alarm Systems.
 - .3 CAN/ULC-S526-07, Visual Signal Devices for Fire Alarm Systems.
-

1.2 REFERENCES
(Cont'd)

- .3 (Cont'd)
 - .4 CAN/ULC-S528-05, Manual Pull Stations for Fire Alarm Systems.
 - .5 CAN/ULC-S529-09, Smoke Detectors for Fire Alarm Systems.
 - .6 CAN/ULC-S530-(M91), Heat Actuated Fire Detectors for Fire Alarm Systems.
 - .7 CAN/ULC-S1001-11, Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems.
- .4 National Fire Protection Agency
 - .1 NFPA 72 - 2007, National Fire Alarm Code.
 - .2 NFPA 90A-2012, Installation of Air Conditioning and Ventilating Systems.

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00.
 - .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00.
 - .1 Shop drawings: stamped and signed by professional engineer registered or licensed in Province s of Ontario, Canada.
 - .2 Include:
 - .1 Layout of equipment.
 - .2 Zoning.
 - .3 Complete wiring diagram, including schematics of modules.
 - .3 Quality assurance submittals: submit following in accordance with Section 01 33 00.
 - .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 Manufacturer's Field Reports: manufacturer's field reports specified.
 - .4 Closeout Submittals:
 - .1 Submit maintenance and engineering data for incorporation into manual specified in
-

1.3 SUBMITTALS
(Cont'd)

.4 Closeout Submittals:(Cont'd)

.1 (Cont'd)

Section 01 78 00 in accordance with ANSI/NFP A 20.

.2 Authority of Jurisdiction will delegate authority for review and approval of submittals required by this Section.

.3 Submit to Authority of Jurisdiction 2 sets of approved submittals and drawings immediately after approval but no later than 15 working days to prior to final inspection.

.4 Submit following:

.1 Manufacturer's Data for:

.1 Manual pull stations.

.2 Heat detectors.

.3 Open-area smoke detectors.

.4 Alarm bells with recessed box and grille to match existing.

.5 Visible appliances.

.6 Mark data which describe more than one type of item to indicate which type will be provided.

.7 Submit 1 original for each item and clear, legible, first-generation photocopies for remainder of specified copies.

.2 System wiring diagrams:

.1 Submit complete wiring diagrams of system showing points of connection and terminals used for electrical connections in the system.

.3 Design data: Power Calculations:

.1 Submit design calculations for new work specified to substantiate that battery capacity exceeds supervisory and alarm power requirements.

.4 Schedules:

.1 Conductor wire marker schedule.

.5 Test Reports:

.1 Open-area 2-wire smoke detectors.

.2 Preliminary testing:

.1 Final acceptance testing.

.2 Submit for inspections and tests specified under Field Quality Control.

1.4 QUALITY
ASSURANCE

- .1 Qualifications:
 - .1 Installer: company or person specializing in fire alarm system installations with 5-years documented experience approved by manufacturer.
 - .2 Provide services of representative or technician from manufacturer of system, experienced in installation and operation of type of system being provided, to supervise installation, adjustment, preliminary testing, and final testing of system and to provide instruction to project personnel.
 - .3 System:
 - .1 To TB OSH Chapter 3-04.
 - .2 Subject to Fire Commissioner of Canada (FC) approval.
 - .3 Subject to FC inspection for final acceptance.
 - .4 To Canadian Forces Fire Marshal approval.
 - .4 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00.
 - .5 Maintenance Service:
 - .1 Provide one year's free maintenance with two inspections by manufacturer during warranty period. Inspection tests to conform to CAN/ULC-S536. Submit inspection report to Departmental Representative.

1.5 DELIVERY,
STORAGE, AND
HANDLING

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

PART 2 - PRODUCTS

- 2.1 SUSTAINABLE REQUIREMENTS .1 Materials and products in accordance with Section 01 47 15.
- 2.2 MATERIALS .1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.
- .2 Audible signal devices: to CAN/ULC-S525.
- .3 Visual signal devices: to CAN/ULC-S526.
- .4 Thermal detectors: to CAN/ULC-S530.
- .5 Smoke detectors: to CAN/ULC-S529.
- 2.3 "EXISTING" SYSTEM OPERATION .1 Two stage operation: operation to actuation following:
- .1 Manual station.
- .2 Heat detector.
- .3 Smoke detector.
- .2 Actuation of two stage operation device to initiate following:
- .1 Audible signal devices throughout building to sound at 20 strokes per minute.
- .2 Audible signal devices in zone of alarm and adjacent zones on same floor level zones on floor level immediately above and floor level immediately below to sound continuously while other audible signal devices throughout building sound at 20 strokes per minute.
- .3 Zone of alarm to be indicated on control panel and remote annunciator.
- .4 Transmit signal to fire department via fire alarm transmitter monitoring station.
- .5 Air conditioning and ventilating fans to shut down or to function so as to provide required control of smoke movement.
- .6 Fire doors and smoke control doors if normally held open, to close automatically.
- .7 Electro-magnetic door holders to de-energize.
- .8 Operations to remain in alarm mode (except alarm notification appliances if manually silenced) until system is manually restored to normal.
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- 2.3 **"EXISTING"**
SYSTEM OPERATION
(Cont'd)
- .3 Operation of alarm initiating device on second stage to:
- .1 Cause audible signal devices throughout building to sound continuously.
 - .4 Capability to program smoke detector status change confirmation on any or zones in accordance with CAN/ULC-S527, Appendix C.
- 2.4 CONTROL PANEL
- .1 Existing control panel to remain. Modify as required to suit the renovation.
 - .2 Two stage operation.
 - .3 Zoned Non-zoned.
- 2.5 AUTOMATIC ALARM
INITIATING DEVICES
- .1 Heat detectors: provide heat detectors as indicated designed for detection of fire by combination fixed temperature rate-of-rise rate compensating line-type fixed temperature principle.
 - .2 Open-Area Smoke Detectors: provide detectors designed for detection of abnormal smoke densities by photoelectric principle.
 - .1 Detectors: 4-wire type.
 - .2 Provide necessary control and power modules required for operation integral with control panel.
 - .3 Detectors and associated modules: compatible with control panel and suitable for use in supervised circuit.
 - .4 Malfunction of electrical circuits to detector or its control or power units to result in operation of system trouble signals.
 - .5 Equip each detector with visible indicator lamp that will flash when detector is in normal standby mode and glow continuously when detector is activated.
 - .6 Provide remote indicator lamps for each detector that is located above suspended ceilings, beneath raised floors, concealed from view.
 - .7 Each detector: plug-in type with tab-lock or twist-lock, quick disconnect head and separate base in which detector base contains screw terminals for making wiring connections.
 - .8 Detector head: removable from its base without disconnecting wires. Removal of detector
-

2.5 AUTOMATIC ALARM .2
INITIATING DEVICES
(Cont'd)

- Open-Area Smoke Detectors:(Cont'd)
- .8 Detector head:(Cont'd)
head from its base to cause activation of system trouble signals.
- .9 Screen each detector to prevent entrance of insects into detection chamber(s).
- .3 Photoelectric Detectors: operate on light scattering principle using LED light source.
.1 Detector: respond to both flaming and smoldering fires.
- .4 Locate detectors in accordance with their listing by ULC and the requirements of NFPA 72, except provide at least 2 detectors in rooms of 54 square meters or larger in area.
- .5 Mount detectors at underside of ceiling or deck above unless otherwise indicated.
.1 For mounting heights greater than 3 m above floor level, reduce actual detector linear spacing from listed spacing as required by NFPA 72.
.2 For heights greater than 9 m space detectors no farther apart than 34 % of their listed spacing.
- .6 Temperature rating of detectors: in accordance with NFPA 72.
- .7 Locate detectors minimum 300 mm to lighting fixtures and not closer than 600 mm to air supply or return diffuser.
- .8 Ensure detectors, located in areas subject to moisture or exterior atmospheric conditions or hazardous locations as defined by NFPA 70, are approved for such locations.
- .9 Provide detectors with terminal screw type connections.
- .10 Removal of detector head from its base to cause activation of system trouble signals if detectors are provided with separable heads and bases.
-

2.6 ALARM
INITIATING DEVICE
SPACING AND
LOCATION

- .1 Detector spacing and location: in accordance with manufacturer's recommendations and requirements of NFPA 72.
- .2 Provide at least 2 detectors in rooms of 54 square meters or larger.
- .3 Spacing: not to exceed 9 m by 9 m per detector, and 9 linear m per detector along corridors.
- .4 Locate detectors minimum 0.9 from air discharge or return grille, and not closer than 300 mm to lighting fixtures.
- .5 In areas without finished ceilings, mount detectors at underside of deck above unless otherwise indicated.

2.7 NEW AUDIBLE
SIGNAL DEVICES TO
MATCH EXISTING

- .1 Audible device(s):
 - .1 Bells: recessed mounted, single stroke, polarized, 24 V dc, 150 mm, 95db.
- .2 Do not exceed 80 percent of listed rating in amperes of notification appliance circuit. Provide additional circuits above those shown if required to meet this requirement.
- .3 Provide appliances specifically listed for outdoor use in locations exposed to weather.
- .4 Finish appliances in red enamel.
- .5 For surface mounting provide appliance manufacturer's approved back box. Back box finish to match appliance finish.

2.8 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 and remotely as indicated.
 - .2 Replace end of line devices to facilitate the renovation.
-

- 2.9 GRAPHIC ANNUNCIATOR PANEL .1 Provide revised graphic to reflect the renovation in the existing panel located as shown.
- 2.10 VISUAL ALARM SIGNAL DEVICES .1 Surface mounted assembly of stroboscopic type suitable for use in electrically supervised circuit and powered from notification appliance circuits.
- .2 Appliances: minimum of 110 candela measured as approved by ULC, but not less than effective intensity required by National Building Code of Canada for appliance spacing and location shown.
- .3 Protect lamps with thermoplastic lens and labelled "FIRE" in letters at least 12 mm high.
- .4 Provide visible appliances within 300 mm of each audible appliance as indicated.
- .5 Visible appliances may be part of audio-visual assembly, where more than two appliances are located in same room or corridor.
- 2.11 CONDUIT .1 Electrical Metallic Tubing (EMT).
- 2.12 WIRING .1 Wire for 120 V circuits: No. 12 AWG minimum solid copper conductor.
- .2 Wire for low voltage DC circuits: No. 14 AWG minimum solid copper conductor
- .3 Insulation 75 degrees C minimum with nylon jacket.
- .4 Colour code wiring.
- 2.13 ANCILLARY DEVICES .1 Remote relay unit to initiate fan shutdown.
-

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 systems in accordance with CAN/ULC-S524 and TB OSH Chapter 3-04.
- .2 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.
- .3 Connect alarm circuits to main control panel.
- .4 Locate and install signal bells chimes horns and visual signal devices and connect to signalling circuits.
- .5 Connect signalling circuits to main control panel.
- .6 Locate and install remote relay units to control fan shut down.
- 3.3 FIELD QUALITY CONTROL .1 Site Tests:
- .1 Perform tests in accordance with Section 26 05 00 and CAN/ULC-S537.
- .2 Fire alarm system:
- .1 Test each device and alarm circuit to ensure manual stations, detectors transmit alarm to control panel and actuate alarm.
- .2 Check annunciator panels to ensure zones are shown correctly.
- .3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.
- .4 Class A circuits.
- .1 Test each conductor on circuits for capability of providing alarm signal on each side of single open-circuit fault condition imposed near midmost point of circuit. Reset control unit after each alarm function

3.3 FIELD QUALITY CONTROL
(Cont'd)

- .1 Site Tests:(Cont'd)
- .2 Fire alarm system:(Cont'd)
- .4 (Cont'd)

and correct imposed fault after completion of each test.

.2 Test each conductor on circuits for capability of providing alarm signal during ground-fault condition imposed near midmost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.5 Class B circuits.

.1 Test each conductor on circuits for capability of providing alarm signal on line side of single open-circuit fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.2 Test each conductor on circuits for capability of providing alarm signal during ground-fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.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 as described in PART 1 - SUBMITTALS.

.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 PART 1 - QUALITY ASSURANCE.

.3 Verification requirements in accordance with Section 01 47 17, include:

.1 Materials and resources.

.2 Storage and collection of recyclables.

.3 Construction waste management.

.4 Resource reuse.

.5 Recycled content.

.6 Local/regional materials.

.7 Low-emitting materials.

- 3.4 TRAINING .1 Arrange and pay for on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.
- 3.5 CLEANING .1 Proceed in accordance with Section 01 74 11.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.