Public Works and Government Services Canada

Requisition No. EZ899-190130

DRAWINGS & SPECIFICATIONS
for
Maintenance Building
William Head Institution - Bldg 107
6000 William Head Road
Metchosin, BC

Project No.: R.069377.001
Date 16.11.17

APPROVED BY:

A/ Regional Manager, AES — Date 2018 04 12

Construction Safety Coordinator — Date 17.12.05

TENDER:

Project Manager — Date 2018 04 23

Real Property Services Branch, Professional and Technical Services, Pacific Region
Room 219 - 800 Burrard Street, Vancouver, B.C. V6Z 0B9

CONSULTANTS – SEAL & SIGNATURE

Discipline	Seal / Signature / Date
Architectural (Prime)	REGISTERED ARCHITECT · SEBASTIAN BURLO · BRITISH COLUMBIA · NOV 24 2017
Structural	PROFESSIONAL ENGINEER · PROVINCE OF · L. K. S. LAM · BRITISH COLUMBIA · NOV 22, 2017
Mechanical	PROFESSIONAL ENGINEER · PROVINCE OF · M. MARKOVIC · 24829 · BRITISH COLUMBIA · Nov 22/2017
Electrical	PROFESSIONAL ENGINEER · PROVINCE OF · M. J. FOURIE · # 37786 · BRITISH COLUMBIA · 2017-11-29
Civil	PROFESSIONAL ENGINEER · PROVINCE OF · S. B. ROGERS · # 46078 · BRITISH COLUMBIA · 2017-11-28

Discipline	**Seal / Signature / Date**
Geotechnical	

INDEX

LIST OF DRAWINGS

Bound Separately

Title Sheet

ARCHITECTURAL

A000 Cover Sheet & Drawing List
A001 General Notes + Assemblies
A002 3D Views
A101 Location Plan & Overall Site Plan
A200 Building Code Compliance Plans and Sections
A201 Base Building - Main Floor Plan (Level 1)
A202 Base Building - Upper Floor Plan (Level 2)
A203 Base Building – Lower and Upper Roof Plans
A211 Rm 107 Vehicle Maintenance Garage - Equipment Information
A212 Rm 107, 111, 112 Vehicle Maintenance Garage & Storage - Equipment Information
A213 Rm 114 Metal & Welding Shop - Equipment Information
A214 Rm 115 Carpentry Shop - Equipment Information
A215 Rm 111 General Workshop - Equipment Information
A221 Equipment & Furniture Plan - Main Floor Plan
A222 Equipment & Furniture Plan - Upper Floor Plan
A301 Reflected Ceiling Plan - Main Floor & U/S Canopy
A302 Reflected Ceiling Plan - Upper Floor & Lower Roof
A401 Front and Back Elevations
A402 Side Elevations
A501 Building Sections
A502 Building Sections
A503 Building Sections
A601 Wall Sections
A602 Wall Sections
A611 Partial Plans - Elevator & Stair A
A612 Sections - Elevator & Stair A

A613 Sections - Elevator & Stair A
A614 Partial Plans & Sections - Stair B
A615 Partial Plans & Sections – Stair C
A616 Partial Plans & Sections – Stair D
A701 Plan Details
A702 Details
A703 Section Details
A704 Section Details
A801 Washrooms and Shower Partial Plans and Accessories
A802 Millwork Elevations and Interior Elevations
A803 Millwork Details
A821 Int. Elevations - Rm 107 & 108 Vehicle Maintenance Garage & Garage Work Bay
A822 Int. Elevations - Rm 107 & 108 Vehicle Maintenance Garage & Garage Work Bay
A823 Int. Elevations - Rm 110 General Workshop & Tool Storage
A824 Int. Elevations - Rm 112 Welding Work Bay
A825 Int. Elevations - Rm 113 Carpentry Work Bay
A826 Int. Elevations - Rm 114 Carpentry Shop
A901 Door & Window Schedules
A902 Finishes Schedules

CIVIL

C01 Site Servicing Plan
C02 Site Grading Plan
C03 Details and Notes

STRUCTURAL

S101 General Notes & Typical Details
S201 Foundation and Main Floor Plan
S202 Upper Floor Plan
S203 Lower Roof & Upper Roof Plans
S301 Sections & Details Sheet 1
S302 Section & Details Sheet 2
S401 Snow Load Diagram and Bracing Elevations

MECHANICAL

M-1 Legend & Schedules HVAC
M-2 Main Floor Plan HVAC
M-3 Upper Floor Plan HVAC
M-4 Roof Plan HVAC
M-5 Details HVAC
P-1 Legend Plumbing
P-2 Underslab Main Floor Plan Plumbing
P-3 Main Floor Plan Plumbing
P-4 Upper Floor Plan & Stairwell Plan @ Roof Level Plumbing
P-5 Details Plumbing
F-1 Main Floor Plan, Legend Fire Protection
F-2 Upper Floor Plan & Stairwell Plan @ Roof Level Fire Protection

ELECTRICAL

END OF INDEX

1 SUMMARY OF WORK

.1 Work covered by Contract Documents:

.1 Work under this Contract comprises construction of new Maintenance Building, connection to services, pavement at building and remedial work as indicated, located at William Head Institution, 6000 William Head Rd. Metchosin, B.C.

.2 Contractor's Use of Premises:

.1 Contractor has controlled use of site within the construction area for Work, storage, and access as directed by the Departmental Representative.

.2 Use of areas inside William Head Institution, for access to the construction site is controlled, by the Departmental Representative.

.3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

.4 The new building will be constructed inside the security fence. The institution will be fully operational during work of this Contract. Provide temporary construction fence around site until new security fencing is installed.

2 WORK RESTRICTIONS

.1 Notify, Departmental Representative of intended interruption of disconnected services and provide schedule for review. Schedule major disruption of services in existing during approved times.

.2 Where Work involves breaking into or connecting to existing service lines, give departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions to a minimum. Coordinate interruptions affecting existing building if affected by the disruption.

.3 Construct barriers in accordance with Temporary Barriers and Enclosures clause.

.4 Security Requirements: refer to Section 01 14 10 - Security requirements.

.5 Hours of work:

.1 Perform work during normal working hours of the Institution (0730 to 1600), Monday through Friday except holidays. Work may be performed after normal working hours of the Institution, Monday through Friday, on weekends and holidays, with a minimum forty-eight (48) hours advance notice and approval of the Departmental Representative. Provide schedule for prior approval of Departmental Representative.

.2 Allow for delays due to security protocol when work interferes with Institution security operations.

.6 Access into Institution is required:

.1 Vehicular access through the Principal Entrance sally port will be restricted during the inmate "count" at breakfast, lunch and dinner hours. Confirm "count" times with Departmental Representative. Delays may occur when entering and exiting the Institution with vehicles during "count" times and due to security situations and heavy traffic.

.2 A construction escort will be provided by the Departmental Representative, at no cost to the Contract when access is required inside institution. Notify Departmental Representative minimum 24 hours in advance of when Construction Escort is required.

3 CONSTRUCTION WORK SCHEDULE

.1 Commence work immediately upon official notification of acceptance of offer and complete the work within 64 week period from the date of such notification.

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

.3 Submittals:
- .1 Submit to Departmental Representative within ten (10) working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of construction progress.
- .2 Identify each trade or operation.
- .3 Show dates for delivery of items requiring long lead time.
- .4 Departmental Representative will review schedule and return one copy.
- .5 Re-submit two (2) copies of finalized schedule to Departmental Representative within five (5) working days after return of reviewed preliminary copy.

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

.5 Project Meetings:
- .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.
- .2 Weather related delays with their remedial measures will be discussed and negotiated.
- .3 Before submitting first progress claim submit breakdown of Contract price in detail as directed by Departmental Representative and aggregating contract price. After approval by Departmental Representative cost breakdown will be used as basis for progress payments.

4 SUBMITTAL PROCEDURES

.1 Administrative:
- .1 Submit to Departmental Representative submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work.
- .2 Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .3 Do not proceed with work affected by submittal, until review is complete.
- .4 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .5 Where items or information is not produced in SI Metric units converted values are acceptable.
- .6 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of Work

and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and shall be considered rejected.

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

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

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

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

.11 Keep one reviewed copy of each submission on site.

.2 Shop Drawings:

.1 Drawings to be originals prepared by Contractor, Subcontractor, Supplier or Distributor, which illustrate appropriate portion of work; showing fabrication, layout, setting or erection details as specified in appropriate sections.

.3 Product Data:

.1 Certain specification Sections specify that manufacturer's standard schematic drawings, catalogue sheets, diagrams, schedules, performance charts, illustrations and other standard descriptive data will be accepted in lieu of shop drawings, provided that the product concerned is clearly identified. Submit in sets, not as individual submissions.

.4 Samples:

.1 Submit samples in sizes and quantities specified.

.2 Where colour is criterion, submit full range of colours.

.3 Submit all samples as soon as possible after the contract is awarded, to facilitate production of complete colour scheme by the Departmental Representative.

.5 Mock-ups:

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

.2 Construct in location as specified in specific Section.

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

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

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

.6 Submission Requirements:

.1 Schedule submissions at least ten days before dates reviewed submissions will be needed.

.2 Submit number of copies of product data, shop drawings which Contractor requires for distribution plus four (4) copies which will be retained by Departmental Representative.

.3 Accompany submissions with transmittal letter in duplicate.

.4 Submit either bond copies or one (1) electronic pdf file of each shop drawing and product data as directed by Departmental Representative.

.7 Coordination of Submissions:

.1 Review shop drawings, product data and samples prior to submission.
.2 Coordinate with field construction criteria.
.3 Verify catalogue numbers and similar data.
.4 Coordinate each submittal with requirements of the work of all trades and contract documents.
.5 Responsibility for errors and omissions in submittals is not relieved by Departmental Representative's review of submittals.
.6 Responsibility for deviations in submittals from requirements of Contract documents is not relieved by Departmental Representative's review of submittals, unless Departmental Representative gives written acceptance of specified deviations.
.7 Notify Departmental Representative, in writing at time of submission, of deviations in submittals from requirements of Contract documents.
.8 Make any changes in submissions which Departmental Representative may require consistent with Contract Documents and re-submit as directed by Departmental Representative.
.9 After Departmental Representative's review, distribute copies.
.10 Shop Drawings Review:
  .1 Review of shop drawings by Public Works and Government Services Canada (PWGSC) is for the sole purpose of ascertaining conformance with the general concept.
  .2 The Departmental Representative's review does not mean that PWGSC approves the detail design inherent in the shop drawings, responsibility remains with the contractor submitting same, and such review will not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the construction and contract documents.
  .3 Without restricting the generality of the foregoing, the Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for co-ordination of the work of all sub trades.

5 HEALTH AND SAFETY

.1 Specified in Section 01 35 33 - Health and Safety Requirements.

6 ENVIRONMENTAL PROCEDURES

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

.2 Do not bury rubbish and waste materials on site unless approved by Departmental Representative.

.3 Do not dispose of waste or volatile materials such as oil, paint thinner or mineral spirits into waterways, storm or sanitary systems.

.4 Provide temporary drainage and pumping as necessary to keep excavations and site free from water during excavation and grading activities.

.5 Control disposal of run-off of water containing suspended materials or other harmful substances in accordance with local authority requirements. Construct settlement ponds and silt fences as required by the Provincial Environmental authority.

.6 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.

.7 Under no circumstances dispose of rubbish or waste materials on property or CSC waste bins.

7 REGULATORY REQUIREMENTS

.1 References and Codes:
- .1 Perform Work in accordance with National Building Code of Canada (NBCC2010) including all amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Meet or exceed requirements of:
  - .1 Contract documents.
  - .2 Specified standards, codes and referenced documents.

8 QUALITY CONTROL

.1 Inspection:
- .1 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.
- .2 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .3 Departmental Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

.2 Independent Inspection Agencies:
- .1 Provide independent Inspection/Testing Agencies for purpose of inspecting and/or testing portions of Work as specified in relevant sections. Cost of such services will be borne by the Contractor.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no extra cost to Contract. Pay costs for retesting and re-inspection.

.3 Procedures:
- .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site.

Provide sufficient space to store and cure test samples.

.4 Rejected Work:
- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.

.5 Reports:
- .1 Submit (4) four copies or one scanned pdf copy of inspection and test reports to Departmental Representative.

.6 Tests and Mix Designs:
- .1 Furnish test results and mix designs as may be requested.

.7 Mock-ups;
- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.
- .2 Construct in locations acceptable to Departmental Representative and as specified in specific Section.
- .3 Prepare mock-ups for Departmental Representative review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.
- .4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .5 If requested, Departmental Representative will assist in preparing a schedule fixing dates for preparation.
- .6 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

.8 Mill Tests:
- .1 Submit mill test certificates as requested and as required of specification Sections.

.9 Equipment and Systems:
- .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.
- .2 Refer to specific Section for definitive requirements.

9 TEMPORARY UTILITIES

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

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

.3 Water Supply:
- .1 Existing water supply system may be used for construction purposes provided that damaged components are replaced when damaged. Provide own hoses from

source.

.4 Temporary Heating and Ventilation:
- .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .2 Construction heaters used inside building must be vented to outside or be flameless type. Solid fuel salamanders are not permitted.
- .3 Provide temporary heat and ventilation in enclosed areas as required to:
  - .1 Facilitate progress of Work.
  - .2 Protect Work and products against dampness and cold.
  - .3 Prevent moisture condensation on surfaces.
  - .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
  - .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .4 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress.
- .5 The air system will be in use during work of this contract inside existing building. Protect ducting system by filters inspected daily and replaced as necessary. During dust generating construction work block off all outlets and seal air tight.
  - .1 Before Substantial Completion comply with the following conditions:
    - .1 Remove all temporary duct covers.
    - .2 Replace used air filters with new filters.
- .6 Ventilating:
  - .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
  - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
  - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
  - .4 Ventilate storage spaces containing hazardous or volatile materials.
  - .5 Ventilate temporary sanitary facilities.
  - .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .7 Activate air system under direction of Departmental Representative to provide temporary heat. Protect ducting system by filters inspected daily and replaced as necessary.
  - .1 Before Substantial Completion comply with the following conditions:
    - .1 Bring plant and systems to as new conditions. (Vacuum clean duct system.)
    - .2 Replace used air filters with new filters.
- .8 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
  - .1 Conform with applicable codes and standards.
  - .2 Enforce safe practices.
  - .3 Prevent abuse of services.
  - .4 Prevent damage to finishes.
  - .5 Vent direct-fired combustion units to outside.
- .9 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

.5 Temporary Power and Light:
- .1 Arrange, pay for and maintain temporary electric power supply in accordance with

local power authority governing regulations and ordinances.

.2 Electrical power and lighting installed under this contract may be used for construction purposes at no extra cost, provided that guarantees are not affected thereby and electrical components used for temporary power are replaced when damaged.

.3 Replace lighting bulbs/tubes used for more than three months or provide replacement bulbs/tubes and hand over to Departmental Representative.

.6 Temporary Communication Facilities:

.1 Provide and pay for temporary telephone and fax hook up, line(s) necessary for own use. Conform to Section 01 14 10 Security Requirements.

.7 Fire Protection:

.1 Provide and maintain temporary fire protection equipment during performance of Work required by governing codes, regulations and bylaws.

10 CONSTRUCTION FACILITIES

.1 Installation and Removal:

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

.2 Remove from site all such work after use.

.2 Scaffolding:

.1 Design, construct and maintain scaffolding in rigid, secure and safe manner, in accordance with WCBBC regulations and Section 01 35 33.

.2 Erect scaffolding independent of walls. Remove promptly when no longer required.

.3 Hoisting/lifts:

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

.2 Hoists/lifts: operated by qualified operator.

.4 Site Storage/Loading:

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

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

.5 Construction Parking:

.1 Make good damage to local roads used for access to project site.

.2 Parking space is available outside double fence and temporary parking of delivery vehicles within construction site as directed by the Departmental Representative.

.6 Contractor's Site Office:

.1 Provide office as required to accommodate Contractor's operations.

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

.7 Equipment, Tools and Material Storage:

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

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

.8 Sanitary Facilities:

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.9 Construction Signs:
- .1 Format, location and quantity of site signs and notices to be approved by Departmental Representative.
- .2 Signs and notices for safety or instruction to be in English language, or commonly understood graphic symbols.
- .3 Maintain signboards, signs and notices for duration of project. Remove and dispose of signs off site when directed by Departmental Representative.
- .4 Remove signs from site at completion of project or as directed by Departmental Representative.

11 TEMPORARY BARRIERS AND ENCLOSURES

.1 Enclosure of Structure:
- .1 Provide temporary weather tight secure protection for exterior openings until permanently enclosed. Design enclosures to withstand wind pressure. Secure construction areas inside institution with fenced area to secure materials and temporary buildings.
- .2 Provide temporary dust screens in existing building where dust generating work occurs.

.2 Guardrails and Excavations:
- .1 Provide secure, rigid guard rails and barricades around deep excavations, open edges of floors and roofs in accordance with WCB requirements.

.3 Access to Site:
- .1 Maintain existing access roads and designated parking area in broom clean condition.

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

12 COMMON PRODUCT REQUIREMENTS

.1 Reference Standards:
- .1 If there is a question as to whether any product or system is in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .2 Cost for such testing will be borne by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.
- .3 Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.

.2 Quality:
- .1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish

evidence as to type, source and quality of products provided.

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

.3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.

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

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

.3 Storage, Handling and Protection:

.1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

.3 Store products subject to damage from weather in weatherproof enclosures.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

.6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.

.7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

.9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

.4 Transportation:

.1 Pay costs of transportation of products required in performance of Work.

.2 Transportation cost of products supplied by Departmental Representative will be paid for by Departmental Representative. Unload, handle and store such products.

.5 Manufacturer's Instructions:

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

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

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

.6 Quality of Work:

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

produce required results.

.2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.

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

.7 Co-ordination:

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

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

.8 Concealment:

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

.2 Before installation, inform Departmental Representative if there is interference. Install as directed by Departmental Representative.

.9 Remedial Work:

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

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

.10 Location of Fixtures:

.1 Inform Departmental Representative of conflicting installation. Install as directed.

.2 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

.11 Fastenings:

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

.2 Prevent electrolytic action between dissimilar metals and materials.

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

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

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

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

.12 Fastenings - Equipment:

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

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.

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

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

.13 Protection of Work in Progress:

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

.14 Existing Utilities:

.1 Where work involves breaking into or connecting to existing services, carry out work at times directed by Departmental Representative and governing authorities, with minimum of disturbance to pedestrian and vehicular traffic. Maintain vehicular access on roadways at all times.

.2 Before commencing work, establish location and extent of service lines in areas of work and notify Departmental Representative of findings.

.3 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility. Adhere to approved schedule and provide notice to affected parties.

.4 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.

.5 Record locations of maintained and re-routed services lines.

13 EXAMINATION AND PREPARATION

.1 Existing Services:

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

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

.2 Location of Equipment and Fixtures:

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

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform Departmental Representative of impending installation and obtain approval for actual location.

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

14 EXECUTION REQUIREMENTS

.1 Preparation:

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

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

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

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

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

.2 Execution:

.1 Execute cutting, fitting, and patching, including excavation and fill, to complete Work.

.2 Fit several parts together, to integrate with other Work.
.3 Uncover Work to install ill-timed Work.
.4 Remove and replace defective and non-conforming Work.
.5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
.6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
.7 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
.8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
.9 Restore work with new products in accordance with requirements of Contract Documents.
.10 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
.11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with fire stopping material, full thickness of the construction element.
.12 Refinish surfaces to match adjacent finishes: For continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.
.13 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

15 CLEANING

.1 Project Cleanliness:
.1 Maintain Work in tidy condition, free from accumulation of waste products and debris.
.2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
.3 Provide on-site containers for collection of waste materials and debris.
.4 Provide and use clearly marked separate bins for recycling. Refer to- Construction/Demolition Waste Management and Disposal.
.5 Clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations.
.6 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
.7 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
.8 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
.9 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

.2 Final Cleaning:
.1 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
.3 Prior to final review, remove surplus products, tools, construction machinery and equipment.
.4 Remove waste products from site.
.5 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain

enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

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

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

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

.9 Wax, seal, vacuum clean, shampoo or prepare floor finishes, as recommended by manufacturer.

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

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

.12 Remove dirt and other disfiguration from exterior surfaces.

.13 Sweep and wash clean paved areas used during work of this contract.

.14 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.

.15 Clean roofs, downspouts, and drainage systems.

.16 Remove snow and ice from access to building.

16 CONSTRUCTION/DEMOLITION WASTE MANAGEMENT AND DISPOSAL

.1 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and/or recyclable materials and waste. Separate non-salvageable materials from salvaged items. Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes. Transport and deliver non-salvageable items to licensed disposal facility.

.2 Provide containers to deposit reusable and/or recyclable materials. Locate containers in locations, to facilitate deposit of materials without hindering daily operations. Provide containers to deposit reusable and/or recyclable materials.

.3 Collect, handle, store on-site and transport off-site, salvaged materials in separate condition. Transport to approved and authorized recycling facility and/or users of material for recycling.

.4 Locate waste and salvage bins on site as directed by Departmental Representative.

17 CLOSEOUT PROCEDURES

.1 Inspection and Declaration:

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

.2 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.

.3 Request Departmental Representative's Inspection.

.2 Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.

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

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

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

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

operational.

.4 Certificates required by Authority Having Jursidiction, Utility companies have been submitted.

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

.6 Work is complete and ready for Final Inspection.

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

18 CLOSEOUT SUBMITTALS

.1 Record Drawings:

.1 As work progresses, maintain accurate records to show all deviations from the Contract Drawings. Note on as-built drawings as changes occur. At completion supply:

.1 Four (4) set of CD's in AutoCad file format (version: 2007) with all as-built information on the diskettes.

.2 Four (4) sets of printed as-built drawings.

.3 Submit one copy of check plots to Departmental Representative prior to final printing of as-built drawings.

.4 Departmental Representative will supply copies of the original AutoCad files.

.5 Retain original logo and title block on the as-built drawings. Contractor may place on the upper right-hand title block area a small company logo, the text "AS-BUILT" and the date.

.2 Costs for transferring as-built information from marked up working set of drawings to electronic format using ACAD and plotting service is included in the Contract.

.2 Maintenance manual:

.1 On completion of project submit to Departmental Representative four (4) CD R/ disk copies and four paper (in loose leaf type binder) of Operations and Maintenance Manual, made up as follows:

.1 Provide maintenance manual on CDs using pdf, or other approved format for descriptive writing, page size images and page size drawings. Organize manuals into industry standard maintenance manual tabs with links in index to each descriptive section describing the component or maintenance procedure etc.

.2 Organize files into CSI Masterformat numbering system or other approved descriptive titles.

.3 Label disk "Operation and Maintenance Data", project name, date, names of Contractor, subcontractors, consultants and sub consultants.

.4 Include scanned guarantees, diagrams and drawings.

.5 Organize contents into applicable sections of work to parallel project specification break-down. Mark each section by labeled tabs (navigational buttons).

.6 Drawings, diagrams and manufacturer's literature must be legible.

.7 Refer to Mechanical and Electrical Divisions for specific details for Mechanical and Electrical data.

.3 Maintenance Materials, Special Tools and Spare Parts:

.1 Specific requirements for maintenance materials, tools and spare parts are specified in individual sections.

.2 Deliver maintenance materials, special tools and spare parts to Departmental

Representative and store in designated area as directed by Departmental Representative.

.3 Prepare lists of maintenance materials, special tools and spare parts for inclusion in Manual specified in Clause 18.2.

.4 Maintenance materials:

.1 Deliver wrapped, identify on carton or package, colour, room number, system or area as applicable where item is used.

.5 Special tools:

.1 Assemble as specified;

.2 Include identifications and instructions on intended use of tools.

.6 Spare parts:

.1 Assemble parts as specified;

.2 Include part number, identification of equipment or system for which parts are applicable;

.3 Installation instructions;

.4 Name and address of nearest supplier.

.4 Warranties and Bonds:

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

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

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

.4 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until the Date of Interim Completion is determined.

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

.6 Retain warranties and bonds until time specified for submittal.

19 DEMONSTRATION AND TRAINING

.1 Demonstration and Training:

.1 Demonstrate operation and maintenance of equipment and systems to maintenance personnel following interim Completion and prior to date of final certificate of completion

.2 Departmental Representative will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

END OF SECTION

1 PURPOSE

.1 To ensure that both the construction project and the institutional operations may proceed without undue disruption or hindrance and that the security of the Institution is maintained at all times.

2 DEFINITIONS

.1 "Contraband" means:
- .1 an intoxicant, including alcoholic beverages, drugs and narcotics
- .2 a weapon or a component thereof, ammunition for a weapon, and anything that is designed to kill, injure or disable a person or that is altered so as to be capable of killing, injuring or disabling a person, when possessed without prior authorization,
- .3 an explosive or a bomb or a component thereof,
- .4 currency over any applicable prescribed limit, $25.00, and
- .5 any item not described in paragraphs (a) to (d) that could jeopardize the security of a Penitentiary or the safety of persons, when that item is possessed without prior authorization.

.2 "Unauthorized smoking and related Items" means all smoking items including, but not limited to, cigarettes, cigars, tobacco, chewing tobacco, cigarette making machines, matches and lighters.

.3 "Commercial Vehicle" means any motor vehicle used for the shipment of material, equipment and tools required for the construction project.

.4 "CSC" means Correctional Service Canada.

.5 "Director" means Director, Warden or Superintendent of the Institution as applicable.

.6 "Construction employees" means persons working for the general contractor, the sub-contractors, equipment operators, material suppliers, testing and inspection companies and regulatory agencies.

.7 "Departmental Representative" means the Public Works and Government Services Canada representative defined in General Conditions.

.8 "Perimeter" means the fenced or walled area of the institution that restrains the movement of the inmates.

.9 "Construction limits" means the area, as indicated in the contract documents, that the contractor will be allowed to work". This area may or may not be isolated from the security area of the institution. Limits to be confirmed at construction start-up meeting.

3 PRELIMINARY PROCEEDINGS

.1 At construction start-up meeting:
- .1 Discuss the nature and extent of all activities involved in the Project.
- .2 Establish mutually acceptable security procedures in accordance with this instruction and the institution's particular requirements.

.2 The Contractors's responsibilities:
- .1 Ensure that all construction employees are aware of the security requirements.
- .2 Ensure that a copy of the security requirements is always prominently on display at the job site.
- .3 Co-operate with institutional personnel in ensuring that security requirements are observed by all construction employees.

4 CONSTRUCTION EMPLOYEES

.1 Submit to the Departmental Representative a list of the names with date of birth of all construction employees to be employed on the construction site and a security clearance form for each employee.

.2 Allow 10 working days for processing of security clearances. Employees will not be admitted to the

Institution without a valid security clearance in place and a recent picture identification such as a provincial driver's license. Security clearances obtained from other CSC institutions are not valid at this institution except as approved otherwise.

.3 The Director may require that facial photographs may be taken of construction employees and these photographs may be displayed at appropriate locations in the institution or in an electronic database for identification purposes. The Director may require that these Photo ID cards be provided for all construction workers. ID cards will then be left at the designated entrance to be picked up upon arrival at the Institution and be displayed prominently on the construction employees clothing at all times while employees are in the institution.

.4 Entry to Institutional Property will be refused to any person there may be reason to believe may be a security risk.

.5 Any person employed on the construction site will be subject to immediate removal from Institutional Property if they:
.1 appear to be under the influence of alcohol, drugs or narcotics.
.2 behave in an unusual or disorderly manner.
.3 are in possession of contraband.

5 VEHICLES

.1 All unattended vehicles on CSC property must have windows closed; fuel caps locked, doors and trunks locked and keys removed. The keys must be securely in the possession of the owner or an employee of the company that owns the vehicle.

.2 The director may limit at any time the number and type of vehicles allowed within the Institution.

.3 Drivers of delivery vehicles for material required by the project will require security clearances and must remain with their vehicle the entire time that the vehicle is in the Institution. The director may require that these vehicles be escorted by Institutional staff or PWGSC Construction Escorts while in the Institution.

.4 If the Director permits trailers to be left inside the secure perimeter of the Institution, the trailer doors must be locked at all times. All windows must be securely locked bars when left unoccupied. Cover all windows with expanded metal mesh. When not in use lock all storage trailers located inside and outside the perimeter.

6 PARKING

.1 The parking area(s) to be used by construction employees will be designated by the Director. Parking in other locations will be prohibited and vehicles may be subject to removal.

7 SHIPMENTS

.1 To avoid confusion with the institution's own shipments, address all shipments of project material, equipment and tools in the Contractor's name and have a representative on site to receive any deliveries or shipments. CSC or PWGSC staff will **NOT** accept receipt of deliveries or shipments of any material equipment or tools.

8 TELEPHONES

.1 The installation of telephones, facsimile machines and computers with Internet connections is not permitted within the Institution perimeter unless prior approved by the Director.

.2 The Director will ensure that approved telephones, facsimile machine and computers with Internet connections are located where they are not accessible to inmates. All computers will have an approved password protection that will stop an Internet connection to unauthorized personnel.

.3 Wireless cellular and digital telephones, including but not limited to devices for telephone messaging, pagers, Blackberries, telephone used as 2-way radios are not permitted within the Institution unless approved by the Director. If wireless cellular telephones are permitted, the user will not permit their use by any inmate.

.4 The Director may approve but limit the use of 2-way radios.

9 WORK HOURS

.1 Conform to Division 1.

.2 Work is not permitted during weekends and statutory holidays without the permission of the Director. A minimum of seven days advance notice will be required to obtain the required permission. In case of emergencies or other special circumstances, this advance notice may be waved by the Director.

10 OVERTIME WORK

.1 Conform to Division 1.

.2 Provide 48 hours advance notice to Director for all work to be performed after normal working hours of the Institution. Notify Director immediately if emergency work is required, such as to complete a concrete pour or make the construction site safe and secure.

11 TOOLS AND EQUIPMENT

.1 Maintain a complete list of all tools and equipment to be used during the construction project. Make this inventory available for inspection when required by the Institution.

.2 Throughout the construction project maintain up-to-date the list of tools and equipment specified above.

.3 Keep all tools and equipment under constant supervision, particularly power-driven and cartridge-driven tools, cartridges, files, saw blades, rod saws, wire, rope, ladders and any sort of jacking device.

.4 Store all tools and equipment in approved secure locations.

.5 Lock all tool boxes when not in use. Keys to remain in the possession of the employees of the contractor. Secure and lock scaffolding when not erected and when erected Secure in a manner agreed upon with the Institution designate.

.6 Report all missing or lost tools or equipment immediately to the Departmental Representative/Director.

.7 The Director will ensure that the security staff members carry out checks of the Contractor's tools and equipment against the list provided by the Contractor. These checks may be carried out at the following intervals:

.1 At the beginning and conclusion of every work day or shift upon entering and exiting the Institution.

.2 At any time when contractor is on Institution property.

.8 Certain tools/equipment such as cartridges and hacksaw blades are highly controlled items. The contractor will be given at the beginning of the day, a quantity that will permit one day's work. Used blades/cartridges will be returned to the Director's representative at the end of each day. Maintain up to date inventory of all used blades/cartridges.

.9 If propane or natural gas is used for heating the construction, the institution will require that the

contractor supervise the construction site during non-working hours.

12 KEYS

.1 Security Hardware Keys.
- .1 Arrange with the security hardware supplier/installer to have the keys for the security hardware to be delivered directly to Institution, specifically the Security Maintenance Officer (SMO).
- .2 The SMO will provide a receipt to the Contractor for security hardware keys.
- .3 Provide a copy of the receipt to the Departmental Representative.

.2 Other Keys
- .1 Use standard construction cylinders for locks for his use during the construction period.
- .2 Issue instructions to employees and sub-trades, as necessary, to ensure safe custody of the construction set of keys.
- .3 Upon completion of each phase of the construction, the CSC representative will, in conjunction with the lock manufacturer:
  - .1 Prepare an operational keying schedule
  - .2 Accept the operational keys and cylinders directly from the lock manufacturer.
  - .3 Arrange for removal and return of the construction cores and install the operational core in all locks.
- .4 Upon putting operational security keys into use, the PWGSC construction escort shall obtain these keys as they are required from the SMO and open doors as required by the Contractor. The Contractor shall issue instructions to his employees advising them that all security keys shall always remain with the PWGSC construction escort.

13 SECURITY HARDWARE

.1 Turn over all removed security hardware to the Director of the Institution for disposal or for safekeeping until required for re-installation.

14 PRESCRIPTION DRUGS

.1 Employees of the contractor who are required to take prescription drugs during the workday shall obtain approval of the Director to bring a one day supply only into the Institution.

15 SMOKING RESTRICTIONS

.1 Smoking is not permitted inside correctional facilities or outdoors within the perimeter of a correctional facility and persons must not possess unauthorized smoking items within the perimeter of a correctional facility.

.2 Persons in violation of this policy will be requested to immediately cease smoking or dispose of any unauthorized smoking items and, if they persist will be directed to leave the Institution.

.3 Smoking is permitted outside the perimeter of a correctional facility in an area designated by the Director.

16 CONTRABAND

.1 Weapons, ammunition, explosives, alcoholic beverages, drugs and narcotics are prohibited on institutional property.

.2 The discovery of contraband on the construction site and the identification of the person(s) responsible for the contraband shall be reported immediately to the Director.

.3 Contractors should be vigilant with both their staff and the staff of their sub-contractors and suppliers that the discovery of contraband may result in cancellation of the security clearance of the affected employee. Serious infractions may result in the removal of the company from the Institution for the

duration of the construction.

.4 Presence of arms and ammunition in vehicles of contractors, sub-contractors and suppliers or employees of these will result in the immediate cancellation of security clearances for the driver of the vehicle.

17 SEARCHES

.1 All vehicles and persons entering institutional property may be subject to search.

.2 When the Director suspects, on reasonable grounds, that an employee of the Contractor is in possession of contraband, he may order that person to be searched.

.3 All employees entering the Institution may be subject to screening of personal effects for traces of contraband drug residue.

18 ACCESS TO AND REMOVAL FROM INSTITUTIONAL PROPERTY

.1 Construction personnel and commercial vehicles will not be admitted to the institution after normal working hours, unless approved by the Director.

19 MOVEMENT OF VEHICLES

.1 Escorted commercial vehicles may not be allowed to enter or leave the institution through the vehicle access gate during the regular "inmate count" occurring at breakfast, lunch and dinner hour as established by the Institution. Confirm "count" times with Director or Departmental Representative to reduce down times for deliveries to Institution and movement of contractors vehicles through Institution vehicle access gate.

.2 Construction vehicles will not be allowed to leave the Institution until an inmate count is completed.

.3 The contractor shall advise the Director twenty four (24) hours in advance to the arrival on the site of heavy equipment such as concrete trucks, cranes, etc.

.4 Vehicles being loaded with soil or other debris, or any vehicle considered impossible to search, must be under continuous supervision by CSC staff or PWGSC construction escorts working under the authority of the Director.

.5 Commercial vehicles will only be allowed access to institutional property when their contents are certified by the Contractor or his representative as being strictly necessary to the execution of the construction project.

.6 Vehicles shall be refused access to institutional property if, in the opinion of the Director, they contain any article which may jeopardize the security of the institution. Arrange with Director for parking of contractor's vehicles at minimum security Institutions.

.7 Private vehicles of construction employees will not be allowed within the security wall or fence of medium or maximum security institutions without the permission of the Director.

.8 With prior approval of the Director, a vehicle may be used in the morning and evening to transport a group of employees to the work site. This vehicle will not remain within the Institution the remainder of the day.

.9 With the approval of the Director, certain equipment may be permitted to remain on the construction site overnight or over the weekend. This equipment must be securely locked, with the battery removed. The Director may require that the equipment be secured with a chain and padlock to another solid object.

20 MOVEMENT OF CONSTRUCTION EMPLOYEES ON INSTITUTIONAL PROPERTY

.1 Subject to the requirements of good security, the Director will permit the Contractor and his employees as much freedom of action and movement as is possible.

.2 However, notwithstanding paragraph above, the Director may:
- .1 Prohibit or restrict access to any part of the institution.
- .2 Require that in certain areas of the institution, either during the entire construction project or at certain intervals, construction employees only be allowed access when accompanied by a member of the CSC security staff.

.3 During the lunch and coffee/health breaks, all employees will remain within the construction site. Employees are not permitted to eat in the officer's lounge and dining room.

21 SURVEILLANCE AND INSPECTION

.1 Construction activities and all related movement of personnel and vehicles will be subject to surveillance and inspection by CSC security staff members to ensure that established security requirements are met.

.2 CSC staff members will ensure that an understanding of the need to carry out surveillance and inspections, as specified above, is established among construction employees and maintained throughout the construction project.

22 STOPPAGE OF WORK

.1 The director may request at any time that the contractor, his employees, sub-contractors and their employees not enter or leave the work site immediately due to a security situation occurring within the Institution. The contractor's site supervisor shall note the name of the staff member making the request and the time of the request and obey the order as quickly as possible.

.2 The contractor shall advise the Departmental Representative within 24 hours of this delay to the progress of the work.

23 CONTACT WITH INMATES

.1 Unless specifically authorized, it is forbidden to come into contact with inmates, to talk with them, to receive objects from them or to give them objects. Any employee doing any of the above will be removed from the site and his security clearance revoked.

.2 It is forbidden to take pictures of inmates, of CSC staff members or of any part of the Institution other than those required as part of this contract.

END OF SECTION

1 REFERENCES

.1 Government of Canada:
- .1 Canada Labour Code - Part II.
- .2 Canada Occupational Health and Safety Regulations.

.2 American National Standards Institute (ANSI):
- .1 ANSI A10.3-2006, – Safety Requirements for Powder-Actuated Fastening Systems ANSI for Construction and Demolition Operations

.3 Canadian Standards Association (CSA):
- .1 CSA Z797-2009 Code of Practice for Access Scaffold.

.4 National fire Code of Canada:
- .1 FCC No. 301, Standard for Construction Operations (as amended).
- .2 FCC No. 302, Standard for Welding and Cutting (as amended).
- .3 Part 5 – hazardous Processess and Operations & Division B (as required).

.5 National Building Code of Canada (NBCC 2005):
- .1 Part 8, Safety Measures at Construction and Demolition Sites

.6 Province of British Columbia Building Code (2006):
- .1 Part 8, Safety Measures at Construction and Demolition Sites.

.7 Province of British Columbia:
- .1 Workers Compensation Act Part 3 - Occupational Health & Safety.
- .2 Occupational Health & Safety Regulations.

2 RELATED SECTIONS

.1 Section 01 01 50 - General Instructions for; Submittals procedures, Section Temporary utilities, Construction facilities and Temporary barriers and enclosures.

3 WORKERS' COMPENSATION BOARD COVERAGE

.1 Comply fully with the Workers' Compensation Act, regulations and orders made pursuant thereto, and any amendments up to the completion of the work.

.2 Maintain Workers' Compensation Board coverage during the term of the Contract, until and including the date that the Certificate of Final Completion is issued.

4 COMPLIANCE WITH REGULATIONS

.1 PWGSC may terminate the Contract without liability to PWGSC where the Contractor, in the opinion of PWGSC, refuses to comply with a requirement of the Workers' Compensation Act or the Occupational Health and Safety Regulations.

.2 It is the Contractor's responsibility to ensure that all workers are qualified, competent and certified to perform the work as required by the Workers' Compensation Act or the Occupational Health and Safety Regulations.

5 SUBMITTALS

.1 Make submittals in accordance with Section 01 01 50 General Instructions for Submittals.

.2 Submit the following:
- .1 Health and Safety Plan.
- .2 Copies of reports or directions issued by federal and provincial health and safety inspectors.
- .3 Copies of incident and accident reports.
- .4 Complete set of Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.
- .5 Emergency Procedures.

.3 The Departmental Representative will review the Contractor's site-specific project Health and Safety Plan and emergency procedures, and provide comments to the Contractor within 5 days after receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative for review.

.4 Medical surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of work, and submit additional certifications for any new site personnel to Departmental Representative.

.5 Submission of the Health and Safety Plan, and any revised version, to the Departmental Representative is for information and reference purposes only. It shall not:
- .1 Be construed to imply approval by the Departmental Representative.
- .2 Be interpreted as a warranty of being complete, accurate and legislatively compliant.
- .3 Relieve the Contractor of his legal obligations for the provision of health and safety on the project.

6 RESPONSIBILITY

.1 Assume responsibility as the Prime Contractor for work under this contract and appoint a qualified coordinator for the purpose of ensuring the coordination of health and safety activities for the location in accordance with sections 118 and 119 of Part 3 of the Workers Compensation Act.

.2 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.3 Comply with and enforce compliance by employees with safety requirements of Contract documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

7 HEALTH AND SAFETY COORDINATOR

.1 The Health and Safety Coordinator must:
- .1 Be responsible for completing all health and safety training, and ensuring that personnel that do not successfully complete the required training are not permitted to enter the site to perform work.
- .2 Be responsible for implementing, daily enforcing, and monitoring the site-specific Health and Safety Plan.

.3 Be on site during execution of work.

8 GENERAL CONDITIONS

.1 Provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.

.2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.
- .1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.
- .2 Secure site after working hours in accordance with Section 01 14 10 - Security Requirements.

9 PROJECT/SITE CONDITIONS

.1 Work at site will involve:
- .1 Working in areas where inmates may be present who are under supervision by CSC staff. Conform to Security Requirements Section 01 41 10 Contact with Inmates clause and other security requirements pertaining to a CSC institution.

10 REGULATORY REQUIREMENTS

.1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.

.2 In event of conflict between any provision of the above authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, the Departmental Representative will advise on the course of action to be followed.

11 FILING OF NOTICE

.1 Submit a Notice of Project, form 52E49, to WorkSafeBC in accordance with OH&S Regulation 20.2, at least 24 hours before start of work.

.2 Submit copy to Departmental Representative.

12 HEALTH AND SAFETY PLAN

.1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards.

.2 Prepare and comply with a site-specific project Health and Safety Plan based on hazard assessment, including, but not limited to, the following:
- .1 Primary requirements:
  - .1 Contractor's safety policy.
  - .2 Identification of applicable compliance obligations.
  - .3 Definition of responsibilities for project safety/organization chart for project.
  - .4 General safety rules for project.
  - .5 Job-specific safe work, procedures.
  - .6 Inspection policy and procedures.

.7 Incident reporting and investigation policy and procedures.
.8 Occupational Health and Safety Committee/Representative procedures.
.9 Occupational Health and Safety meetings.
.10 Occupational Health and Safety communications and recordkeeping procedures.

.2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.

.3 List hazardous materials to be brought on site as required by work.

.4 Indicate engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.

.5 Identify personal protective equipment (PPE) to be used by workers.

.6 Identify personnel and alternates responsible for site safety and health.

.7 Identify personnel training requirements and training plan, including site orientation for new workers.

.3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.

.4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.

.5 Departmental Representative's review: the review of Health and Safety Plan by Public Works and Government Services Canada (PWGSC). PWGSC's review shall not relieve the Contractor of responsibility for errors or omissions in final Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.

13 EMERGENCY PROCEDURES

.1 List standard operating procedures and measures to be taken in emergency situations. Include an evacuation plan and emergency contacts (i.e. names/telephone numbers) of:
.1 Designated personnel from own company.
.2 Regulatory agencies applicable to work and as per legislated regulations.
.3 Local emergency resources.
.4 Departmental Representative.

.2 Include the following provisions in the emergency procedures:
.1 Notify workers of the nature and location of the emergency.
.2 Evacuate all workers safely.
.3 Check and confirm the safe evacuation of all workers.
.4 Notify the fire department or other emergency responders.
.5 Notify adjacent workplaces which may be affected if the risk extends beyond the workplace.
.6 Notify Departmental Representative.

.3 Provide written rescue/evacuation procedures as required for, but not limited to:
.1 Work at high angles.
.2 Work in confined spaces or where there is a risk of entrapment.
.3 Work with hazardous substances.
.4 Underground work.

14 HAZARDOUS PRODUCTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials, and regarding labeling and provision of Material Safety Data Sheets (MSDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.

.2 Where use of hazardous and toxic products cannot be avoided:

.1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents in accordance with clause 5.2.4.

15 ELECTRICAL SAFETY REQUIREMENTS

.1 Comply with authorities and ensure that, when installing new facilities or modifying existing facilities, all electrical personnel are completely familiar with existing and new electrical circuits and equipment and their operation.

.1 Before undertaking any work, coordinate required energizing and de-energizing of new and existing circuits with Departmental Representative.

.2 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.

16 ELECTRICAL LOCKOUT

.1 Develop, implement and enforce use of established procedures to provide electrical lockout and to ensure the health and safety of workers for every event where work must be done on any electrical circuit or facility.

.2 Prepare the lockout procedures in writing, listing step-by-step processes to be followed by workers, including how to prepare and issue the request/authorization form. Have procedures available for review upon request by the Departmental Representative.

.3 Keep the documents and lockout tags at the site and list in a log book for the full duration of the Contract. Upon request, make such data available for viewing by Departmental Representative or by any authorized safety representative.

17 OVERLOADING

.1 Ensure no part of work is subjected to a load which will endanger its safety or will cause permanent deformation.

18 FALSEWORK

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

19 SCAFFOLDING

.1 Design, construct and maintain scaffolding in a rigid, secure and safe manner, in accordance with CSA Z797-2009 Code of Practice for Access Scaffold and BC Occupational Health and Safety Regulations.

20 CONFINED SPACES

.1 Carry out work in confined spaces in compliance with provincial regulations.

21 POWDER-ACTUATED DEVICES

.1 Use powder-actuated devices in accordance with ANSI A10.3 only after receipt of written permission from the Departmental Representative.

22 FIRE SAFETY AND HOT WORK

.1 Obtain Departmental Representative's authorization before any welding, cutting or any other hot work operations can be carried out on site.

.2 Hot work includes cutting/melting with use of torch, flame heating roofing kettles, or other open flame devices and grinding with equipment which produces sparks.

23 FIRE SAFETY REQUIREMENTS

.1 Store oily/paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

24 FIRE PROTECTION AND ALARM SYSTEM

.1 Do not obstruct, shut-off or leave inactive at the end of a working day or shift, the fire protection and alarm systems.

.2 Do not use fire hydrants for purposes other than firefighting.

.3 Be responsible/liable for costs incurred from the fire department and the Departmental Representative, resulting from false alarms.

25 UNFORESEEN HAZARDS

.1 Should any unforeseen or peculiar safety-related factor, hazard or condition become evident during performance of the work, immediately stop work and advise the Departmental Representative verbally and in writing.

26 POSTED DOCUMENTS

.1 Post legible versions of the following documents on site:
- .1 Health and Safety Plan.
- .2 Sequence of work.
- .3 Emergency procedures.
- .4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.
- .5 Notice of Project.
- .6 Floor plan(s).
- .7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.

.8 Workplace Hazardous Materials Information System (WHMIS) documents.
.9 Material Safety Data Sheets (MSDS).
.10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.

.2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, visible to all workers and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.

.3 Postings should be protected from the weather, and visible from the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by the Departmental Representative.

27 MEETINGS

.1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.

28 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by the Departmental Representative.

.2 Provide Departmental Representative with written report of action taken to correct non-compliance with health and safety issues identified.

.3 The Departmental Representative may issue a "stop work order" if non-compliance of health and safety regulations is not corrected immediately or within posted time. The Contractor will be responsible for any costs arising from such a "stop work order".

END OF SECTION

1 RELATED SECTIONS

.1 Section 01 01 50 - General Instructions for training.

.2 Division 22- Plumbing.

.3 Division 23 - Heating, Ventilating and Air-Conditioning.

.4 Division 25 - Integrated Automation (EMCS).

.5 Division 26 - Electrical.

.6 Division 28 - Electronic Safety and Security.

2 DEFINITIONS

.1 Acronyms:
- .1 Cx - Commissioning.
- .2 EMCS - Energy Monitoring and Control Systems.
- .3 O&M - Operation and Maintenance.
- .4 PI - Product Information.
- .5 PV - Performance Verification.
- .6 TAB - Testing, Adjusting and Balancing.

3 QUALITY ASSURANCE

.1 Testing organization: current member in good standing of AABC certified to perform specified services.

.2 Comply with applicable procedures and standards of the certification sponsoring association.

.3 Perform services under direction of supervisor qualified under certification requirements of sponsoring association.

4 REFERENCES

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

5 SUBMITTALS

.1 Submit test reports in accordance with Section 01 01 50 - General Instructions; Submittal Clause.

.2 Prior to start of Work, submit name of organization proposed to perform services. Designate who has managerial responsibilities for coordination of entire testing, adjusting and balancing.

.3 Prior to start of Work, designate who has managerial responsibilities for coordination of entire testing and adjusting of electronic equipment.

.4 Submit documentation to confirm organization compliance with quality assurance provision.

.5 Submit 3 preliminary specimen copies of each of report forms proposed for use.

.6 Ten (10) days prior to Substantial Performance, submit 3 copies of final reports on applicable forms.

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

6 PROCEDURES - GENERAL

.1 Comply with procedural standards of certifying association under whose standard services will be performed.

.2 Notify Departmental Representative 3 days prior to beginning of operations.

.3 Accurately record data for each step.

.4 Report to Departmental Representative any deficiencies or defects noted during performance of services.

7 CONTRACTOR'S RESPONSIBILITY

.1 Prepare each system for testing and balancing.

.2 Cooperate with testing organization and provide access to equipment and systems.

.3 Provide personnel and operate systems at designated times, and under conditions required for proper testing, adjusting, and balancing.

.4 Notify testing organization 7 days prior to time project will be ready for testing, adjusting, and balancing.

8 PREPARTATION

.1 Provide instruments required for testing and adjusting operations.

.2 Make instruments available to Departmental Representative to facilitate spot checks during testing.

.3 Test electronic system for proper operation and programming.

9 FINAL REPORTS

.1 Reports to be completed by organization having managerial responsibility.

.2 Ensure each form bears signature of recorder and his supervisor.

10 COMPLETION OF COMMSSIONING

.1 Upon completion of Cx leave systems in specified operating and program mode.

.2 Complete Cx prior to issuance of Substantial Completion.

.3 Cx deliverables have been submitted and accepted by Departmental Representative.

END OF SECTION

1.0 GENERAL

1.1 Related Work

.1	Section 03 20 00	Concrete Reinforcing
.2	Section 03 30 05	Cast-In-Place Concrete

1.2 References

.1 Canadian Standards Association (CSA International)

- .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .2 CAN/CSA-O86-14, Engineering Design in Wood.
- .3 CSA O121-08(R2013), Douglas Fir Plywood.
- .4 CSA O151-09, Canadian Softwood Plywood.
- .5 CSA O153-13, Poplar Plywood.
- .6 CAN/CSA-O325.0-07(R2012), Construction Sheathing.
- .7 CSA O437 Series-93(R2011), Standards for OSB and Waferboard.
- .8 CSA S269.1-1975(R2003), Falsework for Construction Purposes.
- .9 CAN/CSA-S269.3-M92(R2013), Concrete Formwork, National Standard of Canada

.2 Underwriters' Laboratories of Canada (ULC)

- .1 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.3 Submittals

.1 Submittals in accordance with Section 01 01 50 – General Instructions.

.2 Submit shop drawings for formwork and falsework.

- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada.

.3 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 01 50 – General Instructions.

Co-ordinate submittal requirements and provide submittals required by Section 01 01 50 – General Instructions.

.4 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with

CSA S269.1, for falsework drawings and Comply with CAN/CSA-S269.3 for formwork drawings.

.5 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

.6 Indicate sequence of erection and removal of formwork/falsework as directed by Departmental Representative.

1.4 Delivery, Storage and Handling

.1 Store and manage hazardous materials in accordance with Section 01 01 50 – General Instructions and Section 01 35 33 - Health and Safety Requirements.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

.2 Place materials defined as hazardous or toxic in designated containers.

.3 Divert wood materials from landfill to a recycling, reuse, composting facility as approved by Departmental Representative.

.4 Divert plastic materials from landfill to a recycling, reuse, composting facility as approved by Departmental Representative.

.5 Divert unused form release material from landfill to an official hazardous material collections site as approved by the Departmental Representative.

2.0 PRODUCTS

2.1 Materials

.1 Materials and resources in accordance with Section 01 01 50 – General Instructions.

.2 Formwork materials:

.1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86, CSA O437 Series, CSA-O153.

.2 Rigid insulation board: to CAN/ULC-S701.SPEC NOTE: Drawings should designate areas requiring special architectural concrete features.

.3 Form ties:

.1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.

.4 Form liner:

.1 Plywood: high density overlay, medium density overlay, Douglas Fir to CSA O121, Canadian Softwood Plywood to CSA O151 or Poplar to CSA O153 grade, square edge, 20 mm thick.

.5 Form release agent: non-toxic, biodegradable, low VOC.

.6 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 70 and 110s Saybolt Universal 15 to 24 mm^2/s at 40 degrees C, flashpoint minimum 150 degrees C, open cup.

.7 Falsework materials: to CSA-S269.1.

.8 Sealant: to Section 07 92 10 – Joint Sealing.

3.0 EXECUTION

3.1 Fabrication and Erection

.1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.

.2 Obtain Departmental Representative's approval for use of earth forms framing openings not indicated on drawings.

.3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

.4 Fabricate and erect falsework in accordance with CSA S269.1.

.5 Do not place shores and mud sills on frozen ground.

.6 Provide site drainage to prevent washout of soil supporting mud sills and shores.

.7 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.

.8 Align form joints and make watertight.

.1 Keep form joints to minimum.

.9 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.

.10 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.11 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.

.1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.12 Line forms for following surfaces:

.1 Outer face of outside girders beams and vertical edge of sidewalk slab.

.2 Soffit of girders and underside of bridge decks if exposed.

.3 Exposed faces of abutments, wingwalls, piers and pylons: do not stagger joints of form lining material and align joints to obtain uniform pattern. Secure lining taut to formwork to prevent folds.

.4 Pull down lining over edges of formwork panels.

.5 Ensure lining is new and not reused material.

.6 Ensure lining is dry and free of oil when concrete is poured.

.7 Application of form release agents on formwork surface is prohibited where drainage lining is used.

.8 If concrete surfaces require cleaning after form removal, use only pressurized water stream so as not to alter concrete's smooth finish.

.9 Cost of textile lining is included in price of concrete for corresponding portion of Work.

.13 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 Removal and Shoring

.1 Leave formwork in place for following minimum periods of time after placing concrete.

.1 Three days for walls and sides of beams.

.2 Three days for columns.

.3 Three days for beam soffits, slabs, decks and other structural members, or one days when replaced immediately with adequate shoring to standard specified for falsework.

.4 One days for footings and abutments.

.2 Remove formwork when concrete has reached 75% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.

.3 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

.4 Space reshoring in each principal direction at not more than 3000 mm apart.

Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

END OF SECTION

1.0 GENERAL

1.1 Related Work

.1 Section 03 10 00 — Concrete Forming and Accessories

.2 Section 03 30 05 — Cast-In-Place Concrete

1.2 Measurement Procedures

.1 Measure reinforcing steel in kilograms tonnes of steel incorporated into Work, computed from theoretical unit mass specified in CAN/CSA-G30.18 for lengths and sizes of bars as indicated or authorized in writing by Departmental Representative.

.2 No measurement will be made under this Section.

.1 Include reinforcement costs in items of concrete work in Section 03 30 05 - Cast-In-Place Concrete.

1.3 References

.1 American Concrete Institute (ACI)

.1 SP-66-04, ACI Detailing Manual 2004.

.1 ACI 315-99, Details and Detailing of Concrete Reinforcement.

.2 ACI 315R-04, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM A143/A143M-07, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

.2 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

.3 ASTM A497/A497M-07 Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.

.3 Canadian Standards Association (CSA International)

.1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA-A23.3-14, Design of Concrete Structures.

.3 CAN/CSA-G30.18-09, Billet-Steel Bars for Concrete Reinforcement, A National Standard of Canada.

.4 CSA-G40.20-04/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.5 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles, A National Standard of Canada.

.6 CSA W186-M1990(R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.4 Reinforcing Steel Institute of Canada (RSIC)

.1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.4 Submittals

.1 Submittals in accordance with Section 01 50 – General Instructions.

.2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and ACI 315.

.3 Submit shop drawings including placing of reinforcement and indicate:

.1 Bar bending details.

.2 Lists.

.3 Quantities of reinforcement.

.4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings.

.5 Indicate sizes, spacings and locations of chairs, spacers and hangers.

.4 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.

.1 Provide type A tension lap splices where indicated unless otherwise indicated.

When Chromate solution is used as replacement for galvanizing non-prestressed reinforcement, provide product description for review by Departmental Representative prior to its use.

.5 Quality Assurance: Provide the following to the Departmental Representative.

.1 Mill Test Report: upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, minimum 4 weeks prior to beginning reinforcing work.

.2 Upon request submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

1.5 Delivery, Storage and Handling

.1 Store and manage hazardous materials in accordance with Section 01 50 – General Instructions and Section 01 35 33 – Health and Safety Requirements.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

.2 Place materials defined as hazardous or toxic in designated containers.

2.0 PRODUCTS

2.1 Materials

.1 Materials and resources in accordance with Section 01 01 50– General Instructions.

.2 Substitute different size bars only if permitted in writing by Departmental Representative.

.3 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.

.4 Reinforcing steel: weldable low alloy steel deformed bars to CAN/CSA-G30.18.

.5 Cold-drawn annealed steel wire ties: to ASTM A497/A497M.

.6 Deformed steel wire for concrete reinforcement: to ASTM A497/A497M.

.7 Welded steel wire fabric: to ASTM A185/A185M.

.3 Provide in flat sheets only.

.8 Welded deformed steel wire fabric: to ASTM A497/A497M.

.1 Provide in flat sheets only.

.9 Epoxy Coating of non-prestressed reinforcement: to ASTM A775/A775M.

.10 Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating 610 g/m^2.

.1 Protect galvanized reinforcing steel with chromate treatment to prevent reaction with Portland cement paste.

.2 If chromate treatment is carried out immediately after galvanizing, soak steel in aqueous solution containing minimum 0.2% by weight sodium dichromate or 0.2% chromic acid.

.1 Temperature of solution equal to or greater than 32 degrees and galvanized steels immersed for minimum 20 seconds.

.3 If galvanized steels are at ambient temperature, add sulphuric acid as bonding agent at concentration of 0.5% to 1%.

.1 In this case, no restriction applies to temperature of solution.

.4 Chromate solution sold for this purpose may replace solution described above, provided it is of equivalent effectiveness.

.1 Provide product description as described in PART 1 - SUBMITTALS

.11 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

.12 Mechanical splices: subject to approval of Departmental Representative.

.13 Plain round bars: to CSA-G40.20/G40.21.

2.2 Fabrication

.1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2, ACI 315 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.1 ACI 315R unless indicated otherwise.

.3 Obtain Departmental Representative's approval for locations of reinforcement splices other than those shown on placing drawings.

.4 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.

.5 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

.1 Ship epoxy coated bars in accordance with ASTM A775A/A775M.

2.3 Source Quality Control

.1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.

.2 Upon request, inform Departmental Representative of proposed source of material to be supplied.

3.0 EXECUTION

3.1 Preparation

.1 Galvanizing to include chromate treatment.

.1 Duration of treatment to be 1 hour per 25 mm of bar diameter.

.2 Conduct bending tests to verify galvanized bar fragility in accordance with ASTM A143/A143M.

3.2 Field Bending

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.

.2 When field bending is authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

3.3 Placing Reinforcement

.1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.

.2 Use plain round bars as slip dowels in concrete.

- .1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.
- .2 When paint is dry, apply thick even film of mineral lubricating grease.

.3 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.

.4 Ensure cover to reinforcement is maintained during concrete pour.

.5 Protect epoxy and paint coated portions of bars with covering during transportation and handling.

3.4 Field Touch-Up

.1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 This section relates to civil concrete work external to the building, associated with subsurface utility works, manholes, catchbasins, lawn drains, watermains, Building structure concrete and concrete walks are specifically excluded from the scope of this section.

1.2 RELATED SECTIONS

.1 Section 33 05 13 – Manholes and Catchbasin Structures

.2 Section 33 11 16 – Site Water Utility Distribution Piping

1.3 REFERENCES

.1 ASTM International

.1 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

.2 ASTM D260-86(2001), Standard Specification for Boiled Linseed Oil.

.3 ASTM D1751-04, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non extruding and Resilient Bituminous Types).

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-19.24-M90, Multicomponent, Chemical-Curing Sealing Compound.

.3 CSA International

.1 CSA-A23.1/A23.2-2004, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.3 CAN/CSA-G30.18-M92(R2002), Billet-Steel Bars for Concrete Reinforcement.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

1.5 QUALITY ASSURANCE

.1 Provide to Departmental Representative, 2 weeks minimum prior to starting concrete work, valid and recognized certificate from plant delivering concrete.

.1 Quality Control Plan (QCP): provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements. The QCP is to include details of the sampling

and testing of concrete in compliance with CSA-A23.1. The results of all testing are to be furnished to the Departmental Representative.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.

.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

Part 2 Products

2.1 PERFORMANCE CRITERIA

.1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

2.2 MATERIALS

.1 Cement: to CSA A3001.

.2 Water: to CSA A23.1/A23.2.

.3 Reinforcing bars: to CAN/CSA-G30.18, Grade 400.

.4 Welded steel wire fabric: to ASTM A185.

.5 Premoulded joint filler:

.1 Bituminous impregnated fibreboard: to ASTM D1751.

.6 Joint sealer/filler: grey to CAN/CGSB-19.24, Type 1, Class B.

.7 Sealer: boiled linseed oil to ASTM D260, mixed with mineral spirits 1:1 proprietary poly-siloxane resin blend.

.8 Waterstops: extruded ribbed PVC strips, 12MPa tensile strength, minimum 350% elongation, minus 45 to plus 80 degrees centigrade working temperature.

.9 Supplementary and other concrete materials: to CSA A23.1/A23.2.

2.3 MIXES

.1 Alternative 1 - Performance Method for specifying concrete: to meet Departmental Representative performance criteria to CSA A23.1/A23.2.

.1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 – FIELD QUALITY CONTROL.

.2 Intended application: Subsurface civil works.

.1 Uniformity and workability: free of loss of mortar, segregation.

.2 Durability and class of exposure: C-4.

.3 Compressive strength at 28 days: 25 MPa minimum.

.4 Nominal maximum aggregate size 28 mm.

.5 For cast-in-place manhole bases achieve reduced permeability in the long term.

.3 Concrete supplier's certification required.

.4 Provide quality management plan to ensure verification of concrete quality to specified performance.

Part 3 Execution

3.1 PREPARATION

.1 Provide Departmental Representative 24 hours notice before each concrete pour.

.2 During concreting operations:

.1 Development of cold joints not allowed.

.2 Ensure concrete delivery and handling facilitates placing with minimum of rehandling, and without damage to existing structure or Work.

.3 Protect previous Work from staining.

.4 Clean and remove stains prior to application of concrete finishes.

3.2 INSTALLATION/APPLICATION

.1 Do cast-in-place concrete work in accordance with CSA A23.1/A23.2.

.2 Sleeves and inserts:

.1 Cast in sleeves, ties, slots, anchors, reinforcement, frames, conduit, bolts, waterstops, joint fillers and other inserts required to be built-in.

.2 Sleeves and openings greater than 100 mm x 100 mm not indicated, must be reviewed by Departmental Representative.

3.3 FINISHES

.1 Formed surfaces exposed to view: in accordance with CSA A23.1/A23.2, unless specified otherwise.

3.4 CURING

.1 Use curing compounds compatible with applied finish on concrete surfaces free of bonding agents and to CSA A23.1/A23.2.

3.5 FIELD QUALITY CONTROL

.1 Concrete testing: to CSA A23.1/A23.2 by independent testing laboratory. A minimum of 2 tests per batch are required.

3.6 CLEANING

.1 Use trigger operated spray nozzles for water hoses.

.2 Designate cleaning area for tools to limit water use and runoff.

END OF SECTION

1.0 GENERAL

1.1 Related Work

.1	Section 03 10 00	Concrete Forming and Accessories
.2	Section 03 20 00	Concrete Reinforcing
.3	Section 03 35 00	Concrete Finishing

1.2 References

.1 American Society for Testing and Materials International (ASTM)

- .1 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
- .2 ASTM D260-86(2001), Standard Specification for Boiled Linseed Oil.
- .3 ASTM D1751-04(2008), Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non extruding and Resilient Bituminous Types).

.2 Canadian Standards Association (CSA International)

- .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
  - .1 CSA-A3001-08, Cementitious Materials for Use in Concrete.
- .2 CAN/CSA-G30.18-09, Billet-Steel Bars for Concrete Reinforcement.

1.3 Design Requirements

.1 Alternative 2 - Prescription: in accordance with CSA-A23.1/A23.2, and as described in Mixes of PART 2 - PRODUCTS.

1.4 Submittals

.1 Submittals in accordance with Section 01 01 50 – General Instructions.

.2 Shop Drawings:

- .1 Submit placing drawings prepared in accordance with plans to clearly show size, shape, location and all necessary details of reinforcing.
- .2 Submit drawings showing formwork and falsework design to: CSA-A23.1/A23.2.
- .3 Drawings to bear stamp and signature of qualified professional engineer registered or licensed in British Columbia.

.3 At least 4 weeks prior to beginning Work, inform Departmental Representative source of fly ash and submit samples to Departmental Representative.

.1 Do not change source of Fly Ash without written approval of Departmental Representative.

.4 At least 4 weeks prior to beginning Work, submit to Departmental Representative samples of following materials proposed for use: curing compound.

.5 Submit samples of materials to be used in concrete mix for testing:

.1 Supplementary cementing materials.

.2 Blended hydraulic cement.

.3 Admixture.

.6 Submit testing inspection results and reports for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.

.7 Concrete hauling time: submit for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.

1.5 Quality Assurance

.1 Submit to Departmental Representative, minimum 4 weeks prior to starting concrete work, valid and recognized certificate from plant delivering concrete.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.6 Delivery, Storage and Handling

.1 Concrete hauling time: maximum allowable time limit for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.

.1 Modifications to maximum time limit must be agreed to by the Departmental Representative and concrete producer as described in CSA A23.1/A23.2.

.2 Deviations to be submitted for review by the Departmental Representative.

.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

1.7 Waste Management and Disposal

.1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

.2 Ensure emptied containers are sealed and stored safely.

.3 Use excess concrete for:

.4 Divert unused concrete materials from landfill to local facility as reviewed by Departmental Representative.

.5 Provide appropriate area on job site where concrete trucks and be safely washed.

.6 Divert admixtures and additive materials from landfill to approved official hazardous material collections site as reviewed by Departmental Representative.

.7 Unused admixtures and additive materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard

2.0 PRODUCTS

2.1 Materials

.1 Cement: to CAN/CSA-A3001, Type GU.

.2 Blended hydraulic cement: Type GUb to CAN/CSA-A3001.

.3 Supplementary cementing materials: with minimum 10% Type F fly ash replacement, by mass of total cementitious materials to CAN/CSA A3001.Water: to CSA-A23.1/A23.2.

.4 Air entraining admixture: to CAN/CSA-23.1

.5 Chemical admixtures: to CAN/CSA-A23.1 as approved by Departmental Representative.

.6 Reinforcing bars: to CAN/CSA-G30.18, Grade 400.

.7 Welded steel wire fabric: to ASTM A185.

.8 Premoulded joint filler:

.1 Bituminous impregnated fibreboard: to ASTM D1751.

.9 Joint sealer/filler: grey to ASTM C920, Type S, Grade P, Class 25.

.10 Sealer: boiled linseed oil to ASTM D260, mixed with mineral spirits 1:1 proprietary poly-siloxane resin blend. Exterior pavement areas : to ASTM C309 Liquid Membrane-Forming compound for Curing Concrete, Type 1.

.11 Other concrete materials: to CSA-A23.1/A23.2.

2.2 Mixes

.1 Proportion normal density concrete in accordance with CAN/CSA-A23.1, Alternative 1 to give the following properties:

.1 Cement: Type GU Portland cement
.2 Minimum compressive strength at 28 days, class of exposure and nominal size of coarse aggregate:

Member	minimum 28-days strength (MPa)	maximum aggregate size (mm)	exposure class Category	air content
Perimeter footings, Exterior footings	25	25	F-2	1
Slab on grade (Exterior)	35	20	C-1	1
Slab on grade (Interior)	25	20	N	-
Topping on Metal Deck	20	10	N	-

.3 Slump at time and point of discharge: To CSA-A23.1 Clause 4.3.2.3. When super plasticizers are used, the slump may be increased by shall kept below the point where segregation will occur. The cost of super plasticizers shall be included in the cost of the concrete. Smaller aggregate size may be used where necessary to increase slump.
.4 Air content: To CSA-A23.1 Table 2 & 4 to suit appropriate exposure class.
.5 Chemical admixtures: following admixtures in accordance with to ASTM C494M. Admixtures shall contain no salts or acids.
.6 Concrete mix designs shall be submitted to a material consultant for approval and to Departmental representative for review prior to any concrete work.

3.0 EXECUTION

3.1 Preparation

.1 Provide Departmental Representative 72 hours notice before each concrete pour.

.2 Place concrete to CAN/CSA A23.1, Clause 19; Adhere strictly to CSA A23.1 for proper preparation of Cold Weather Concrete.

.3 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

.4 During concreting operations:

.1 Development of cold joints not allowed.

.2 Ensure concrete delivery and handling facilitates placing with minimum of rehandling, and without damage to existing structure or Work.

.5 Protect previous Work from staining.

.6 Clean and remove stains prior to application of concrete finishes.

3.2 Construction

.1 Perform cast-in-place concrete work in accordance with CSA-A23.1/A23.2.

3.3 Inserts

.1 Cast in sleeves, ties, slots, anchors, reinforcement, frames, conduit, bolts, waterstops, joint fillers and other inserts required to be built-in.

.1 Sleeves and openings greater than 100 mm x 100 mm not indicated, must be reviewed by Departmental Representative.

3.4 Finishes

.1 Formed surfaces exposed to view: sack rubbed finish in accordance with CSA-A23.1/A23.2.

.2 Interior floor slabs to be left exposed to receive epoxy, carpet, sheet vinyl, other covering requiring smooth surface: initial finishing operations followed by final finishing comprising mechanical floating and steel trowelling as specified in CSA-A23.1/A23.2 to produce hard, smooth, dense trowelled surface free from blemishes.

.3 Floor slabs to receive mortar bed for ceramic or quarry tile: screed to correct grade to provide broomed texture.

.4 Equipment pads: provide smooth trowelled surface.

.5 Pavements, walks, curbs and exposed site concrete:

.1 Screed to plane surfaces and use aluminum floats.

.2 Provide round edges and joint spacings using standard tools.

.3 Trowel smooth to provide lightly brushed non-slip finish.

3.5 Control Joints

.1 Cut and form control joints in interior and exterior slabs on grade at locations indicated, in accordance with CSA-A23.1/A23.2 and install specified joint sealer/filler.

.2 Provide saw cuts details as follows:

.1 Interior slab on grade:

.1 Install 35mm deep saw cut control joint @ 4500mm grid maximum for 150 thick concrete slab.

.2 Install 50mm deep saw cut control joint @4500mm grid maximum for 200 thick concrete slab.

.2 .Exterior Slab on grade:

.1 Install 25mm deep saw cut control joint @ 2000mm grid maximum for 100 thick concrete slab.

3.6 Expansion and Isolation Joints

.1 Install premoulded joint filler in expansion and isolation joints full depth of slab flush with finished surface to CSA-A23.1/A23.2.

3.7 Curing

.1 Use curing compounds compatible with applied finish on concrete surfaces free of bonding agents and in accordance with CSA-A23.1/A23.2.

3.8 Sealing

.1 Following curing, apply two even coats of linseed oil mixture to clean dry surfaces, each at 8 m^2/L. Allow first coat to dry before applying second coat. Apply poly-siloxane resin blend sealer at 4 m^2/L.

3.9 Site Tolerances

.1 Concrete floor slab finishing tolerance in accordance with CSA-A23.1/A23.2.

3.10 Field Quality Control

.1 Concrete testing: to CSA-A23.1/A23.2 by testing laboratory designated by Departmental Representative. The testing costs shall be borne by the Contractor.

3.11 Verification

.1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established in PART 2 - PRODUCTS, by Departmental Representative and provide verification of compliance.

3.12 Cleaning

.1 Use trigger operated spray nozzles for water hoses.

.2 Designate cleaning area for tools to limit water use and runoff.

.3 Cleaning of concrete equipment to be done in accordance with Section 01 01 50 – General Instructions.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1 Section 01 01 50 - General Instructions.

.2 Section 03 30 05 - Cast-in-Place Concrete.

.3 Section 03 35 00 - Concrete Finishing; sealer.

1.2 DESCRIPTION OF WORK

.1 Floor grinding and sealing of new concrete floors as scheduled.

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit data to Departmental Representative for review. Data to show description and operation of equipment, energy requirements, and noise levels expected and concrete sealing products etc.

.2 Mock-up:
- .1 Provide a mock-up area showing the final appearance of floor after grinding, polishing and sealing, in an area designated by the Departmental Representative. Mock-up sample finish will be the approved standard of acceptance used throughout all floor areas.

.3 Maintenance Data:
- .1 Submit maintenance data to Departmental Representative for cleaning of sealed floors and recommended schedule of floor treatment.

.4 Health and Safety:
- .1 Conform to Section 03 35 33 Health and Safety Requirements.
- .2 Reduce silica dust exposure in concrete floor grinding using HEPA extractors, HEPA air scrubbers, personal protection equipment, worker training and education.

2 Products

2.1 MATERIALS

.1 Sealers: non-flammable, non-toxic, breathable, abrasion resistant, water based formulation purpose made for application over existing concrete resulting in a water repellent, and harden surface within seven days. Acceptable Product: Convergent Concrete Technologies - Pentra-Sil or Approved Equal.

.2 Penetrant/coating: high performance lithium-silica and polymer penetrant, solvent free, water based solution providing stain resistance against oils, selected acids, fats and grease. Acceptable Product: Convergent Concrete Technologies - Pentra-Guard or Approved Equal.

.3 Exterior pavement areas : to ASTM C309 Liquid Membrane-Forming compound for Curing Concrete, Type 1.

3 Execution

3.1 INSTALLATION

.1 Grind concrete floors, using approved equipment, in four successive stages with a 30 grit, 40 grit, 60 grit and 80 grit grinding discs to provide a clean and dust contaminant free surface ready for polishing.

.2 Polish floors using 100, 150 and 200 resin ready for sealing.

.3 Apply one coat of penetrating sealer over finished floor in accordance with manufacturer's instructions. Apply two applications of top coat using penetrant/coating to meet surface requirements to match mock-up sample to Departmental representative's approval.

.4 Advise Departmental Representative when floor surface can be put into use and provide maintenance data.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions.

.2 Section 05 05 00 – Metal Fabrications.

.3 Section 05 31 00 - Steel Decking.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM A 36/A 36M-12, Specification for Structural Steel.

.2 ASTM A307-12, Specification for Carbon Steel Bolts and Studs, 60,000psi Tensile.

.3 ASTM A325-10e1, Specification for Structural Bolts, Steel, Heat Treated,120/105 ksi Minimum Tensile Strength.

.4 ASTM A325M-13, Specification for High-Strength Bolts for Structural Steel Joints.

.2 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA).

.1 CISC/CPMA 1-73a, Quick-Drying, One-Coat Paint for Use on Structural Steel.

.2 CISC/CPMA 2-75, Quick-Drying, Primer for Use on Structural Steel.

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA-G40.20-13, General Requirements for Rolled or Welded Structural Quality Steel.

.2 CAN/CSA-G40.21-13, Structural Quality Steels.

.3 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.4 CAN/CSA-S16-14, Design of steel structures, Includes

.5 CSA W47.1-03 (R2009), Certification of Companies for Fusion Welding of Steel Structures.

.6 CSA W48-14, Electrodes.

.7 CSA W55.3-08, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.

.8 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

1.3 DESIGN OF DETAILS AND CONNECTIONS

.1 Design details and connections in accordance with requirements of CAN/CSA-S16, CAN/CSA-S136 with CAN/CSA-S136.1 to resist forces, carry loads, moments and shears indicated.

.2 Submit sketches and design calculations stamped and signed by qualified Professional engineer licensed in Province of British Columbia, Canada for Non Standard connections.

.3 Other steel connections:

.1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institution of Steel Construction" when connection for shears only (standard connection) is required.

.2 All structural steel connectors shall be designed by the fabricator for forces, moments and shears resulting from the specified load and self weight unless noted otherwise. All main connection bolts shall be minimum M20. Use minimum two bolts per connection. All welds shall be 6mm leg minimum.

.3 Where beam shears are not indicated on the drawings, design connections to support the reaction from 120% maximum uniformly distributed factored load that the beam can safely support in bending (60% each end) provided no point loads act on the beam. For beam supporting point loads, design connection to support 50% of the factored shear resistance of the beam, unless noted otherwise on the drawing.

.4 Factored lateral loads for moment frames and cross-bracing shown on the drawings, do not include the requirements for connection design as required by clause 27 of CSA-S16.1. Connection plates and doubler plates to be provided as required by design.

.5 Provide splices as indicated on drawings, unless noted otherwise, all continuous elements called up on the drawings shall be provided with full strength splice either by full strength groove weld or by full strength splice plates on each end of the connection elements.

.6 Submit design details with shop drawings for details not shown on plans.

1.4 SUBMITTALS

.1 Submit shop drawings including fabrication and erection documents and materials list as well as anchor bolt layout and embedded plate layout in accordance with Section 01 01 50 – General Instructions.

.2 On erection drawings, indicate all details and information necessary for assembly and erection purposes such as, description of methods, sequence of erection, type of equipment used in erection and temporary bracings.

.3 Ensure Fabricator designed assemblies, components and connections, and drawings are stamped and signed by qualified professional engineer licensed in BC.

.4 The Professional Engineer responsible for the shop drawings shall inspect the installation of the work for conformance with the design and the shop drawings, and shall upon completion of the work, provide to the Departmental Representative a completed Schedules S-B: Assurance of Professional Design an Commitment for Field Review by Supporting Registered Professional, and Schedules S-C: Assurance of Professional Field Review and Compliance by Supporting Registered Professional.

1.5 QUALITY ASSURANCE

.1 Submit 2 copies of mill test reports showing chemical and physical properties and other details of steel to be incorporated into work at least 2 weeks prior to fabrication of structural steel. Mill test reports shall be certified by metallurgists qualified to practice in British Columbia, Canada.

.2 Fabricator of structural steel shall, in addition, provide an affidavit stating that materials and products used in fabrication conform to applicable material and products standards called for by design drawings and specifications.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50 – General Instructions.

Part 2 Products

2.1 MATERIALS

.1 Structural steel: to CAN/CSA-G40.21 Grade as indicated on drawings.

.2 Anchor bolts: ASTM A307 unless noted otherwise on drawings.

.3 Bolts, nuts and washers: to ASTM A325.

.4 Welding materials: to CSA W48 Series and CSA W59 and certified by Canadian Welding Bureau.

.5 Field paint primer: zinc rich, read mix to MPI Manual-MPI #200.

.6 Galvanize touch-up primer: zinc rich, read mix to MPI Manual-MPI #200.

2.2 FABRICATION

.1 Fabricate structural steel in accordance with CAN/CSA-S16 and in accordance with reviewed shop drawings.

.2 Provide welds to CSA CSAW48 Series and CSA W59 and certified by Canadian Welding.

2.3 FIELD PAINTING

.1 Clean, prepare surfaces and field prime structural steel in accordance with CAN/CSA-S16.

.2 Sand blast Cleaning to bare surface of existing members, remove loose mill scale, rust, oil, dirt and other foreign matter by approved sandblasting to meet WCB Requirements. Prepare surface according to SSPC SP7 brush off blast.

.3 Apply one coat of zinc rich in field to steel surfaces to achieve minimum dry film thickness of 3 to 4 mils, except:

.1 Surfaces and edges to be field welded.

.2 Faying surfaces of friction-type connections.

.4 Apply paint on site under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.

.5 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.

.6 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

Part 3 Execution

3.1 GENERAL

.1 Structural steel work: in accordance with CAN/CSA-S16.

.2 Welding: in accordance with CSA W59.

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

3.2 CONNECTION TO EXISTING WORK

.1 Verify dimensions and condition of existing work, report discrepancies and potential problem areas to Departmental Representative for direction before commencing fabrication.

3.3 MARKING

.1 Mark materials in accordance with CAN/CSA G40.20/G40.21. Do not use die stamping. If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.

.2 Match marking: shop mark, bearing assemblies and splices for fit and match.

3.4 ERECTION

.1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16, CAN/CSA-S136 and in accordance with approved, reviewed erection drawings.

.2 Field cutting or altering structural members: to approval of Departmental Representative.

.3 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.

.4 Continuously seal members by continuous welds where indicated. Grind smooth.

.5 Precaution must be made to removal of Existing Lead Based paint by WCB standards.

.6 Clean with mechanical brush and touch up field primer to bolts, rivets, welds and burned or scratched surfaces at completion of work.

3.5 FIELD QUALITY CONTROL

.1 The Departmental Representative will not be responsible for inspection of the Contractor's work as described in Clause 7.12 of the CISC Code of Standard Practice for Structural Steel. The Contractor is responsible for the accuracy and completeness of his own work and shall verify that the structural steel has been fabricated, erected and finished in accordance with the contract specifications.

.2 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Departmental Representative.

SCHEDULES OF INSPECTION AND TESTING OF MATERIALS

.1 Non destructive Testing of welds:
  i) 100% of all welds to be visually inspected (Shop & Field).
.2 Perform bolt torque test to all bolted connections.
.3 Verify the certification and conformance of the steel fabricator and erector to any relevant CSA Standards.

.3 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Departmental Representative.

.4 Submit test reports to Departmental Representative within 1 week of completion of inspection.

.5 Costs of tests shall be borne by the Contractor.

3.6 FIELD PAINTING

.1 Paint in accordance with Section 09 91 23 – Finish Painting.

.1 Touch up damaged surfaces and surfaces unpainted field coat with zinc rich, read mix to MPI product #76 except as specified otherwise. Apply in accordance with MPI system INT5.1A.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

.1	Painting	Section 09 91 23
.2	Steel Deck	Section 05 31 00

1.2 REFERENCES

.1 Canadian Standards Association (CSA).

- .1 CAN/CSA-G40.20-13, General Requirements for Rolled or Welded Structural Quality Steel.
- .2 CAN/CSA-G40.21-13, Structural Quality Steels.
- .3 CAN/CSA-S16-14, Limit States Design of Steel Structures.
- .4 CAN/CSA-S136-12, Cold Formed Steel Structural Members.
- .5 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel Structures.
- .6 CSA W55.3-08, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
- .7 CSA W59-13, Welded Steel Construction (Metal Arc Welding)
- .8 CSA W59S1-M1989 (R1998), Supplement No. 1 to W59-M1989 Welded Steel Construction (Metal Arc Welding).

.2 Canadian General Standards Board (CGSB).

- .1 CAN/CGSB-1.40-M89, Primer Structural Steel, Oil Alkyd Type.
- .2 CAN/CGSB-1.105-M91, Quick Drying Primer.
- .3 CGSB 85-GP-14M-78, Painting Steel Surfaces Exposed to Normally Dry Weather.
- .4 CAN/CGSB-85.100-93, Painting.

.3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA).

- .1 CISC/CPMA 2-75, Quick-Drying, Primer for Use on Structural Steel.
- .2 CISC/CPMA 1-73b, Quick-Drying, One-Coat Paint for Use on Structural Steel.

1.3 QUALITY ASSURANCE

.1 At least 4 weeks prior to fabrication of steel joists and accessories, submit 2 copies of mill test reports showing chemical and physical properties and other details of steel to be incorporated into work. Such mill test reports shall be certified by qualified metallurgists confirming that tests conform to requirements of CAN/CSA G40.20 and CAN/CSA G40.21.

.2 Fabricator of structural steel joists shall, in addition, provide an affidavit stating that materials and products used in fabrication conform to applicable material and products standards called for by design drawings and specifications.

1.4 DESIGN OF STEEL JOISTS AND BRIDGING

.1 Design steel joists and bridging to carry loads indicated on drawings in accordance with CAN/CSA-S16-01, CAN/CSA-S136.

.2 Design joists and anchorages for uplift forces as required by the Building Code unless otherwise indicated on the drawings.

.3 Ensure joists are manufactured to consider load effects due to fabrication, erection and handling.

.4 Limit natural frequency of joist/floor system to between 5Hz and 8Hz.

.5 Perform floor vibration analysis as directed by Department Representative.

.6 Submit 3 copies of calculations and joist design drawings for typical joists for Departmental Representative review at least 4 weeks prior to fabrication and/or delivery.

1.5 SHOP DRAWINGS

.1 Submit shop details and erection drawings in accordance with Section 01 33 00 – Shop Drawings, Product Data & Samples.

.2 Submit drawings stamped and signed by qualified professional engineer registered or licensed in province of British Columbia, Canada.

.3 On erection drawings, indicate relevant details such as joist mark, depth, spacing, bridging lines, bearing, anchorage and other details.

.4 In shop details, provide particulars relative to joist geometry, framed openings, splicing details, bearing and anchorage. Include member size, properties, specified and factored member loads, and stresses under various loadings, deflection and camber.

.5 The Professional Engineer responsible for the shop drawings shall inspect the installation of the work for conformance with the design and the shop drawings, and shall upon completion of the work, provide to the Departmental Representative a completed Schedule S-B: Assurance of Professional Design and Commitment for Field Review by Supporting Registered Professional, and Schedule S-C: Assurance of Professional Field Review and Compliance by Supporting Registered Professional.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50 – General Instructions.

2.0 PRODUCTS

2.1 MATERIALS

.1 Structural steel: to CAN/CSA-G40.21 and CAN/CSA-S136.

.2 Welding materials: to CSA W59 with CSA W59S1.

.3 Shop paint primer: to CISC/CPMA 2.

.4 Shear studs: to CSA W59, Appendix H with CSA W59S1.

2.2 FABRICATION

.1 Fabricate steel joists and accessories as indicated in accordance with CAN/CSA-S16-01, CAN/CSA-S136 and in accordance with reviewed shop drawings.

.2 Weld in accordance with CSA W59 and with CSA W59S1.

.3 Provide bottom chord extensions where indicated.

.4 Provide diagonal and horizontal bridgings and anchorages in accordance with CAN/CSA-S16.

2.3 SHOP PAINTING

.1 Clean, prepare and shop prime all surfaces of steel joists to CAN/CSA-S16.

.2 Clean all members of loose mill scale, rust, oil, dirt and other foreign matter. Prepare surfaces in accordance with SSPC SP 1 brush off blast.

.3 Apply one coat of CISC/CMPA-2 primer to all steel surfaces to achieve maximum dry film thickness of 3 mil to 4 mil except:

.1 Surfaces to be encased in concrete.
.2 Surfaces to receive field installed stud shear connectors.
.3 Surfaces and edges to be field welded.
.4 Faying surfaces of friction-type connections.
.5 Below grade surfaces in contact with soil.

.4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5□C.

.5 Maintain dry condition and 5□C minimum temperature until paint is thoroughly dry.

.6 Strip paint bolts, nuts, sharp edges and corners before prime coat is dry.

3.0 EXECUTION

3.1 GENERAL

.1 Structural steel work: in accordance with CAN/CSA-S16, CAN/CSA-S136.

.2 Welding: in accordance with CSA W59.

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding and/or CSA W55.3 for resistance welding.

.4 Provide certification that all welded joints are qualified by Canadian Welding Bureau.

3.2 CONNECTION TO EXISTING WORK

.1 Verify dimensions and condition of existing work; report any discrepancy and potential problem areas to Departmental Representative for direction before commencing fabrication.

3.3 FIELD QUALITY CONTROL

.1 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Departmental Representative.

.2 Testing laboratory will inspect representative joists for integrity, accuracy of fabrication and soundness of welds. Testing laboratory will also monitor test loading of joists used by manufacturer to verify design and check representative field connections. Departmental Representative will determine extent of and identify all inspections.

.3 Submit test report to Departmental Representative within 3 days after completion of inspection.

.4 Costs of tests will be borne by Contractor as specified in Section 01 11 55 – General Instructions.

3.4 ERECTION

.1 Erect steel joists and bridging as indicated in accordance with CAN/CSA-S16-01 and in accordance with reviewed erection drawings.

.2 Complete installation of all bridging and anchorages before placing construction loads on joists.

.3 Field cutting or altering joists or bridging: to approval of Departmental Representative.

.4 Clean and touch up shop primer to bolts, welds, burned or scratched surfaces at completion of erection.

3.5 FIELD PAINTING

.1 Paint: in accordance with Section 09 91 23 – Painting.

.2 Touch up all damaged surfaces and surfaces without shop coat with primer in accordance with manufacturers' recommendations to CGSB 85-GP-14M.

END OF SECTION

1.0 General

1.1 RELATED WORK

.1 Section 05 12 23 - Structural Steel For Buildings.

.2 Section 07 46 13 - Wall Cladding Assembly.

1.1 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA)
- .1 CAN/CSA-S136-12, North American Specification for the design of Cold Formed Steel Structural Members.
- .2 CSA W47.1-03(R2009), Certification of Companies for Fusion Welding of Steel Structures.
- .3 CSA W55.3-08, Certification of companies for resistance welding of steel and aluminum.
- .4 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.2 Canadian Sheet Steel Building Institute (CSSBI)
- .1 CSSBI 10M-08, Standard for Steel Roof Deck.

.3 American Society for Testing and Materials International, (ASTM)
ASTM A 653/A653M-08, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.2 WELDING QUALIFICATIONS

.1 Erection companies must be certified by the Canadian Welding Bureau (CWB) under CAN/CSA-W47.1 Certification of Companies for Fusion Welding of Steel Structures, and welding operators must be qualified by CWB for deck welding.

1.3 DESIGN REQUIREMENTS

.1 Steel deck and connections to steel framing to carry dead, live and other loads including lateral loads, diaphragm action and uplift as indicated.

.2 Deflection under specified live load not to exceed 1/240 of span, except that when gypsum board ceilings are hung directly from deck, live load deflection not to exceed 1/360 of span.

1.4 SUBMITTALS

.1 Welders must present proof of their certification to the Departmental Representative before welding commences.

.2 Submit shop drawings in accordance with Section 01 01 50 - General Instructions.

.3 Indicate deck plan, profile, dimensions, base steel thickness, metallic coating designation, connections to supports and spacings, projections, openings, reinforcement details and accessories.

.4 Submit shop drawings for gravity load only to be stamped and signed by qualified professional engineer registered or licensed in Provinces of British Columbia, Canada.

.5 The Professional Engineer responsible for the shop drawings shall inspect the installation of the work for conformance with the design and the shop drawings, and shall upon completion of the work, provide to the Departmental Representative a completed Schedules S-B: Assurance of Professional Design an Commitment for Field Review by Supporting Registered Professional, and Schedules S-C: Assurance of Professional Field Review and Compliance by Supporting Registered Professional.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50 - General Instructions.

.2 Divert unused metal 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 location where it will pose health or environmental hazard.

.5 Dispose of unused caulking material at official hazardous material collections site approved by Departmental Representative.

2.0 Products

2.1 MATERIALS

.1 Zinc coated steel sheet: to ASTM A 653/A653M structural quality Grade A, with Z275 coating.

.2 Closures to external walls: closed cell neoprene as recommended by manufacturer.

.3 Cover plates, deck flute closures and flashings: steel sheet with minimum base steel thickness of 0.91 mm. Metallic coating same as deck material.

.4 Primer: zinc rich, ready mix to MPI Manual, MPI #200.

.5 Caulking: to Section 07 92 10 - Joint Sealing.

.6 Fire stopping: to Section 07 46 13 – Roof and Wall Cladding Assembly.

2.2 TYPES OF DECKING

.1 Roof deck: 0.91 mm minimum base steel thickness, 38 mm deep profile, non-cellular interlocking side laps.

3.0 Execution

3.1 General

.1 Structural steel work: in accordance with CAN/CSA_S136 and CSSBI 10M.

.2 Welding: in accordance with CSA W59, except where specified otherwise.

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel and/or CSA W55.3 for resistance welding.

3.2 ERECTION

.1 Erect steel deck as indicated and in accordance with CSSBI 10M and with reviewed erection drawings.

.2 Where possible, supply and install decking in length that will permit continuity over a minimum of three spans.

.3 Lap ends: to 50 mm minimum.

.4 Provide minimum 20mm Dia. puddle weld spaced at 150mm with side laps button punched @ maximum 450mm for steel deck to steel beams and inserts or as indicated on structural drawings.

.5 OWSJ Size Limits: minimum flat width of the top chord surface, where welding contact will be made, shall be 38 mm. Top chord minimum thickness, at point of welding, is 2.5 times the aggregate thickness of the steel deck material to be welded.

.6 Arc Spot Weld Size Limits: the visible surface diameter of an arc spot weld size is 15mm nominal top diameter.

.7 Fit Up: install the steel deck generally in full contact with the beam flange at point of welding, with no gap greater than 1.5 mm and no deleterious material interposed between deck and beam flange. Primer on beam flange is acceptable.

.8 Immediately after deck is permanently secured in place, touch up metallic coated top surface with primer where burned by welding.

.9 Deck edge:
All edges of steel decking shall be supported by edge angles fastened to main structural members, unless noted otherwise, use L75x75x6 at roofs.

.10 Unless noted otherwise, all members designated as diaphragm chord members and all perimeter edge angles shall be connected by full strength grove welds or by full strength splice plates on each leg to form continuous compression and tension members. Weld edge angles and chords to Beams, joists and shear connectors and weld deck to angles chords and structural members as shown on drawings or as detailed by decking contractor.

3.3 FIELD QUALITY CONTROL

.1 The Departmental Representative will not be responsible for inspection of the Contractor's work as described in Clause 7.12 of the CISC Code of Standard Practice for Structural Steel. The Contractor is responsible for the accuracy and completeness of his own work and shall verify that the structural steel has been fabricated, erected and finished in accordance with the contract specifications.

Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Departmental Representative.

SCHEDULES OF INSPECTION AND TESTING OF MATERIALS

.1 Non-destructive Testing of puddle welds:
i) 100% of all welds to be visually inspected (Field).

.2 Verify the certification and conformance of the erector and welder to any relevant CSA Standards.

.2 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Departmental Representative.

.3 Submit test reports to Departmental Representative within 1 week of completion of inspection.

.4 The costs of tests shall be borne by the Contractor.

3.4 OPENINGS AND AREAS OF CONCENTRATED LOADS

.1 No reinforcement required for openings cut in deck which are smaller than 150 mm square.

.2 For larger openings, detail framing as follows:

Location	Opening Size (In any direction)	Reinforcing
Roof	<150mm but < 500mm	L51x51x6.4 running perpendicular to flutes and welded to minimum two flutes each side of opening
Roof	>500mm	L76x76x6.4 all around and extending to supporting structural steel members

3.5 CONNECTIONS

.1 Install connections in accordance with CSSB1 Steel Roof Deck,10M.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 03 30 05 - Cast-in-Place Concrete for installation of anchors in concrete.

.2 Section 05 51 29 - Metal Stairs.

.3 Section 08 36 12 - Sectional Metal Overhead Doors

.4 Section 09 91 23 - Finish painting.

.5 Section 32 31 13 - Chain link fencing.

1.2 REFERENCE STANDARDS

.1 ASTM International:
- .1 ASTM A53 / A53M - 10 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- .2 ASTM A123 / A123M - 09 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .3 ASTM A 307-10, Specification for Carbon Steel Bolts and Studs, 60,000psi Tensile.
- .4 ASTM A 653/A653M-10, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- .5 ASTM A1011 / A1011M - 10 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- .6 ASTM F1267 - 07, Standard Specifications For Expanded Metal - Steel

.2 CSA International:
- .1 CAN/CSA-G40.21-04(2009), Structural Quality Steels.
- .2 CAN/CSA-S16-01 Consolidation (R2007) includes; Limit States Design of Steel Structures; S16S1-05, Supplement #1 to CAN/CSA-S16-01, Limit States Design of Steel Structures.
- .3 CSA W59-03(R2008), Welded Steel Construction (Metal Arc Welding).

.3 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-1.40-M97, Primer, Structural Steel, Oil Alkyd Type.
- .2 CAN/CGSB-1.181-99, Ready-Mixed, Organic Zinc-Rich Coating.

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 01 50 - General Instructions, Submittals clause.
- .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 01 50 - General Instructions, Submittals clause. Indicate VOC's:
  - .1 For finishes, coatings, primers and paints.

.2 Shop Drawings
- .1 Submit shop drawings in accordance with Section 01 01 50 - General Instructions, Submittals clause.
- .2 Indicate materials, core thicknesses, finishes, connections, joints, method of

anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.4 QUALITY ASSURANCE

.1 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.2 Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:
- .1 Deliver, store, handle and protect materials in accordance with Section 01 01 50 - General Instructions, Common Product Requirements clause.

.2 Storage and Protection:
- .1 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job site.
- .2 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50 - General Instructions for Construction/Demolition Waste Management And Disposal clause.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material in appropriate on-site containers for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CSA-G40.21, Grade 300W.

.2 Steel pipe: to ASTM A53, Type S, Grade A, standard weight.

.3 Welding materials: to CSA W59.

.4 Bolts and anchorbolts: to ASTM A307; corrosion resistant types to ASTM A325M, Type 3. Provide all required anchoring devices including anchor clips, bar and strap anchors, expansion bolts and shields, and other devices designed to support and secure work.

.5 Expanded sheet steel mesh: commercial sheet steel to ASTM A1011 and to ASTM A1267 type II, flattened expanded, class 1 uncoated, Style: 20 - #13, opening size SWD-17 mm x LWD-45 mm ± 1 mm, designed for penetration resistance, sheet thickness 1.78 mm, 72-77% open area and 3.7 kg/m². Acceptable Product: Exmet C3/4-13F or Approved Equal.

.6 Galvanizing: hot dipped galvanizing with minimum zinc coating of 600 g/m² to ASTM A123. All ferrous metal fabrication for exterior locations to be galvanized after fabrication.

.7 Shop coat primer: to CAN/CGSB-1.40M.

.8 Galvanize touch-up primer: zinc rich, ready mix to CAN/CGSB-1.181.

.9 Stainless steel – wall protection Janitor Rm: to ASTM A66 Type 302 or 304 #4 finish, 0.8 mm thickness.

2.2 FABRICATION

.1 Build work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Fabricate items from steel unless indicated otherwise; use galvanized steel for exterior items, unless indicated otherwise.

.3 Use self-tapping shake-proof countersunk flat headed screws on items requiring assembly by screws or as indicated. Use screws for interior work. Use welded connections for exterior work, unless approved otherwise by Engineer.

.4 Where possible, fit and shop assemble work, match mark, ready for erection.

.5 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush with sharp edges and corners rounded to 3 mm radius. Where continuous welds may cause distortion of fabrication use stitch welds and plastic filler, grind and sand smooth.

.6 Seal exterior steel fabrications to provide corrosion protection in accordance with CAN/CSA-S16.

2.3 MISCELLANEOUS STEEL BRACKETS AND ANGLES

.1 Supply for installation by respective trades. Drill for countersunk screws and anchor bolts.

.2 Prime paint interior steel and hot dip galvanized exterior steel.

2.4 OVERHEAD DOOR FRAMES

.1 Description: formed 4.8 mm thickness steel plate frames at jambs and head of door opening size with four evenly spaced anchor holes at each jamb .

.2 Provide steel plate jamb extensions fastened to interior wall blocking, to suit overhead door hardware mounting requirements.

.3 Grind welds smooth.

.4 Hot dip galvanize finish.

2.5 OVERHEAD DOOR TRACKGUARDS

.1 Fabricate 1500 mm long trackguards from 75 x 152 x 4.8 mm 'Z' shaped formed bent plate with four 13 mm φ holes on one leg for fastening to door frame

.2 Apply one coat of primer.

2.6 OVERHEAD DOOR CHAIN PROTECTION

.1 Fabricate strap anchors from galvanized steel and provide anchor bolt as indicated and specified in Section 08 36 12 Sectional Metal Overhead Doors.

2.7 FLOOR EDGE ANGLES

.1 Fabricate steel edge angles, with bent anchors weld to back of angle leg, for setting into contrete at mezzanine floor, or welding directly to steel structural floor.

.2 Prime paint.

2.8 PIPE GUARDRAIL AND HAND RAILING

.1 Handrails:
- .1 Steel pipe: 42 mm OD with ends closed. Handrails with 300 mm long horizontal section at top and bottom of stair radiused towards wall.
- .2 Provide purpose made steel brackets spaced at maximum 825 mm o.c. and designed to hold railing 40 mm clear of wall. Bracket not to break handhold.
- .3 Prime paint handrail and brackets.

.2 Guardrail:
- .1 40 mm and 20 mm nominal diameter posts and horizontal framework.
- .2 Fabricate guardrail in sections and provide base plates where no floor edge angle exists, for fastening to concrete floor with four 9.5 mm φ galvanized purpose made expansion inserts drilled into concrete floor.
- .3 Join guardrail together at horizontal members using pipe sleeve slip connections.
- .4 Provide removable guardrail section with pipe sleeves to retain posts and for welding to floor structure with standoff plates.
- .5 Prime paint after fabrication.

.3 Cap and weld exposed ends of handrail and guardrails.

.4 Provide self drilling/threading anchors to steel and expansion anchors for fastening to concrete.

2.9 BOLLARDS

.1 Bollards: 150 mm diameter extra strong pipe, galvanized finish, at locations as indicated.

2.10 FINISHES

.1 Galvanizing: hot dipped galvanizing with minimum zinc coating of 600 g/m² to ASTM A123. Except for pipe railings all ferrous metal fabrication for exterior locations to be galvanized after fabrication.

.2 Shop coat primer: to CAN/CGSB-1.40M.

.3 Galvanize touch-up primer: zinc rich, ready mix to CAN/CGSB-1.181.

2.11 ISOLATION COATING

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

2.12 SHOP PAINTING

.1 Remove scale rust, grease and other surface coating and apply one shop coat of primer to all ferrous metal items after fabrication, with exception of galvanized or concrete encased items.

.2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7°C.

.3 Clean surfaces to be field welded; do not paint.

3 Execution

3.1 ERECTION

.1 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections. Hold in place until concrete embedment are cured.

.2 Provide suitable means of anchorage as indicated or as acceptable to the Engineer, such as dowels, anchor clips, bar anchors, expansion bolts and shields, toggles.

.3 Make field connections with high tensile bolts, to CAN/CSA-S16 or weld.

.4 Hand items over for casting into concrete, building into masonry and to appropriate trades together with setting templates.

.5 Touch-up field welds, bolts and burnt or scratched surfaces after completion of erection using primer.

.6 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

3.2 MISCELLANEOUS STEEL BRACKETS AND ANGLES

.1 Supply to respective trades and install miscellaneous metal items in accordance with reviewed shop drawings and details.

3.3 OVERHEAD DOOR FRAMES

.1 Set frame structure in place plumb and level for installation by trade.

.2 Touchup damaged galvanized surfaces with zinc rich primer.

3.4 OVERHEAD DOOR TRACKGUARDS

.1 Install track guards to steel overhead door frame using bolts in accordance with reviewed

shop drawings.

.2 Touch up damaged surfaces with primer.

3.5 OVERHEAD DOOR CHAIN PROTECTION

.1 Install door chain protection as indicated on drawings using zinc plated anchors.

3.6 EDGE ANGLES

.1 Weld edge angles to mezzanine floor as indicated.
.2 Install angles for support of large louvres.
.3 Install angle for door threshold at roof.

3.7 PIPE GUARDRAIL AND HAND RAILING

.1 Handrails and Guardrails:
  .1 Mount handrails to wall backing in stud walls with purpose made fasteners at wall brackets.
  .2 Weld guard rails to stair stringer, floor edge angles and to concrete floor with anchor bolts at base plates.
  .3 Connect guardrail sections together horizontally using pipe sleeve slip connections.

.2 Touch up damaged primed surfaces after installation.

3.8 BOLLARDS

.1 Supply to concrete trade for installation.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 03 30 05 - Cast-in-Place Concrete.

.2 Section 05 50 00 - Metal Fabrications.

.3 Section 09 91 23 - Finish painting.

1.2 REFERENCE STANDARDS

.1 American National Standards Institute/National Association of Architectural Metal Manufacturers (ANSI/NAAMM)
- .1 ANSI/NAAMM MBG531-00, Metal Bar Grating Manual.

.2 ASTM International:
- .1 ASTM A 53M-10, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
- .2 ASTM A 653/A653M-10, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .3 ASTM A 307-10, Specification for Carbon Steel Bolts and Studs, 60,000psi Tensile.
- .4 ASTM A123 / A123M - 09 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .5 CAN/CGSB-1.40-M97, Primer, Structural Steel, Oil Alkyd Type.

.3 CSA International:
- .1 CAN/CSA-G40.21-M04(2009), Structural Quality Steels.
- .2 CSA W59-03(R2008), Welded Steel Construction (Metal Arc Welding).

.4 National Association of Architectural Metal Manufactures (NAAMM)
- .1 AMP 510 - 92, Metal Stair Manual.

1.3 SYSTEM REQUIREMENTS

.1 Design metal stair and connections to NBC vertical and horizontal live load requirements.

.2 Detail and fabricate straight and parallel stairs to NAAMM AMP 510 Metal Stairs Manual for service class.

1.4 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 01 50 - General Instructions, Submittals clause.
- .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 01 50 - General Instructions, Submittals clause. Indicate VOC's:
  - .1 For finishes, coatings, primers and paints.

.2 Shop Drawings
- .1 Submit shop drawings in accordance with Section 01 01 50 - General Instructions, Submittals clause.

.2 Indicate materials, core thicknesses, finishes, connections, and joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

.3 Submit shop drawing bearing stamp of a qualified professional engineer registered in Province of BC.

1.5 QUALITY ASSURANCE

.1 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.2 Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50 - General Instructions for Construction/Demolition Waste Management and Disposal clause.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material in appropriate on-site containers for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CSA-G40.21, Grade 300W, checkered plates Grade 260W.

.2 Steel pipe: to ASTM A53, Type S, Grade A, standard weight and extra strong, galvanized finish for bollards.

.3 Steel plate: to CAN/CSA-G40.20/G40.21, Grade260 W.

.4 Welding materials: to CSA W59.

.5 Bolts and anchor bolts: to ASTM A307; corrosion resistant types to ASTM A325M, Type 3. Provide all required anchoring devices including anchor clips, bar and strap anchors, expansion bolts and shields, and other devices designed to support and secure work.

2.2 FABRICATION

.1 Fabricate to NAAMM, Metal Stair Manual, straight and parallel stairs, service class.

.2 Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, colour and finish as base material on which they occur.

.3 Accurately form connections with exposed faces flush; mitres and joints tight. Make risers of equal height.

.4 Grind or file exposed welds and steel sections smooth.

.5 Shop fabricate stairs in sections as large and complete as practicable.

2.3 INTERIOR STEEL PAN STAIRS

.1 Fabricate stairs with closed riser steel pan construction.

.2 Form treads and risers from minimum 2 mm thick steel plate to meet design requirements. Secure treads and risers to L35 x 35 x 5 horizontal and vertical welded to stringers.

.3 Form stringers from MC 310 x 31 or to meet design requirements.

.4 Form landing from 3 mm thick steel plate, reinforced by L 55 x 55 x 6 mm spaced at 400 mm on centre.

.5 Extend stringers past first and last riser minimum 100 mm and to 100 mm above floor finish.

.6 Close ends of stringers where exposed.

.7 Stair stringers and associated framing all shop primed.

2.4 PIPE GUARDRAILS/HAND RAILING

.1 Specified in Section 05 50 00 Metal Fabrications.

2.5 FINISHES

.1 Shop coat primer: to CAN/CGSB-1.40M.

2.6 SHOP PAINTING

.1 Remove scale rust, grease and other surface coating and apply one shop coat of primer to all ferrous metal items after fabrication, with exception of galvanized or concrete encased items.

.2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7°C.

.3 Clean surfaces to be field welded; do not paint.

3 Execution

3.1 INSTALLATION OF STAIRS

.1 Install in accordance with NAAMM, Metal Stair Manual.

.2 Install plumb and true in exact locations, using welded connections wherever possible to provide rigid structure. Provide anchor bolts, bolts and plates for connecting stairs to structure.

Bolted connections preferred for exterior applications.

.3 Do welding work in accordance with CSA W59 unless specified otherwise.

.4 Touch up shop primer to bolts, welds, and burned or scratched surfaces at completion of erection.

3.2 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

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

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 01 01 50 - General Instructions for Waste Management and Disposal.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)
- .1 CSA O121-M1978(R1998), Douglas Fir Plywood.
- .2 CAN/CSA-O141-05, Softwood Lumber.
- .3 CAN/CSA 080.15-M97, Preservative Treatment of Wood for Building Foundation Systems, Basements and Crawlspaces by Pressure Processes.

.2 National Lumber Grades Authority (NLGA)
- .1 Standard Grading Rules for Canadian Lumber 2003.

.3 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.4 AWPA M4-06 - Standard for the Care of Preservative-Treated Wood Products.

.5 ASTM International:
- .1 ASTM A123 / A123M - 09 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM F1667 - 05 Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

1.3 QUALITY ASSURANCE

.1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood identification: by grade mark in accordance with applicable CSA standards.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50 - General instructions for Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused wood materials from landfill to recycling composting facility approved by Engineer.

2 Products

2.1 LUMBER MATERIAL

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in

accordance with following standards:
.1 CAN/CSA-O141 Softwood lumber.
.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Furring and backing in walls:
.1 Dimension sizes: kiln dried framing or better grade, finger-jointed lumber is acceptable.

.3 Blocking, nailers and strapping: S4S Hem-Fir or S-P-F species, NLGA No. 2 or better Grade:
.1 Board sizes: "Standard" or better grade.
.2 Dimension sizes: "Standard" light framing or better grade.

.4 Framing and board lumber: in accordance with NBCC 2005 Subsection 9, except as follows:
.1 All other blocking and framing:
.1 Hem-Fir species, NLGA No. 2 or better grade.
.2 S-P-F species, NLGA No. 1 or better grade.

.5 All wood for exterior areas and lumber in contact with concrete, roofing and flashing, pressure preservative treated.

2.2 PANEL MATERIALS

.1 Douglas fir plywood (DFP): to CSA O121, standard construction.

2.3 PANEL MATERIALS END USES

.1 Miscellaneous plywood panels: DFP or CSP solid one side or G1S grade square edge, 15.5 mm thick, panel mounting boards and as indicated.

.2 Backing in walls: Plywood, DFP, sheathing grade, square edge, 20.5 mm thickness except where specified otherwise.

.3 Roof parapet sheathing: DFP sheathing grade, square edge, 15.5 mm thick, pressure preservative treated.

2.4 ACCESSORIES

.1 Nails, spikes and staples: ASTM F1667.

.2 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.

.3 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.

.4 Galvanizing: to ASTM A123 / A123M, use galvanized fasteners for exterior work and in pressure-preservative treated lumber. Screw fasteners with applied epoxy or polymer coating is also acceptable.

.5 Wood plates in contact with concrete: use pressure preservative treated wood D-Fir Grade No. 1 or better with compressible gasket filler of either 25 mm fibreglass insulation, closed cell polyethylene sponge 3 mm thick or roll roofing.

.6 Air barrier membrane: Specified in Section 07 27 10.

2.5 WOOD PRESERVATIVE

.1 Pressure Impregnation Wood Preservative: Material to bear Canadian Wood Preservers Bureau (CWPB), CSA 080 or AWPA stamps.

.1 Wood out of ground contact and continuously protected from liquid water: Borate pressure treatment to minimum net retention of 2.7 kg/m3 of wood with CWPB Advance Guard quality mark.

.2 Treat material as indicated and as follows:

.1 Wood furring, blocking and nailers etc. on outside face of exterior wall in contact with concrete, roofing membranes and metal flashing.

.2 Wood members in contact with concrete, exterior and soil.

2.6 FIRE RETARDANT TREATMENT

.1 Conform to the following requirements when tested in accordance with ASTM E-91a and CAN/ULC S102-M88 and CAN/CSA O80 Series-08:

.1 Flame spread: 25 or less.

.2 Fuel Contributed: 25 or less.

.3 Smoke Developed: 50 or less.

.2 Fire-retardant treated wood to bear ULC label or be accompanied by certificate acceptable to Consultant showing compliance with ULC approved treatment. Wood treated in accordance with retardant manufacturer's instructions to provide required ULC rating.

3 Execution

3.1 INSTALLATION

.1 Comply with requirements of NBC, supplemented by the following paragraphs.

.2 Install framing members true to line, levels and elevations, square and plumb.

.3 Construct continuous members from pieces of longest practical length.

.4 Install plywood backing in walls to space-out and support wall mounted fixtures, and other work as required.

.5 Align and plumb faces of furring and blocking to tolerance of 1:600.

.6 Install rough bucks, to rough openings as required to provide backing for finish carpentry and other work. Fasten bucks to jamb studs using screws.

.7 Fasten blocking and nailers to steel stud framing using wood screws.

.8 Install wood nailers, blocking, backing for metal flashing, and other wood supports as required and secure using galvanized steel fasteners.

3.2 FURRING, STRAPPING AND BLOCKING

.1 Install furring, strapping and solid backing in walls and structures as required to space-out and support casework, cabinets, applied finishes, facings, pipe chases, wall mounted door stops, electrical and mechanical fixtures and other items as indicated. Use solid blocking or 20.5 mm plywood securely nailed to framing members.

.2 Align and plumb faces of furring and blocking to tolerance of 1:600.

3.3 CURBS, BLOCKING, NAILERS AND PARAPETS

.1 Install wood nailers, cants, blocking and capping for roofing and metal flashing work as indicated. Fasten wood using galvanized steel fasteners in accordance with NBC Part 9. Fasten beveled cedar board to top of parapets

.2 Install pressure treated 15.5 mm plywood at parapets where new waterproofing membrane is installed, screwed to framing at maximum 200 oc spacing along framing members.

.3 All fasteners with non-corroding finish.

3.4 FIELD TREATMENTS OF PRESERVATIVE-TREATED PRODUCTS

.1 Comply with AWPA.M4.

.2 Re-treat surfaces of PT lumber and plywood exposed by cutting, trimming or boring with liberal brush application of preservative before installation.

.3 Use approved preservative to manufacturer's instructions

3.5 ELECTRICAL EQUIPMENT BACKBOARD

.1 Provide backboards for mounting electrical equipment as indicated. Install 19 mm thick fire retardant treated plywood fastened through gypsum board panels into studs using screws at maximum 300 mm oc. Install from floor base level to 2400 mm off floor from top of base.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 06 10 11 - Rough carpentry.

.2 Section 06 30 00 - Plywood Finish

.3 Section 07 92 10 - Joint Sealing.

.4 Section 09 91 23 - Painting and finishing.

.5 Section 11 10 10 - Work Bench.

1.2 REFERENCES

.1 American National Standards Institute (ANSI):
- .1 ANSI/NPA A208.1-2009, Particleboard.
- .2 ANSI A208.2-2009, Medium Density Fibreboard (MDF).

.2 ASTM International:
- .1 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
- .2 ASTM A240/A240M-11b: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- .3 ASTM E 1333-96(2002), Test Method for Determining Formaldehyde Concentrations in Air and Emissions Rates from Wood Products Using a Large Chamber.
- .4 ASTM A123 / A123M - 09 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .5 ASTM F1667 - 05 Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

.3 Architectural Woodwork Institute / Architectural Wood Manufacturer's Association of Canada (AWI/AWMAC)
- .1 Architectural Woodwork Standards, 1st Edition, 2009.

.4 Canadian Standards International (CSA):
- .1 CSA O115-M82(R2001), Hardwood and Decorative Plywood.
- .2 CSA O121-M78(R1998), Douglas Fir Plywood.
- .3 CAN/CSA O141-05, Softwood Lumber.
- .4 CSA-O112 Series M1977, Adhesive, Contact, Brushable.

.5 National Electrical Manufacturers Association (NEMA):
- .1 NEMA LD3-2000, High Pressure Decorative Laminates.

.6 National Hardwood Lumber Association (NHLA):
- .1 Rules for the Measurement and Inspection of Hardwood and Cypress January 2004.

.7 National Lumber Grades Authority (NLGA):
- .1 Standard Grading Rules for Canadian Lumber 2007.

.8 Environmental Choice Program (EPC):

.1 CCD-045-95, Sealants and Caulking Compounds.
.2 CCD-046-95, Adhesives.
.3 CCD-047-05, Architectural Surface Coatings.
.4

1.3 SUBMITTALS

.1 Submit shop drawings, product data, samples and maintenance data in accordance with Section 01 01 50.
.1 Samples:
.1 Submit duplicate 300 x 300 mm samples of each type of solid wood or plywood to receive stain or natural finish.
.2 Plastic Laminate:
.1 Submit duplicate samples of manufacturer's standard range of solid colours and finishes.
.2 Shop drawings:
.1 Clearly indicate details of construction, profiles, jointing, fastening and other related details.
.3 Product Data:
.1 Submit two copies of WHMIS MSDS - Material Safety Data Sheets. Indicate VOC's for adhesives, solvents and cleaners.
.4 Provide maintenance data for plastic laminate work for incorporation into manual.

1.4 PRODUCT HANDLING

.1 Cover finished laminated plastic surfaces with heavy kraft paper or put in cartons during shipment. Protect installed laminated surfaces by approved means. Do not remove until immediately before final inspection.

.2 Do not store or install materials in areas where relative humidity is less than 25% or greater than 60% at 22°C.

2 Products

2.1 MATERIALS

.1 Softwood lumber: to CAN/CSA-0141 and National Lumber Grades Authority (NLGA), 1991 requirements, with maximum moisture content of 12% for interior work, to AWI/AWMAC custom grade construction, D-fir species for all concealed areas except as specified otherwise.

.2 Hardwood lumber: moisture content 12% or less in accordance with following standards:
.1 National Hardwood Lumber Association (NHLA), January 1982.
.2 Species: Clear white birch to match birch plywood.

.3 Douglas fir plywood: to CSA 0121:
.1 Concealed areas: to AWI/AWMAC guidelines.

.4 Hardwood plywood: to CSA O115-M of thickness indicated, rotary cut white birch species veneer of Architectural A-1 grade for exposed fronts and faces, A-2 for shelves, B-1 for interior gables and B-4 for backs. Use birch plywood core. Select veneers to provide slip matching.

.5 Thermally fused plastic finish: Melamine surface both sides of either particleboard or MDF,

minimum 19 mm thickness for areas indicated and shelves inside cabinets. Provide extruded PVC edging for all edges exposed in final assembly.

.6 Interior mat-formed wood particleboard: to CAN3-0188.1.

.7 Medium density fibreboard (MDF): to ANSI A208.2, density 769 kg/m3.

.8 Nails and staples: to ASTM F1667; galvanized for interior highly humid areas and for treated lumber; plain finish elsewhere.

.9 Wood screws: steel, electro-plated.

.10 Plastic Laminate:
- .1 Based on standard colour range with selected texture finish conforming to the following:
  - .1 Laminated plastic for flatwork: to CAN/CSA-A172, Grade GP, Standard Duty, 1.15 mm thick for horizontal surfaces and 0.8 mm for vertical surfaces.
  - .2 Laminated plastic for post forming work: to CAN3-A172, Grade PF, minimum 0.75 mm thick.
  - .3 Backing grade laminated plastic: minimum 0.7 mm thick, same manufacturer as facing sheet, sanded one (1) face.
- .2 Core:
  - .1 For post formed countertops: particle board to CAN3-0188.1, sanded faces, of minimum 19 thickness.
  - .2 For non-post formed horizontal and vertical surfaces: D-Fir plywood, 19 mm thickness.
- .3 Laminated plastic adhesive: Low VOC contact adhesive.
- .4 Sealant: silicone, one component to CAN/CGSB-19.18.
- .5 Draw bolts and splines: type as recommended by fabricator.
- .6 Sealer: water resistant sealer or glue acceptable to laminate manufacturer.

.11 Casework hardware furnished and installed under this Section as follows:
- .1 Counter/cupboard door hinges: self-closing, 3-way adjustable unit for overlay construction or offset concealed type.
- .2 Pulls: 100 mm long "D" shaped chrome plated brass/steel or stainless steel, brushed finish.
- .3 Drawer slides: self-closing, baked-on epoxy coated steel slides with nylon rollers, parallel close feature, with tolerance adjustment on one side and 100% extension, 45 kg capacity.
- .4 Adjustable shelf hardware:
  - .1 Pilaster strips and four clips per shelf. Semi-recess mounted Finish in dull chrome.
  - .2 Plastic inserts for mounting in predrilled holes.
  - .3 Shelf brackets: of size indicated, dull chrome finish.

.12 Applied finish: low VOC clear lacquer, satin finish. Acceptable product: Cloverdale Paint Ecologic water-borne clear lacquer 458 Series or Approved Equal.

2.2 CASEWORK

.1 Fabricate caseworks to AWMAC custom quality grade.

.2 <u>COUNTER AND CUPBOARD UNITS WITH SINKS</u>
- .1 AWMAC custom grade.

.2 Construction: Birch plywood, 19 mm thickness for bulkheads, sides, drawer fronts, doors and shelves.
.3 Second Floor: Counter top and integral surfaces: post-formed plastic laminate on veneer core plywood with integral backsplash and wrap around leading counter edge.
.4 Exposed drawer fronts, doors and faces: 19 mm Birch plywood with solid birch edging and clear finish. 12 mm ply for backs.
.5 Cabinet interior and shelves: Birch ply with solid Birch edging with clear finish.
.6 Interior drawers: Melamine faced MDF with thermally fused pvc or Melamine
.7 Hardware: wire pulls, magnetic catches, drawer slides and pilaster strips with clips.

.3 COUNTER AND CUPBOARD UNITS WITHOUT SINKS
.1 AWMAC custom grade.
.2 Construction: Birch plywood, 19 mm thickness for bulkheads, sides, drawer fronts, doors and shelves. D-Fir framing for counter top extensions mounted to wall framing as indicated.
.3 Second Floor: Counter top and integral surfaces: post-formed plastic laminate on MDF core with integral backsplash and wrap around leading counter edge.
.4 Exposed drawer fronts, doors and faces: 19 mm Birch plywood with solid birch edging and clear finish. 12 mm ply for backs.
.5 Cabinet interior and shelves: Birch ply with solid Birch edging with clear finish.
.6 Interior drawers: Melamine faced MDF with thermally fused pvc or Melamine
.7 Hardware: wire pulls, magnetic catches, drawer slides and pilaster strips with clips.

.4 SHELVING UNITS
.1 AWMAC custom grade.
.2 Construction: 19 mm thickness G2S Birch plywood, gables, shelves, top, bottom and 12 mm ply back, and clear finish.
.3 Shelves: 19 mm birch plywood, fixed and adjustable.
.4 Edge banding: solid Birch edging.
.5 Adjustable shelves: with pilaster strips and clips.

.5 SINGLE SHELF UNITS
.1 AWMAC custom grade.
.2 Construction: 38 x 89 support frame with 19 mm thickness G1S Birch plywood, shelf, face and 12 mm back with paint finish.
.3 Edge banding: solid Birch edging.

.6 RUNNING TRIM
.1 AWMAC custom grade.
.2 Material and Finish:
.1 Solid Birch species to match Birch plywood.

.7 WINDOW OPENING LINERS AND TRIMS
.1 Window stools and trim to be AWMAC custom grade construction Birch plywood with Birch edging and matching trim.
.2 Fit backs of trim snug to wall surfaces to eliminate cracks at junction of trim with walls.
.3 Install window liners and trim in maximum lengths with T&G joints.

.8 STAINLESS STEEL COUNTERTOPS
.1 Ground floor: 1.52 mm (16 ga), type 316 stainless steel with No. 4 finish, laminated to 2 layers 19 mm marine grade plywood core, with marine edges, backsplash on back and leading edge.

2.3 DRAWERS

.1 Fabricate drawers to AWMAC custom grade supplemented as follows:
- .1 Sides and Backs.
  - .1 Melamine faces, 12.7 mm thickness.
- .2 Bottoms:
  - .1 Melamine faces, 6.4 mm thickness.
- .3 Fronts and Edges:
  - .1 19 mm thickness, plywood and finish as indicated.

2.4 SHOP FABRICATION - PLASTIC LAMINATE

.1 Counters with basins:
- .1 Form shaped profiles and bends as indicated, using post forming grade laminate to laminate manufacturer's instructions.
- .2 Keep joints 600 mm from sink cutouts. Where joints are unavoidable, on tops longer than 3000, use draw bolts and splines.

.2 Use straight self-edging laminate strip, at post-formed tops, to cover exposed ends of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.

.3 Comply with CAN3-A172, Appendix "A".

2.5 EDGE BANDING

.1 Melamine panels: thermally fused PVC.

.2 Plastic laminate edging for countertops, fronts and facings.

2.6 FABRICATION

.1 Set nails and countersink screws, apply matching wood filler to indentations, sand smooth and leave ready to receive finish.

.2 Shop install cabinet hardware for doors, shelves and drawers.

.3 Provide cutouts for fixtures, inserts and as indicated.

.4 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.

2.7 FINISHING

.1 Except as indicated otherwise Birch veneered and trim surfaces of cabinets: factory applied, low VOC clear lacquer in satin finish.

.2 Site finishing of wood window casing/stools specified in Section 09 91 23.

2.8 FABRICATION STAINLESS STEEL COUNTERTOPS

.1 Form edges of exposed tops into a channel shape with wood inserts on all four edges of underside of top to facility anchoring to the base units.

.2 Form backsplash and curbs from the same stainless steel sheet as top; form top edges of curbs and backsplashes into a channel shape.

.3 Perform welding without discolouration and grind, polish and passivate to blend harmoniously with the work surface finish.

.4 Form mechanical or filed joints to tight butt joint to top surfaces, reinforced and held in alignment with steel reinforcements.

.5 Protect the surface of the tops with strippable plastic coating to protect the tops during shipment and installation.

.6 Coordinate installation of stainless steel tops with Cabinet work specified in this Section.

3 Execution

3.1 INSTALLATION

.1 Install prefinished millwork at locations shown on reviewed shop drawings. Position accurately, shim level, plumb and straight.

.2 Fasten and anchor millwork securely. Provide heavy duty fixture attachments for wall mounted cabinets. Coordinate with carpentry trade where backing is required inside walls.

.3 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects. Install trim to conceal spaces between walls and cabinets.

.4 Use draw bolts at joints in countertops.

.5 At junction of plastic laminate counter back splash and adjacent wall finish, apply small bead of silicone sealant for counters with sinks only, except as noted otherwise in high security areas.

.6 Fit hardware accurately and securely in accordance with manufacturer's directions.

3.2 STANDING AND RUNNING TRIM

.1 Butt and cope internal joints of baseboards to make snug and tight. Cut right angle joints of casing and base with mitred joints.

.2 Fit backs of casing snugly to wall surfaces to eliminate cracks at junction of base and casing with walls.

.3 Make joints, in runs longer than 3.6 m using a 45° scarf type joint.

.4 Install trim in single lengths without splicing.

3.3 INSTALLATION SITE APPLIED PLASTIC LAMINATE

.1 Install work plumb, true and square, neatly scribed to adjoining surfaces.

.2 Make allowances around perimeter where fixed objects pass through or project into laminated

plastic work to permit normal movement without restriction.

.3 Use draw bolts and splines in countertop joints. Maximum spacing 450 mm oc., 75 mm from edge. Make flush hairline joints.

.4 Provide cutouts for inserts, grilles, appliances, outlet boxes and other penetrations. Round internal corners, chamfer edges and seal exposed core.

.5 At junction of laminated plastic counter back splash and adjacent wall finish, apply small bead of sealant specified. Use straight self-edging laminate strip, at post-formed tops, to cover exposed ends of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.

3.4 INSTALLATION OF STAINLESS STEEL COUNTERTOPS

.1 Install stainless steel panels, back splashes and counter tops as indicated on the drawings and reviewed shop drawings. Use as long lengths as possible with as few joints as possible. Locate joints where indicated on the reviewed shop drawings. Except for counter tops, ensure all joints are hairline joints and are flush.

.2 All joints in counter tops are to be welded and finished to match adjacent stainless steel and are to be rendered so that they are undistiguishable from adjacent stainless steel. Coordinate installation of stainless steel counter tops to cabinet work, with this Section. Coordinate installation of sinks mechanical fittings with Mechanical.

3.5 PROTECTION

.1 Cover finished laminated plastic surfaces with heavy kraft paper or put in cartons during shipment. Protect installed laminated surfaces by approved means. Do not remove until immediately before final inspection.

3.6 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Perform care and cleaning with CAN3-A172, Annex B.

.3 Remove traces of primer, caulking and filler materials; clean cabinets and millwork.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 06 10 11 - Rough Carpentry.

.2 Section 06 23 00 - Finish Carpentry and Laminated Plastic.

.3 Section 07 92 10 - Caulking.

.4 Section 09 96 59 - Intumescent Coating

1.2 DESCRIPTION OF WORK

.1 Provide 12 mm plywood wall finish over steel stud walls as scheduled.

1.3 REFERENCED STANDARDS

.1 CSA O121-M1978, Douglas Fir Plywood.

2 Products

2.1 LUMBER MATERIAL

.1 Running trim: specified in Section 06 23 00.

2.2 PANEL MATERIALS

.1 Panel standards: type, grade and thickness as specified, in accordance with following standards:
.1 Douglas fir plywood (DFP): to CSA 0121, standard construction.

2.3 PANEL MATERIALS END USES

.1 Interior wall finish: DFP A Grade, sanded one side, veneered patches only, square edge, 19 mm thick.

2.4 FASTENERS

.1 Nails, spikes and staples: to CSA B111-1974.

.2 Proprietary fasteners: self-drilling wood screws with flat heads for countersinking, plated finish. Wood screws without self-drilling feature are permissible with predrilled pilot holes.

3 Execution

3.1 WOOD SUPPORTS, NAILERS AND BLOCKING

.1 Installation of framing, nailers, supports and shims, specified in Section 06 10 11.

3.2 WALL PANEL FINISH

.1 Install interior plywood fastened to framing members on walls, as scheduled, using plated wood screws. Install plywood panels to 2440 mm above floor.

.2 Slightly chamfer corners of plywood panels exposed edges to create a slight v-groove at all joints. Only vertical panel joints are permitted.

.4 Install plywood with panel joints on solid bearing. Screw at perimeter edge 150 mm oc minimum and at interior of panels 300 mm oc minimum.

.6 At 90 degree outside corners and where plywood panels terminate, finish with wood trim D-Fir or hardwood trim to conceal exposed plywood edges, installed in accordance with Section 06 23 00 using finishing nails. Predrill holes and set 2 mm.

.7 Fill all joints, countersunk screws and nail heads with approved wood filler, flush with adjoining surfaces and sand smooth. Use filler compatible with intumescent paint coating.

3.3 FASTENERS

.1 Screws to penetrate through plywood, and metal stud framing. Pre-drill pilot holes at each screw and countersink screw head 2 mm below surface of plywood.

3.5 FINISHING

.1 Fill holes, depressions and joints with wood filler, sand all surfaces smooth, to provide a smooth surface for intumescent paint finish.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 03 30 05 - Cast-in-Place Concrete.

.2 Section 07 21 13 - Board Insulation.

.3 Section 07 26 16 - Underground Vapour Barrier.

1.2 WORK INCLUDED

.1 Spray apply membrane to exterior face of:
- .1 Concrete foundation wall of building in contact with ground, above and below grade level including top of footing. (Damp-proofing)
- .2 Perimeter of foundation wall at elevator pit in contact with ground, including top of footing. (Waterproofing)
- .3 Exterior concrete wall at elevator shaft. (Air/vapour barrier membrane)

.2 Rigid insulation: application to foundation and exterior concrete masonry wall, specified in Section 07 21 13.

1.3 REFERENCES

.1 CAN/CGSB 37.58-M86 Membrane, Elastomeric, Cold Applied Liquid, for Non-Exposed Use in Roofing and Waterproofing.

1.4 ENVIRONMENTAL REQUIREMENTS

.1 Do not proceed with work when temperatures fall below recommended application requirements.

.2 Do not apply during rain or snow unless surfaces are protected to manufacturer's requirements.

1.5 PROTECTION

.1 Provide adequate protection of materials and work of this section from damage by weather backfilling operations and other causes.

.2 Protect work of other trades from damage resulting from work of this section. Make good such damage at own expense to satisfaction of the consultant.

1.6 COMPATIBILITY

.1 Ensure that all materials used are compatible.

1.7 SUBMITTALS

.1 Submit product data in accordance with Section 01 01 50 General Instructions - Submittals clause.

.2 Submit product data sheets for waterproofing membrane and flashings. Include:

.1 Product characteristics.
.2 Performance criteria.
.3 Limitations.

1.8 QUALITY ASSURANCE

.1 Perform Work in accordance with the printed requirements of the membrane manufacturer and this specification. Advise Departmental Representative of any discrepancies prior to commencement of the Work.

.2 Maintain one copy of manufacturer's literature on site throughout the execution of the Work.

.3 Submit documentation certifying that the waterproofing materials comply with CAN/CGSB 37.58, as appropriate for the application.

.4 Submit information indicating that the materials proposed have been installed for not less than five years on projects of similar scope and nature. Submit references for a minimum of five projects.

.5 Installers to complete a certified training program approved by manufacturer.

.6 Spray pump system calibrated by the manufacturer.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.

.2 Store membrane at temperature of 5 degrees C and above to facilitate handling except as noted otherwise by manufacturer's instructions.

1.10 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for disposal and recycling in accordance with Section01 01 50 General Instructions for Construction/Demolition Waste Management and Disposal clause.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for recycling and disposal; paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins in accordance with Waste Management Plan.

2 Products

2.1 MATERIALS

.1 Water based two component membrane, spray applied, with no volatile organic compounds, odourless, non-leaching, dries instantly upon application, meeting requirements specified in table following paragraph 2.1.1.1.
.1 Physical and Performance Requirements for Cold-Applied, Liquid, Elastomeric Roofing and Waterproofing, Non-Exposed:

Property	Unit	Requirement	Results
dimensional stability Water absorption	% %	≤ 5 dimensional change in any direction ≤ 3 change in mass	L2, W2 % 3%, Pass
Adhesion in peel (after water absorption)	N/m	≥ 175	Pass
Crack bridging	no unit	No cracking, splitting or total loss of adhesion	Pass
Low-temperature flexibility	no unit	No cracking when viewed without magnification	Pass
Recovery test	%	≥ 85 0f length after being stretched 100% of it's length	88% Pass
Water tightness	no unit	No leakage	Pass
Sag-flow test (vertical and sloped applications only)	no unit	Shall not flow from 0.75 mm level into the 0.89 mm level	Pass

3 Execution

3.1 PREPARATION

.1 Before application ensure environmental and site conditions are suitable for installation of waterproofing membrane.

.2 Ensure all surfaces are clean, dry, and free of water, frost, dirt, oil, grease, curing compounds or other deleterious to adhesion of waterproofing membrane.

.3 Seal exterior cracks and around penetrations through waterproofing with compatible sealing compound in accordance with manufacturer's instructions.

.4 Notify Departmental Representative in writing of any unsuitable surfaces and working conditions which may affect a successful application.

3.2 APPLICATION

.1 Application of damp-proof, waterproof and air/vapour barrier coating, using manufacturer approved spray equipment, in accordance with manufacturer's instructions:
- .1 Apply coating to dry film thickness of 1.0 mm minimum, for damp-proofing.
- .2 Apply coating to dry film thickness of 1.5 mm minimum, for waterproofing and air/vapour barrier membrane.

3.3 CLEAN-UP

.1 Promptly as the work proceeds and on completion clean up and remove from the premises all rubbish and surplus materials resulting from the foregoing work.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 07 21 16 - Blanket insulation.

.2 Section 07 27 10 - Air/Vapour Barrier membrane and installation of rigid insulation.

.3 Section 07 46 13 - Metal Wall Cladding.

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

1.2 REFERENCES

.1 ASTM International:
- .1 ASTM C 1289-10, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

.2 Underwriters Laboratories of Canada (ULC).
- .1 CAN/ULC-S701-11, Thermal Insulation, Polystyrene, Boards and Pipe Coverings.
- .2 CAN/ULC-S704-11, Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.
- .3 CAN/ULC-S770-09, Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams.
- .4 CAN3-A451.1-M86 (R2001) Polystyrene Insulation Adhesives.

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 01 50 - General Instructions for Submittal Procedures clause.
- .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 01 50 - General Instructions for Submittal Procedures clause. Indicate VOC's insulation products and adhesives.

.2 Manufacturer's Instructions:
- .1 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50 - General Instructions for Construction/Demolition Waste Management and Disposal clause.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

2 Products

2.1 MATERIALS

.1 Exterior insulation below grade:

.1 Perimeter Foundation Insulation: Extruded polystyrene foam insulation to CAN/ULC-S701, Type 4, rigid, closed cell type, with integral high density skin, c/w integral 9 mm thick latex- modified concrete facing.

.1 Thermal Resistance: Long term aged RSI value of 0.87/25 mm, to ASTM C518.

.2 Board Size: 610 x 1220 mm, 75 mm thick.

.3 Compressive Strength: to ASTM D1621, minimum 210 kPa.

.4 Water Absorption: to ASTM D2842, 0.7% by volume maximum.

.5 Edges: Tongue and groove sides, square edge ends.

.6 Water Vapour Permeance: to ASTM E96, 50 ng/Pas m^2.

.2 Fastening: self-drilling/tapping screws with minimum 25 mm dia washers, corrosion resistant types suitable for substrates encountered and capable of retaining insulation in place.

.3 Metal Cap Flashing: 0.61 mm thick galvanized steel J-channel; 57 mm wide, 100 mm long leg and 57 mm short leg; prefinished in colour selected by Departmental Representative.

.4 Clips and Fasteners: corrosion-resistant type, sized to suit application; as supplied by insulation manufacturer.

.2 Exterior wall insulation (Above Grade):

.1 Rigid polyisocyanurate rigid insulation to CAN/CGSB 51.26, Type 1, Facing 2 (foil faced both sides) to meet CAN/ULC-S704 and CAN/ULC S-770 with a LTTR (Long Term Thermal Resistance) of RSI 1.05 (R6) per 25 mm, 102 mm thickness as indicated. Flame spread 500 max to CAN/ULC-S102, Compressive strength 138 kPa to ASTM D 1621, Moisture Vapour Transmission to ASTM E96 <1.5 ng/Pa · s · m^2.

.2 Fastening: corrosion resistant fastening clips and adhesive as recommended by manufacturer.

2.2 ACCESSORIES

.1 Tape for sealing joints as recommended by manufacturer.

2.3 ADHESIVE

.1 Type A (for polystyrene): to CAN3-A451.1 and suitable for bead application.

.2 Adhesive for polyisocyanurate Insulation: in accordance with Section 07 27 10 Air Barrier membrane.

2.4 COMPATIBILITY

.1 Ensure insulation is compatible with other materials in contact with insulation. Confirm compatibility with Damp-proofing at elevator pit.

.2 Where incompatibility exists provide means to separate materials as recommended by manufacturer of insulation.

3 Execution

3.1 WORKMANSHIP

.1 Install insulation after building substrate materials are dry.

.2 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.3 Fit insulation closely around horizontal Z-girt framing, vertical intermediate framing at exterior door and window openings, plumbing pipes and ducts, and around other protruding elements.

.4 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.

.5 Do not enclose insulation until it has been inspected and approved by Engineer.

3.2 PERIMETER FOUNDATION INSULATION

.1 Exterior application: apply Type 4 polystyrene insulation boards to exterior foundation walls using approved adhesive and fastener clips as recommended by insulation manufacturer. Apply panels horizontally to foundation wall from main floor line to top of footing.

.2 Apply adhesive in continuous 6 mm beads in a grid pattern to prevent potential air movement behind the insulation boards. Apply adhesive fully around protrusions.

.3 Fit insulation tight to underside of perimeter flashing.

.4 Layout concrete-faced insulation boards to maximize board sizes. Do not use boards less than 150 mm wide.

3.3 INSULATED STUD WALLS

.1 Install rigid insulation boards to exterior surfaces of sheathed steel stud walls, over applied air/vapour barrier membrane in accordance with Section 07 27 10. Insulation thickness as indicated.

.2 Install rigid boards tight to substrate and to furring, held in place with adhesive. Tape all joints.

.3 Install rigid insulation tight together and to furring. Exposed edges of insulation to be butted to Z-bars or intermediate steel framing.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 07 21 13 - Board insulation.

.2 Section 07 27 10 - Air/Vapour Barrier membrane.

.3 Section 09 21 16 - Gypsum Board Assemblies.

.4 Divisions 22 & 23 - Insulation for mechanical work.

1.2 REFERENCES

.1 CAN/ULC-S702-09 -Mineral Fibre Thermal Insulation for Buildings

.2 CAN/ULC-S702.2-03 - Mineral Fibre Thermal Insulation for Buildings, Part 2: Application Guidelines.

.3 CAN/CGSB 19.13M-84(R1987) - Sealing Compound, One Component, Elastomeric Chemical Curing.

.4 ASTM C919-08. - Standard Practice for Use of Sealants in Acoustical Applications.

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 01 50 - General Instructions for Submittal Procedures clause.
- .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 01 50 - General Instructions for Submittal Procedures clause. Indicate VOC's insulation products and adhesives.

.2 Manufacturer's Instructions:
- .1 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50 - General Instructions for Construction/Demolition Waste Management and Disposal clause.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

2 Products

2.1 INSULATION

.1 Batt and blanket mineral fibre: to CAN/ULC-S702:
- .1 Unfaced, RSI - 3.5 for parapet walls.
- .2 Pressed steel door frames in exterior walls.
- .3 Wall types listed.
- .4 Where indicated.

.2 Sound attenuation batts to ASTM C665, Type 1, CAN/ULC S702.2:
- .1 Sound attenuation fire batt Insulation, self-supporting semi-rigid batts, to fit interior wall stud cavity, manufactured from basaltic rock with a melting point in excess of 1093°C.
- .2 Surface burning characteristics; Flame Spread 5, Smoke Developed 0, when tested in accordance with CAN4-S102, ASTM E-84, and UL 723.
- .3 Material listed as non-combustible by ULC and ULI; tested in accordance with CAN4-S114 and ASTM E-136.
- .4 Provide sound batts for all interior walls scheduled for batt insulation.

3 Execution

3.1 INSULATION INSTALLATION

.1 Install insulation to maintain continuity of thermal and sound protection to building elements and spaces.

.2 Install sound attenuation batts to walls in wall types 20a, 20b, 20c and 20d.

.3 Fill pressed steel door frames with mineral fibre insulation in exterior walls and in walls with sound attenuation batts.

.4 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.5 Do not compress insulation to fit into spaces, except around window frame shim space.

.6 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures.

.7 Do not enclose insulation until installations have been approved by Departmental Representative.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 07 21 13 - Rigid Board Insulation.

1.2 REFERENCES

.1 CAN/ULC-S705.1-01-am3, Spray applied Rigid Polyurethane Foam, medium density.

.2 CAN/ULC-S705.2-05, Spray applied Rigid Polyurethane Foam, medium density, installer's responsibilities.

.3 CAN/ULC-S124M-06, Standard Method of Test for the Evaluation of Protective Coverings for Foamed Plastic.

.4 CUFCA-BC, Canadian Urethane Foam Contractors Association.

1.3 TEST REPORTS

.1 Submit test reports, verifying qualities of insulation meet or exceed requirements of this specification, in accordance with Section 01 01 50.

1.4 PROTECTION

.1 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.

.2 Protect workers as recommended by insulation manufacturer.

.3 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.

.4 Dispose of waste foam daily in accordance with local authority having jurisdiction and decontaminate empty drums in accordance with foam manufacturer's instructions.

1.5 QUALITY ASSURANCE

.1 SPF applicator: only approved applicators of SPF systems, licensed by CUFCA and employing certified installers may.

.2 Inspection service provided and paid for by the Engineer.

1.6 SAFETY REQUIREMENTS

.1 Protect workers as recommended by CAN/ULC-S705.2 and manufacturer's recommendations:
- .1 Workers must wear gloves, respirators, eye protection, protective clothing when applying foam insulation.
- .2 Workers must not eat, drink or smoke while applying foam insulation.

1.7 PROTECTION

.1 Provide temporary drop sheets to prevent spray from contaminating air beyond application area.

.2 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50 - General Instructions for Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Fold up metal banding, flatten and place in designated area for recycling.

.5 Dispose of waste foam daily in location designated by Departmental Representative and decontaminate empty drums in accordance with foam manufacturer's instructions.

.6 Divert metal drums from landfill to metal recycling facility as approved by Departmental Representative and to CAN/ULC-S705.2.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

2 Products

2.1 MATERIALS

.1 Insulation: spray polyurethane to CAN/ULC-S705.1, with five year aged RSI value of 1.02 m^2, meeting the following requirements; density 30 kg/m^3, compressive strength 170 kPa, water vapour permeance <170 $ng/Pa{\cdot}s{\cdot}m^2$, flame spread rating <350.

.2 Primers: in accordance with manufacturer's recommendations for surface conditions.

3 Execution

3.1 APPLICATION

.1 Apply insulation to clean surfaces in accordance with CAN/ULC-S705.2 and manufacturer's printed instructions. Use primer and mechanical fasteners where recommended by manufacturer.

.2 Concealed spaces at canopy overhangs:

.1 Apply polyurethane sprayed foam insulation to minimum 25 mm thickness. Apply in several applications to build up to thickness.

.2 Apply sprayed insulation to all structural steel beams and deck surfaces penetrating exterior wall within building overhangs. Spray underside of steel deck, exposed surfaces of beams in overhang area. In soffit areas spray metal deck and beam surfaces to 1000 mm from exterior wall.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 03 30 05 - Cast-in-Place Concrete

.2 Section 07 21 13 - Board Insulation.

.3 Section 07 27 10 - Air/Vapour Barriers, above grade.

1.2 REFERENCES

.1 ASTM International:

- .1 ASTM D1709 - 09 Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
- .2 ASTM E96/E96M-13 Standard Test Methods for Water Vapor Transmission of Materials.
- .3 ASTM E154 / E154M - 08a (2013) e1 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls.
- .4 ASTM E1643 - 11 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- .5 ASTM E1745 - 11 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
- .6 ASTM F1249-06 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.

1.3 ENVIRONMENTAL REQUIREMENTS

.1 Do not proceed with work when temperatures fall below recommended application requirements.

.2 Do not apply during rain or snow unless surfaces are protected to manufacturer's requirements.

1.4 SUBMITTALS

.1 Comply with Section 01 01 50 - General Instructions, Submittal Procedures.

.2 Submit manufacturer's product data and application instructions.

1.5 QUALITY ASSURANCE

.1 Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the vapor retarder.

.2 Provide vapor retarder materials from a single manufacturer regularly engaged in manufacturing the product.

.3 Provide products which comply with all provincial and local regulations controlling use of volatile organic compounds (VOCs).

1.6 PRECONSTRUCTION MEETING

.1 Convene meeting one week prior to installation of underslab vapour retarder. Attendees to be as follows: - Departmental Representative, General Contractor and Vapor Retarder Installer to discuss the application in detail.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

.2 Store materials in a clean, dry area in accordance with manufacturer's instructions.

.3 Protect materials during handling and application to prevent damage or contamination.

.4 Ensure membrane is stamped with manufacturer's name, product name, and membrane thickness at intervals of no more than 220 cm.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Product not intended for uses subject to abuse or permanent exposure to the elements.

.2 Do not apply on frozen ground

2 Products

2.1 MATERIALS

.1 Plastic Vapor Retarder: manufactured from virgin polyolefin resins, and tested to requirements of ASTM E1745 to meet the following minimum performance requirements:

.1 Maximum Water Vapor Permeance (ASTM E154 Sections 7, 8, 11, 12, 13, by ASTM E96, Method B or ASTM F1249):

.1 As received: 0.0063 perms.

.2 After Wetting and Drying: 0.0052 perms.

.3 Resistance to Plastic Flow and Temperature: 0.0057 perms.

.4 Effect Low Temperature and Flexibility: 0.0052 perms.

.5 Resistance to Deterioration from Organisms and Substances in Contacting Soil: 0.0052 perms.

.2 Puncture Resistance (ASTM D1709) : >3,200 grams.

.3 Tensile Strength ASTM E154, Section 9: 72 Lb. Force/Inch.

2.2 ACCESSORIES

.1 Seam Tape:

.1 High Density Polyethylene Tape with pressure sensitive adhesive. Minimum width 100 mm.

.2 Pipe Collars

.1 Construct pipe collars from vapor retarder material and pressure sensitive tape per manufacturer's instructions.

3 Execution

3.1 SURFACE PREPARATION

.1 Prepare surfaces in accordance with manufacturer's instructions.

.2 Level, tamp, or roll earth or granular material beneath the slab base.

3.2 EXAMINATION

.1 Examine surfaces to receive membrane. Notify architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.3 APPLICATION

.1 Install the vapor retarder membrane in accordance with manufacturer's instructions and ASTM E 1643.

.2 Unroll vapor retarder with the longest dimension parallel with the direction of the pour.

.3 Lap vapor retarder over footings and seal to foundation walls.

.4 Overlap joints 152 m) and seal with manufacturer's tape.

.5 Seal all penetrations (including pipes) with manufacturer's pipe boot.

.6 Ensure no penetration of the vapor retarder occurs throughout installation except for reinforcing steel and permanent utilities.

.7 Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 152 mm and taping all four sides with tape.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 07 21 13 - Board Insulation.

1.2 REFERENCES

.1 ASTM International:
- .1 ASTM E154-08a, Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
- .2 ASTM E96/E96M-10 Standard Test Methods for Water Vapor Transmission of Materials.
- .3 ASTM E283-04 Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- .4 ASTM D882-10 Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
- .5 ASTM D1004-09 Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.

.2 Canadian General Standards Board (CGSB):
- .1 CGSB 37-GP-56M80(1985) Membrane, Modified, Bituminous, Prefabricated, and Reinforced for roofing.
- .2 CGSB 71-GP-24M77 (1983) Adhesive, Flexible, for Bonding Cellular Polystyrene Insulation.

1.3 ENVIRONMENTAL REQUIREMENTS

.1 Do not proceed with work when temperatures fall below recommended application requirements.

.2 Do not apply during rain or snow unless surfaces are protected to manufacturer's requirements.

2 Products

2.1 MATERIALS

.1 Air/vapour barrier membrane (Self-Adhering):
- .1 SBS modified bitumen, self-adhering sheet membrane complete with a cross-laminated polyethylene film, and having the following physical properties:
  - .1 Thickness: 1 mm (40 mils).
  - .2 Air leakage: <0.0001 CFM/ft² @ 75 Pa to ASTM E2178.
  - .3 Vapour permeance: 0.03 perms to ASTM E96.
  - .4 Low temperature flexibility: pass at -30_F to CGSB 37-GP-56M.
  - .5 Elongation: 200% to ASTM D412-modifed.

.2 Through-wall base flashing membrane(Self-Adhering):
- .1 SBS modified bitumen, self-adhering sheet membrane complete with a cross-laminated polyethylene film, having the following physical properties:
  - .1 Thickness: 0.0394" (40 mils).
  - .2 Film Thickness: 9.0 mils.

.3 Puncture Resistance: 40lbf to ASTM E154.
.4 Tensile Strength (film): 5000 psi ASTM D882.
.5 Tear Resistance 13lbs. MD to ASTM D1004.
.6 Low temperature flexibility: -22_F to CGSB 37-GP-56M.

.3 Primer for self-adhering membranes: a synthetic rubber based adhesive type, quick setting, having the following physical properties:
.1 Colour: Blue.
.2 Weight: 6.7 lbs/gal.
.3 Solids by weight: 35%.
.4 Drying time (initial set): 30 minutes.

.4 Liquid air seal mastic and insulation adhesive: a synthetic, trowel applied, rubber based adhesive type, having the following characteristics:
.1 Compatibility: With air/vapour barrier membrane, substrate and insulation.
.2 Long term flexibility: CGSB 71-GP-24M;
.3 Chemical resistance: Alkalis and salt.

.5 Joint sealant: for substrate joints, as recommended by membrane manufacturer.

2.2 COMPATIBILITY

.1 Ensure that all materials used are compatible.

3 Execution

3.1 PREPARATION

.1 Before application ensure environmental and site conditions are suitable for installation of waterproofing membrane.

.2 Ensure all surfaces are clean, dry, and free of water, frost, dirt, oil, grease, curing compounds or other deleterious to adhesion of damp-proofing membrane.

.3 Seal exterior cracks and around penetrations through waterproofing with compatible sealing compound:
.1 Seal cracks in concrete with a strip of membrane lapped a minimum of 75 mm on both sides of the crack.
.2 Seal joints between panels of exterior grade gypsum up to 6 mm, prior to the application of air/vapour barrier membrane.
.3 At joints between panels of exterior grade gypsum wider than 6 mm apply membrane strip adhered to the substrate.

.4 Notify Departmental Representative in writing of any unsuitable surfaces and working conditions which may affect a successful application.

3.2 PRIMER

.1 Primer for all self-adhering membranes over gypsum sheathing board:

.1 Apply primer for self-adhering membranes at rate recommended by manufacturer.
.2 Apply primer to all areas to receive through-wall flashing and air/vapour barrier

membrane, as indicated on drawings by roller or spray and allow minimum 30 minute open time. Primed surfaces not covered by air/vapour barrier membrane or through-wall flashing membrane during the same working day must be re-primed.

.2 Apply peel and stick waterproof membrane at all openings for windows, door frames and other openings at jambs, head and sill.

3.3 MEMBRANE APPLICATION

.1 Through-wall Flashing Membrane (Self-Adhering Type):
- .1 Align and position the leading edge of self-adhering through-wall flashing membrane with the front horizontal edge of the foundation walls, partially remove protective film and roll membrane over surface and up vertically.
- .2 Press firmly into place. Ensure minimum 50 mm overlap at all end and side laps.
- .3 Promptly roll all laps and membrane to effect the seal.
- .4 Ensure through-wall flashing membrane extends fully to the exterior face of the exterior sheathing. Trim off excess as directed by the Departmental Representative.
- .5 Apply through-wall flashing membrane along the base of masonry veneer walls, over windows, doors and all other wall openings. Membrane to form continuous flashing and extend up a minimum of 200 mm up the back-up wall.

.2 Air/vapour barrier Membrane (Self-Adhering Type):
- .1 Align and position self-adhering membrane, remove protective film and press firmly into place. Ensure minimum 50 mm overlap at all end and side laps.
- .2 Tie-in to window frame and hollow metal door frame openings and at the interface of dissimilar materials as indicated in drawings.
- .3 Promptly roll all laps and membrane with a counter top roller to effect seal.

.3 Inspection:
- .1 Notify Departmental Representative when sections of work are complete to allow for review prior to installing insulation.

3.4 INSULATION ATTACHMENT

.1 Ensure air/vapour barrier membrane has been installed and reviewed by the Departmental Representative prior to installation of insulation.

.2 Insulation Adhesive:
- .1 Apply insulation adhesive to insulation boards in continuous strips running from side to side on the board in a serpentine pattern to restrict movement of air behind insulation. Strips are recommended to be placed 150 mm apart and applied in a 12 mm bead.
- .2 Alternately, a full coat notched trowel application may be applied to the back of the insulation board. Press insulation firmly in place ensuring full contact with substrate.

.3 Fully butter all joints of insulation panels with adhesive during installation, except at expansion joints.

3.5 PROTECTION OF FINISHED WORK

.1 Protect air/vapour barrier membranes from UV exposure as dictated by the manufacturer's instructions. Cover membranes as soon as possible.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for wall systems comprising fibre reinforced cementitious.

1.2 RELATED SECTIONS

.1 Section 07 46 13: Steel Wall Cladding.

.2 Section 07 46 23: Wood Siding.

.3 Section 08 50 50: Aluminum Windows.

.4 Section 09 91 23: Painting.

1.3 REFERENCES

.1 CSA B111, Wire Nails, Spikes and Staples.

.2 CAN/CGSB-11.6-M87 Installation of Exterior Hardboard Cladding.

.3 CAN/CGSB-51.32-M77 Sheathing, Membrane, Breather Type.

1.4 DESIGN REQUIREMENTS

.1 Design composite building panel wall to provide for thermal movement of component materials caused by ambient temperature range of 100 degrees C without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.

.2 Include expansion joints to accommodate movement in wall system and between wall system and building structure, caused by structural movements, without permanent distortion, damage to infills, racking of joints, breakage of seals, or water penetration.

.3 Design members to withstand dead load and wind loads as calculated in accordance with NBC and applicable Municipal regulations, to maximum allowable deflection of 1/180 of span.

.4 Provide for positive drainage of condensation occurring within wall construction and water entering at joints, to exterior face of wall in accordance with NRC "Rain Screen Principles".

.5 Design wall system to accommodate specified erection tolerances of structure.

.6 Maintain following installation tolerances:

.1 Maximum variation from plane or location shown on approved shop drawings: 10 mm/m of length and up to 20 mm/100 m maximum.

.2 Maximum offset from true alignment between two adjacent members abutting end to end, in line: 0.75 mm.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 01 50 General Instructions.

.2 Indicate dimensions, wall openings, head, jamb, sill and mullion detail, materials and finish, anchor details, compliance with design criteria and requirements of related work.

1.6 SAMPLES

.1 Submit samples in accordance with Section 01 01 50 General Instructions.

.2 Submit duplicate 150 x 150 mm samples of wall system, representative of materials, finishes and colours.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 General Instructions.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Place materials defined as hazardous or toxic in designated containers.

.5 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.6 Ensure emptied containers are sealed and stored safely.

.7 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 MATERIALS

.1 Fiber-Cement Panels and Trim: Composed of Portland cement, ground sand, cellulose fiber, select additives and water, with the following characteristics:

.1 Durability: Autoclaved, non-rotting, resistant to permanent damage from water and salt spray.

.2 Flexural Strength: In accordance with ASTM test method C1185, Equilibrium Moisture Content.

.1 Parallel to direction of sheet: 1 850 psi.

.2 Perpendicular to direction of sheet: 2 500 psi.

.3 Non-Combustibility: In accordance with ASTM test method E-136; no flame support and no loss of integrity.

.4 Surface Burning Characteristics: In accordance with ASTM test method E-84:

.1 Flame Spread: 0

.2 Fuel Contributed: 0

.3 Smoke Developed: 5

.5 Thermal Resistance: 7.94 mm thick material; R = 0.15.

.6 Texture: Smooth.

.7 Thickness: 7.94 mm (5/16").

.8 Weight: 11.23 kg/m2 (2.3 lbs./sq.ft).

.9 Sheet Size: 1 220 mm x lengths of 2 438 mm, 2 743 mm or 3 048 mm (4' x 8', 4' x 9' or 4' x 10'). Wall panel sizes as indicated.

.10 Finish: Factory primed with alkali resistant primer for site finishing.

.2 Fastenings: Corrosion resistant hot dipped galvanized or stainless steel as recommended by the siding/panel manufacturer. Minimum 6d x 75 mm long spaced at 400 mm centres. Finishing head where exposed.

Part 3 Execution

3.1 INSTALLATION

.1 Do construction occupational health and safety in accordance with Section 01 01 50 General Instructions.

.2 Install siding and accessories in accordance with manufacturer's printed instructions.

.3 Provide 6 mm thick lath strip of pressure treated hem-fir at base of siding starter strip.

.4 Lay out siding lengths to achieve a regular staggered joint pattern. Use longest practical lengths and minimize joints where possible. Stagger joints a minimum of 800 mm.

.5 Install siding true to line and level with clean cut edges and joints.

.6 Prime all cut edges of siding and panels.

.7 Install panel material starting at middle of stud. Start fastening at edge and work across the panel.

.1 Keep fasteners 50 mm away from corners. Keep fasteners 10 mm minimum away from panel edges. Drive fasteners snug or flush with surface.

.2 Use a metal drip flashing at all horizontal joints.

.8 At flashings provide 25 mm clearance between flashing and bottom edge of siding or panels.

.9 Fasteners to penetrate base by a minimum of 50 mm.

.10 Siding overlap to be 31 mm. Nails to be covered by overlapping boards with edge distance recommended by manufacturer.

.11 Provide moderate contact butt joints installed over joint flashing.

.12 Butt panels at joints, back caulk panels to furring.

.13 Where panels fit into accessories, leave 6 mm clearance for expansion and fill with elastic sealant.

.14 Provide 3 mm wide joints between panels/siding and window or door frames and fill with elastic sealant.

.15 Use inside and outside corner boards at the junction of internal and external corners as indicated.

.16 Seal joints to provide weathertight and airtight installation.

3.2 CLEANING

.1 Wash down exposed exterior surfaces using solution of mild domestic detergent in warm water, applied with soft clean wiping cloths.

.2 Remove excess sealant with recommended solvent.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 06 11 01 - Rough Carpentry for plywood sheathing on parapets.

.2 Section 07 21 13 - Rigid insulation on walls.

.3 Section 07 62 00 - Metal Flashing and Trim in conjunction with roof membrane assembly.

1.2 REFERENCES

.1 Underwriters Laboratories of Canada (ULC).
- .1 CAN/ULC-S704-05, Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.
- .2 CAN/ULC-S770-09, Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams.

.2 Canadian General Standards Board (CGSB)
- .1 CGSB 37-GP-5Ma-83 Cement, Plastic, Cutback, Asphalt.
- .2 CAN/CGSB-51.32-M77 Sheathing, Membrane, Breather Type.
- .3 CAN/CGSB-93.1-M85 Sheet, Aluminum Alloy, Prefinished, Residential.

.3 ASTM International:
- .1 ASTM A 653/A653M - 10, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process.
- .2 ASTM A354-07a, Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.
- .3 ASTM B117-09, Standard Practice for Operating Salt Spray (Fog) Apparatus.
- .4 ASTM D3363-05(2011), Standard test Method for film Hardness by Pencil Test.
- .5 ASTM D2794-93(2010), Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid deformation (Impact).
- .6 ASTM D3359-09e2, Standard Test Methods for measuring Adhesion by Tape Test.
- .7 ASTM D2247-11 Standard Practice for Testing water Resistance of Coatings in 100% RH.
- .8 ASTM E96/E96M-10 Standard Test Methods for Water Vapor Transmission of Materials.
- .9 ASTM E283-04 Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- .10 ASTM E331-00(2009) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

1.3 DESIGN CRITERIA

.1 Design preformed wall panel systems to provide for thermal movement of component materials caused by ambient temperature range of 70°C without causing buckling, failure of seals, leakage and undue stress on fasteners or other detrimental effects.

.2 Corrugated wall panel description:
- .1 Prefinished galvanized sheet steel, 0.76 mm thickness x 22 mm deep corrugated profiled panel by 726 ± mm wide, lapping side joints, exposed fastening, with Stelco/Dofasco

Series 8000+ Series coating in colour as selected by Departmental Representative from manufacturer's standard range.

1.4 QUALIFICATIONS OF INSTALLERS

.1 Installation of preformed metal cladding to be performed by manufacturer approved installers having at least five years experience in metal panel installations.

.2 Panel installer/fabricator to have a minimum of five years experience in fabricating and or installing composite panels. Panel supplier must be an authorized fabricator of the specified composite supplier and have a certification program acceptable to local code authorities.

1.5 SUBMITTALS

.1 Submit shop drawings and samples in accordance with Section 01 01 50 - General Instructions for Submittals clause.

.2 Clearly indicate dimensions, system components, and method of thermal expansion adjustment between panels and mounting clips, details at juncture with other membranes and panel system, material and finish, compliance with design criteria and related structural and metal flashing work. Submit shop drawings and/or product data for wall panel assembly composite panel.

.3 Submit duplicate samples of representative prefinished panel materials and sealant for colour selection by Departmental Representative.

1.1 WARRANTY

.1 Wall panel paint system: provide manufacturer's warranty for ten (10) years against peeling and blistering, flaking, cracking or chipping, checking, or lose adhesion.

1.2 SOURCE QUALITY CONTROL

.1 At least 2 weeks prior to fabrication of steel wall panels, submit two (2) copies of mill test reports showing chemical and physical properties from manufacturer. Such mill test reports shall be certified by qualified metallurgists confirming that tests conform to requirements of referenced standards.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50 - General Instructions for Construction/Demolition Waste Management and Disposal clause.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Place materials defined as hazardous or toxic in designated containers.

.5 Ensure emptied containers are sealed and stored safely for disposal away from children.

.6 Divert unused metal materials from landfill to metal recycling facility as approved by

Departmental Representative.

.7 Unused sealant material must be disposed of at an official hazardous material collections site as approved by Departmental Representative.

.8 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.9 Fold up metal banding, flatten and place in designated area for recycling.

2 Products

2.1 MATERIALS

.1 Sheet steel: to ASTM A 653/A653M, Grade E or D, minimum yield strength of 500 or 290 MPa, with galvanized Z275 zinc coating, thickness 0.76 mm.

.2 Coating systems:
- .1 Corrugated wall panels, and flashing: factory finish coating of (Dofasco, Stelco Series +8000), in colour as selected by Departmental Representative.

2.2 ACCESSORIES

.1 Fasteners: self-tapping screws to ASTM A354, purpose made, galvanized finish and stainless steel fasteners as indicated.
- .1 Exposed fasteners "Climaseal" with colour matched heads where exposed.
- .2 Concealed fasteners: stainless steel, pan heads.
- .3 Screws of self-drilling/threading threads.
- .4 All other screws galvanized except as specified above.

.2 Rigid Insulation for walls: specified in Section 07 21 13.

.3 Sealants:
- .1 Exposed sealant: as recommended by manufacturer.
- .2 Tape: butyl tape to manufacturer's standard, to meet design criteria.

.4 Closures: laminated, semi-rigid cross linked polyethylene foam to fit panel profile without gaps.

.5 Exterior gypsum sheathing board: in accordance with paragraph 2.1.2 in Section 09 21 16.

.6 Air/vapour barrier membrane: in accordance with Section 07 27 10.

2.3 COMPONENTS

.1 Wall cladding assembly:
- .1 Corrugated panels of minimum 0.76 mm thickness, with exposed fasteners conforming to profile and shape specified in Design Criteria in Clause 1.3.
- .2 Wall support framing: 'Z' bars installed in conjunction with rigid insulation, designed to transfer wind loads to stud wall and support wall panels.
- .3 Form trim and flashings from 0.6 mm prefinished sheet steel for wall panels; at base, corners, wall penetrations, terminations and openings; and trim at doors, windows, and

metal profile closures to match wall panel finish. Bend trim at corners without exposing cut edges except as approved by Departmental Representative.

.4 Screw fasteners: galvanized steel with colour matched caps where exposed.

2.4 METAL FLASHINGS AND TRIM - GENERAL

.1 Form flashings, trim and sheet metal work to profiles, finishes and thicknesses specified for wall and composite panels.

.2 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints.

.3 Hem exposed edges on underside 12 mm, provide clip fasteners spaced at 610 mm oc. Mitre and seal corners with sealant. Make allowance for expansion at joints. Use either S-lock seams at joins and seal with sealant or fasten through 12 mm slotted holes using fasteners with washers to conceal holes, space fasteners at maximum 600 mm oc. At mitred corners use standing seams. All exposed screws in wall panels with colour matched heads.

.4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.5 Apply isolation coating to metal surfaces in contact with pressure treated wood and dissimilar bare metals.

3 Execution

3.1 PREPARATION

.1 Install wall, panel assembly following completion and approval of structural stud wall framing installation.

.2 Precut panels and flashing sections in factory where practical. Saw cutting or torch cutting of material on site is not acceptable.

3.2 WALL PANEL ASSEMBLY

.1 Installation of wall panel system in accordance with reviewed shop drawings and manufacturer's instructions.

.2 Install 12 mm gypsum sheathing board over exterior faces of steel stud framing full height, tight to steel deck closures. Fasten with galvanized fasteners in accordance with installation requirements of manufacturer. Maximum spacing of screws 300mm. Ensure stud framing occurs at all joints in boards.

.3 Install air/vapour barrier membrane, in accordance with Section 07 27 10, over primed gypsum board sheathing full height of wall to top of parapet. Reinforce corners and joints with additional layer of membrane minimum 100 mm beyond each side of joint and corners. Lap membrane minimum 150 mm over adjoining wall air barrier or roofing membrane. Overlap end laps of membranes and at juncture with vapour barrier at wall openings, a minimum of 50 mm and tape joints, to provide a continuous air barrier system.

.4 Install horizontal steel girts to wall and vertical steel girts at fascia and fasten through sheathing to each steel stud in accordance with Section 05 41 00. Provide girts at all end panel

terminations and to perimeter of wall openings at, windows, doors and louvre openings etc.

.5 Install insulation in single layer with foil facing, and tape joints. Butt insulation boards tight to ensure continuity of thermal protection in roof spaces. Use manufacturer approved tape. Install batt insulation at parapet.

.6 Attach wall panels to girt framing using exposed fastening system. Semi-conceal fasteners at flashings and trim where possible. Install wall panels starting from lowest point at one corner or at termination point. Fit panels tight to flashings and trim to ensure installation is continuously weather tight. Install break formed trim at corners and as indicated and seal. Install drip flashing at transition between vertical lower panels and horizontal fascia panels.

.7 Install and seal notched and formed closures, to arrest direct weather penetration behind panels at all openings.

3.3 CLEANING

.1 Remove excess sealant using recommended solvent.

.2 Clean prefinished metal panels flashings and trim.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Requirements for installation of lumber siding.

1.2 RELATED SECTIONS

.1 Section 06 10 11: Rough Carpentry.

.2 Section 07 44 56: Fibre Reinforced Cementitious Panels.

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

.4 Section 07 92 10 - Joint Sealing.

.5 Section 09 91 25 – Staining.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.2 National Lumber Grades Authority (NLGA).

.1 NLGA Standard Grading Rules for Canadian Lumber 2003.

1.4 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50 - General Instructions for Construction/Demolition Waste Management and Disposal clause.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Place materials defined as hazardous or toxic in designated containers.

.5 Ensure emptied containers are sealed and stored safely for disposal away from children.

.6 Divert unused wood materials from landfill to wood recycling facility as approved by Departmental Representative.

.7 Unused sealant material must be disposed of at an official hazardous material collections site as approved by Departmental Representative.

.8 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.9 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 MATERIALS

.1 Lumber siding: to NLGA Standard Grading Rules for Canadian Lumber.

.1 Board and Batten: Western Red Cedar species, rough sawn grade, 25 mm thickness, nominal 203 mm board width, batten size indicated.

.2 Slats: western Red Cedar species, rough sawn grade, nominal 50 mm x 76 mm.

.2 Fasteners: nails to CSA B111, hot galvanized steel sized as required, smooth shank type with finishing head.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install hardboard to CGSB11-GP-6M and manufacturers' instructions.

.2 Install sill flashings, wood starter strips, inside corner flashings, edgings and flashings over openings.

.3 Fasten wood siding in straight, aligned lengths to furring at 300 mm on centre maximum using two nails at each fixing location. Intermediate butt joints are not permitted. Stagger butt joints not less than 800 mm and distribute evenly over wall faces. Cut butt joints at 45 degrees and for vertical siding slope to outside. Seal cut surfaces.

3.3 CLEANING

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

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 06 11 01 - Rough Carpentry for wood nailers, blocking and backing.

.2 Section 07 27 10 - Air/vapour Barrier for walls.

.3 Section 07 62 00 - Metal Flashing and Trim.

1.2 WORK INCLUDED

.1 Work under this section includes the supply of all labour, materials, plant and services necessary to install a new insulated roof membrane assembly.

.2 Method of application for roof membrane assembly will be by torch-on method.

1.3 REFERENCE STANDARDS

.1 Roofing Contractors Association of British Columbia (RCABC) Roofing Practices.

.2 Canadian General Standards Board (CGSB)
- .1 CGSB 37-GP-9Ma-M83, Primer, Asphalt, Unfilled, for Asphalt Roofing, Damp-proofing and Waterproofing.
- .2 CAN/CGSB 19.13-M87, Sealing Compound, One-Component, Elastomeric, Chemical Curing.

.3 ASTM International:
- .1 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.
- .2 ASTM C1177 / C1177M - 08 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- .3 ASTM C1289 - 10 Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
- .4 ASTM D41 / D41M - 11 Standard Specification for Asphalt Primer Used in Roofing, Damp-proofing, and Waterproofing.
- .5 ASTM D6622 - 01(2009) Standard Guide for Application of Fully Adhered Hot-Applied Reinforced Waterproofing Systems.
- .6 ASTM E84 - 10b Standard Test Method for Surface Burning Characteristics of Building Materials.
- .7 ASTM E136 - 11 Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.

1.4 SUBMITTALS

.1 Submit shop drawings and samples in accordance with Section 01 01 50.

.2 Shop drawing to show accurate roof plan layout with sloped insulation panel thicknesses, RSI values, and drain and equipment locations.

.3 Provide samples of products specified.

1.5 STORAGE AND HANDLING

.1 Provide and maintain dry, off-ground weatherproof storage.

.2 Store rolls of membrane on end.

.3 Remove only in quantities required for same day use.

.4 Prevent insulation from contacting non-compatible materials and protect from sunlight, weather and deleterious material during storage by covering with opaque polyethylene film or light coloured tarpaulins.

.5 Protect new roof membranes with plywood runways to enable movement of material and other traffic.

.6 Store adhesives and sealants at +5°C minimum.

1.6 IDENTIFICATION AND DELIVERY

.1 Indicate on containers or wrappings:
- .1 Manufacturer's name and brand.
- .2 Compliance with applicable standard.
- .3 Mass where applicable.

.2 Deliver materials in original containers, sealed, with labels intact. Deliver fasteners in boxes or kegs and keep in protective storage until used. Do not oil or grease.

1.7 ENVIRONMENTAL REQUIREMENTS

.1 Stop work when temperature remains consistently below +5°C or when wind chill effect would tend to affect membranes or adhesives before proper adhesion takes place.

.2 Use only dry materials and apply only during weather that will not introduce moisture into roofing system.

.3 Conform to Manufacturer's application requirements and observe Manufacturer's recommendations.

1.8 WARRANTY

.1 Provide Departmental Representative with a 20 year manufacturer membrane warranty covering labour and materials.
- .1 Upon successful completion of the work to roofing membrane manufacturer's satisfaction and receipt of final payment, the roofing membrane manufacturer's System Warranty shall be issued. Applicator to submit required information and documents in compliance with roofing membrane manufacturer's requirements.

1.9 QUALIFIED INSTALLERS

.1 Installation of modified asphalt Roofing to be performed only by journeyman applicators holding either a *BC Certificate of Qualification* or be registered as an apprentice in British Columbia for roofing. Installers must be manufacturer certified for installation of this type of membrane assembly.

1.10 COMPATIBILITY

.1 Compatibility between components of roofing system is essential. Materials to be incorporated into the system must be compatible with each other. Use materials of one manufacturer's system.

.2 Provide written declaration that components of roofing system are compatible.

1.11 FIRE PROTECTION

.1 Comply with fire safety precautions specified in Section 5 of RCABC Roofing Practices Manual.

.2 Provide suitable fire extinguishers in close proximity to work areas during application of roof membranes.

.3 Maintain fire watch for minimum two (2) hours following "torch-on" work.

2 Products

2.1 MEMBRANES

.1 Modified bituminous membranes: to CGSB 37-GP-56M + Amdt-Dec-85 described as follows:

.1 **Exposed roof:** two ply system of prefabricated SBS membranes with composite reinforced base and cap sheets conforming to ASTM D6162, Type 1. Base sheet of 2.5 mm minimum thickness and cap sheet 4 mm minimum thickness, with granule finish on cap sheet for heavy duty service. Base sheet and cap sheet torch applied.

.1 Base Sheet Properties:

.1 Weight:
.2 Strain energy: MD – 7.8 kN/m, XD – 7.2 kN/m.
.3 Breaking strength: MD – 15 kN/m, XD – 13.5 kN/m.
.4 Ultimate elongation: MD – 60%, XD – 65%.
.5 Tear Resistance: 125 N.
.6 Static puncture resistance: 560 N.

.2 Cap Sheet Properties:

.1 Weight: 4.8 kg/m2.
.2 Strain energy: MD – 7.8 kN/m, XD – 7.2 kN/m.
.3 Breaking strength: MD – 15 kN/m, XD – 13.5 kN/m.
.4 Ultimate elongation: MD – 60%, XD – 65%.
.5 Tear Resistance: 125 N.
.6 Static puncture resistance: 560 N.

.2 **Membrane flashing/stripping**: same as for base and cap sheet. Cap sheet with granule finish for all exposed stripping plies. Granules colour selected by Departmental Representative.

.3 Provide cap sheet with granules in contrasting colour (red) to demarcate a 2 m wide fall protection warning area at the perimeter of main roof.

.2 Vapour retardant: peel and stick membrane as specified in Section 07 27 10 Air Barriers.

.3 Primer over wood: to CGSB 37-GP-15M in accordance with manufacturer's written instructions.

2.2 INSULATION

.1 Roof insulation: rigid board insulation complying with specified standards, square edges, tapered boards to provide minimum 1:50 slope to layout shown on reviewed shop drawings, with thickness at drains, minimum 50 mm:

.1 Insulation (sloped and flat panels): Isocyanurate insulation conforming to ASTM C1289 and CAN/ULC-S790 Class A glass fibre reinforced core, with fibreglass reinforced facings, flame spread classification: less than 25 to CAN/ULC-S102, slope requirements to paragraph 2.2.1, minimum LTTR RSI value of 1.01 per 25 mm at 24°C mean temperature to CAN/ULC S 770.

.2 Protection board: mineral fortified asphaltic core between two layers of high strength reinforcing glass fibre mat, minimum 3 mm thickness, size 1220 x 2440 mm, purpose made for torching SBS membranes directly to surface.

2.3 GYPSUM BOARD DECK OVERLAY

.1 Exterior gypsum sheathing for roofs: to ASTM C1177/C1178M composed of silicone treated gypsum core and fibreglass matte facings with primer coating, 12.7 mm thickness, panel sizes 1220 mm wide x maximum practical length, FSR 0 and SDC 0 to ASTM E 84, non-combustible when tested to ASTM E 136.

2.4 PRIMERS AND SEALERS

.1 Asphalt primer: to CGSB 37-GP-9Ma-M83.

.2 Sealing compound: to CAN/CGSB-19.13-M87.

2.5 ACCESSORIES

.1 Gypsum Board Fasteners: to ASTM C 1002, self-drilling, galvanized for exterior use.

.2 Roofing screws and plates: in accordance with manufacturer's instructions using approved plates and screws to RCABC requirements.

.3 Roof Walkway:

.1 Cap sheet 5 mm thickness SBS modified membrane with non-woven polyester reinforcement, granular surface with thermofusible undersurface. Applied by torch-on method.

.1 Membrane Properties:

.1 Breaking strength: MD – 34 kN/m, XD – 28 kN/m.
.2 Ultimate elongation: MD – 70%, XD – 80%.
.3 Dimensional stability: -.0.1%/0.1%.
.4 Tear Resistance: 90 N.
.5 Static puncture resistance: 440 N.

3 Execution

3.1 QUALITY ASSURANCE

.1 Do Roofing Work to applicable standard in Roofing Contractors Association of British Columbia (RCABC) Roofing Practices Manual to meet warranty requirements and membrane manufacturer's instructions except that in any case of conflict or discrepancy, the requirements

of authority providing the Guarantee/Warranty will apply.

.2 Do priming for asphalt roofing in accordance with ASTM D41 and membrane manufacturer's instructions.

3.2 PROTECTION

.1 Cover walls and adjacent work where materials hoisted or used.

.2 Use warning signs and barriers. Maintain in good order until completion of work.

.3 Clean off drips and smears of asphalt and adhesive materials.

.4 Prevent traffic over completed roofing except where required by work above roof level and comply with precautions deemed necessary by Departmental Representative. Repair damage caused by non-compliance with Departmental Representative's requirements.

.5 At end of each day's work or when stoppage occurs due to inclement weather provide protection for completed work to maintain building weather tight and protect materials out of storage.

3.3 EXAMINATION OF ROOF DECKS

.1 Examine roof decks and immediately inform Departmental Representative in writing of any defects. Commencement of work implies acceptance of substrate as satisfactory.

.2 Prior to commencement of work ensure decks are firm, straight, smooth, dry, free of water or frost, and swept clean of dust and debris.

.3 Lumber nailer plates to walls, curbs and parapets have been installed as indicated.

3.4 GYPSUM BOARD OVERLAY

.1 Apply gypsum board perpendicular with slope.

.2 Stagger half joints. No gaps will be accepted.

.3 Fasten through top of flutes using number of screws per sheet in accordance with RCABC requirements.

3.5 VAPOUR RETARDER

.1 Apply peel and stick vapour retarder membrane over primed gypsum board deck. Apply in accordance with Section 07 27 10, RCABC requirements and manufacturer's instructions.

3.6 INSULATION

.1 On sheathed steel deck roofs:

.1 Apply flat insulation panels and tapered insulation crickets over vapour retarder together with torchable insulation protection board overlay, using mechanical fasteners and steel plate washers in accordance with RCABC requirements and manufacturer's instructions. (12 fasteners total per 1220 x 2440 sheet at perimeter areas and 8 fasteners per 1220 x 2440 for field areas.)

.2 Fasteners to penetrate structural substrate. Cut off fasteners penetrating deck by

more than 25 mm.

3.7 MODIFIED BITUMINOUS MEMBRANE APPLICATION

.1 Primer:
- .1 Brush or spray asphalt primer on surfaces wood curbs and plywood parapets which are in direct contact with application of membrane, at rate specified by membrane manufacturer's requirements but no less than .37 l/m² in accordance with ASTM D41.

.2 Apply base sheet to primed protection board surfaces, by torch-on method. Apply cap sheet over base sheet by torch-on method with laps of cap sheet being offset minimum 300 mm from those of base sheet, using same side and end laps as base sheet. Embed granules (do not remove) prior to bonding onto granular surfaces. Follow membrane manufacturer's written instructions for application techniques.

.3 Side laps 75 mm minimum and end laps 150 mm minimum, except as otherwise specified by manufacturer. Stagger end laps 300 mm.

.4 Membrane flashing: use materials specified in Part 2

.5 Install base sheet stripping, starting at the outer edge of parapet, across top face, down inside vertical surface, and out minimum 100 mm onto flat portion of roof. Seal membrane to overflow scuppers in accordance with RCABC details.

.6 Limit asphalt bleed-out at laps on granular surfaces to a maximum of 6 mm width. Conceal excessive excess bleed-out by broadcasting with matching loose granules from manufacturer.

.7 Extend cap sheet stripping minimum 150 mm onto flat portion of roof, extend to top inside corner of parapets, or terminate 25 mm higher than base sheet stripping.

.8 Place red granule cap sheet at perimeter of main roof 2 m in from parapet.

.9 Apply roof walkway to layout indicated using either torch-on, cold or hot adhesive method in accordance with manufacturer's instruction. Place boards with 25 mm separation between boards.

.10 Check laps with round nosed roofing trowel as work proceeds, reseal unbonded areas and voids; repair punctures or tears with patches of same cap sheet material.

.11 The granule surfaced cap sheet to meet the following visual requirements as approved by the Departmental Representative:
- .1 Patches smaller than sheet width are not acceptable.
- .2 All sheets installed in correct alignment.
- .3 All exposed asphalt along sheet edges, and as directed, to be covered with matching granules applied when asphalt is hot.
- .4 Spreading or foot tracking of asphalt on granule coated surfaces will not be accepted.

.12 Apply traffic walkway according to manufacturers recommendations to areas indicated.

3.6 PROTECTION OF FINISHED WORK

.1 Permit no work of other trades to be performed over finished membrane until plywood protection sheets have been installed, except as directed by Departmental Representative.

.2 Limit access to finished unprotected membrane to roofing trade, product Manufacturer's representatives, and Departmental Representative.

3.7 CLEAN-UP

.1 Do cleaning of finished roof surfaces in accordance with Section 01 01 50.

.2 Remove all miscellaneous roofing and sheet metal flashing materials and waste from roof surfaces and site.

.3 Make good any damage to building caused by roofing work.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 06 10 11 - Rough Carpentry for wood nailers, blocking and backing.

.2 Section 07 46 13 - Wall Cladding Assembly.

.3 Section 07 52 00 - Modified Asphalt Roofing.

.4 Section 07 92 10 Joint Sealing.

1.2 REFERENCES

.1 ASTM A 653/A653M - 10, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process.

.2 Canadian General Standards Board (CGSB)
- .1 CGSB 37-GP-5Ma-83 Cement, Plastic, Cutback, Asphalt.
- .2 CAN/CGSB-51.32-M77 Sheathing, Membrane, Breather Type.
- .3 CAN/CGSB-93.1-M85 Sheet, Aluminum Alloy, Prefinished, Residential.

1.3 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 01 50, - General Instructions for Shop Drawings, Product Data, Samples and Mock-ups clause.

.2 Submit 50 x 50 mm samples of each type of sheet metal material, colour and finish.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50 - General Instructions for Construction/Demolition Waste Management and Disposal clause.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Place materials defined as hazardous or toxic in designated containers.

.5 Ensure emptied containers are sealed and stored safely for disposal away from children.

.6 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.

.7 Unused sealant material must be disposed of at an official hazardous material collections site as approved by Departmental Representative.

.8 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.9 Fold up metal banding, flatten and place in designated area for recycling.

2 Products

2.1 SHEET METAL MATERIALS

.1 Zinc coated steel sheet: 0.6 mm thickness, commercial quality to ASTM A 653/A653M, with Z275 designation zinc coating.

.2 Aluminum sheet: proprietary utility sheet, plain pattern, prefinished in baked enamel coating to CAN/CGSB 93.1.

.3 Rain Screen Vents: Perforated, 3 mm round holes, 22 gauge aluminum insect vent break formed to sizes and profiles required and/or indicated

.1 Finish to match adjacent cladding material.

2.2 PREFINISHED STEEL SHEET

.1 Finish: factory applied coating to Dofasco Series 8000 coating designation, in colour(s) selected by Engineer from manufacturer's standard range.

.2 Thickness specified for prefinished steel sheet applies to base metal.

2.3 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint.

.2 Plastic cement: to CGSB 37-GP-5Ma.

.3 Underlay for metal flashing: dry sheathing to CAN/CGSB-51.32, except as recommended by membrane manufacturer.

.4 Sealants: to Section 07 92 10.

.5 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.

.6 Fasteners: of same material as sheet metal, self-drilling, self-tapping screws with neoprene washers.

.7 Touch-up paint: as recommended by metal flashing and trim manufacture.

2.4 FABRICATION

.1 Fabricate metal flashings and other sheet metal work in accordance with applicable RCABC specifications and as indicated.

.2 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints.

.3 Hem exposed edges on underside 12 mm. Mitre and seal corners with sealant.

.4 Form sections square, true and accurate to size, free from distortion and other defects

detrimental to appearance or performance.

.5 Apply isolation coating to metal surfaces in contact with pressure treated wood.

2.5 METAL FLASHING

.1 Form flashing and trim to profiles indicated of 0.61 mm thick galvanized prefinished steel.

2.6 VENT FLASHING

.1 Provide all fabricated and proprietary flashing, of size to accommodate roof penetrations. Prefinished where exposed in final assembly and described as follows:

.1 Plumbing stack vents: insulated, spun aluminum, with vandal proof caps, size to suit plumbing vents. Acceptable Product Lexsuco VSC-V

.2 Electrical wiring: purpose made for electrical wiring, size to suit conduit or wiring, UL listed and CSA Certified for wet locations. Acceptable Product: Lexcor Flash-tite conduit post flashing model # CPF-W0.

.3 Supply and exhaust air duct penetrations through roof: to Division 23.

2.7 EAVES TROUGH AND DOWNPIPES

.1 Form eaves troughs and 76 mm diameter downpipes from 0.61 mm thick prefinished, galvanized steel sheet metal.

.2 Sizes and half round profiles as indicated.

.3 Provide goosenecks, outlets, strainer baskets and necessary fastenings.

3 Execution

3.1 INSTALLATION

.1 Install sheet metal work in accordance with RCABC specifications and as detailed.

.2 Use concealed fastenings except where approved before installation.

.3 Provide dry sheathing under sheet metal to RCABC requirements. Secure in place and lap joints 100 mm.

.4 Flash joints using 50 mm lap seams with sealant.

.5 Lock end joints and caulk with sealant.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Fire stopping and smoke seals within mechanical assemblies (i.e. inside ducts, dampers) and electrical assemblies (i.e. Inside cable trays) are specified in Division 22, 23, 26 and 27 respectively.

1.2 DESCRIPTION OF WORK

.1 Apply firestop sealant and systems around all penetrations through openings in fire rated wall and ceiling assemblies.

.2 Seal around ducts and conduits penetrating fire separations.

1.3 REFERENCES

.1 ULC-S115-2005 Standard Method of Fire Tests of Firestop Systems.

1.4 PRODUCT DATA

.1 Submit product data in accordance with Section 01 01 50.

.2 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site. Include manufacturer's printed instructions for installation.

2 Products

2.1 MATERIALS

.1 Fire stopping and smoke seal systems: in accordance with ULC-S115.
- .1 Systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of ULC-S115 and not to exceed opening sizes for which they are intended.
- .2 Fire stop system rating: to match wall/floor/roof assembly of one hour rating.

.2 Service penetration assemblies: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No. 40 U19.

.3 Prefabricated flange units, with outer metal flange die-stamped from 0.3 mm thick 316 stainless steel, with inset of premoulded silicone elastomeric ring, factory moulded, U.L.C. or W.H. listed as a through penetration fire stop. Flange hinged for fixing over pipe and then secured tight with self-tapping screw.

.4 Fire-resistance rating of installed fire stopping assembly not less than the fire- resistance rating of surrounding wall assembly.

.5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal; do not use cementitious or rigid seal at such locations.

.6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other

mechanical items requiring sound and vibration control: prefabricated silicone elastomeric seal; do not use a cementitious or rigid seal at such locations.

.7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

3 Execution

3.1 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

3.2 INSTALLATION

.1 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Tighten self-tapping screw on flange unit to ensure adequate tight and permanent seal.

3.3 INSPECTION

.1 Notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

3.4 SCHEDULE

.1 Fire stop and smoke seal at:
.1 Penetrations through fire-resistance rated walls and ceilings.
.2 Around mechanical and electrical assemblies penetrating fire separations.
.3 Rigid ducts: greater than 129 cm^2: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

3.5 CLEAN UP

.1 Remove excess materials and debris and clean adjacent surfaces immediately after application.

END OF SECTION

1 General

1.1 SUMMARY

.1 This Section specifies caulking and sealants not specified in other Sections.

.2 Refer to other sections for other caulking and sealants.

1.2 REFERENCES

.1 ASTM International:
- .1 ASTM C 919-02, Standard Practice for Use of Sealants in Acoustical Applications.

.2 Canadian General Standards Board (CGSB):
- .1 CAN/CGSB-19.13-M87 Sealing Compound, One-component, Elastomeric, Chemical Curing.
- .2 CAN/CGSB-19.17-M90 One-Component Acrylic Emulsion Base Sealing Compound.
- .3 CAN/CGSB-19.24-M90 Multi-component, Chemical Curing Sealing Compound.

1.3 SUBMITTALS

.1 Submit duplicate samples of each type of material and colour to be used in accordance with Section 01 01 50.

1.4 ENVIRONMENTAL AND SAFETY REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of material safety data sheets acceptable to Labour Canada.

.2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.3 Sealant and substrate materials to be minimum 5°C.

.4 Should it become necessary to apply sealants below 5°C, consult sealant manufacturer and follow their recommendations.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal; packaging material for recycling in accordance with Waste Management Plan.

.4 Place materials defined as hazardous or toxic in designated containers.

.5 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.6 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.7 Divert unused joint sealing material from landfill to official hazardous material collections site approved by Engineer.

.8 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.

1.6 PROJECT CONDITIONS

.1 Environmental Limitations:
- .1 Do not proceed with installation of joint sealants under following conditions:
  - .1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C.
  - .2 When joint substrates are wet.

.2 Joint-Width Conditions:
- .1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:
- .1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

2 Products

2.1 SEALANT MATERIALS

.1 Use caulking that does not emit strong odours, contain toxic chemicals or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas which off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.

.3 Where sealants are qualified with primers use only approved primers.

2.2 SEALANT MATERIAL DESIGNATIONS

.1 Urethanes One Part.
- .1 Self-Leveling to CAN/CGSB-19.13, Type 1, colour as selected.

.2 Urethanes One Part.
- .1 Non-Sag to CAN/CGSB-19.13, Type 2, MCG-2-40, colour as selected.

.3 Silicones One Part.
- .1 To CAN/CGSB-19.13.
- .2 Sealant type: one-part, acetoxy silicone sealant, cures to a flexible rubber when exposed to moisture present in the air, containing a fungicide, suitable for use in

bathrooms, spas and similar applications where joints need protection against fungi and bacteria.

.4 Acoustical Sealant.
.1 To ASTM C 919, Single component, non-skinning, non-hardening synthetic rubber, dark gray colour, designed for use in gypsum board partitions to inhibit air movement and buffer vibration.

.5 Acrylic Latex One Part.
.1 To CAN/CGSB-19.17.

.6 Preformed Compressible and Non-Compressible back-up materials.
.1 Polyethylene, Urethane, Neoprene or Vinyl Foam.
.1 Extruded closed cell foam backer rod.
.2 Size: oversize 30 to 50%.
.2 Neoprene or Butyl Rubber.
.1 Round solid rod, Shore A hardness 70.
.3 High Density Foam.
.1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m3 density, or neoprene foam backer, size as recommended by manufacturer.
.4 Bond Breaker Tape.
.1 Polyethylene bond breaker tape which will not bond to sealant.

2.3 SEALANT SELECTION

.1 Perimeters of exterior openings where frames meet exterior facade of building: Sealant type: one component urethane, non-sag.

.2 Coping joints and coping-to facade joints: Sealant type: one component urethane, non-sag.

.3 Interior control and expansion joints in floor surfaces: Sealant type: one component urethane self-leveling.

.4 Perimeter of bath fixtures and countertops (e.g. sinks, showers, urinals, basins, vanities): one-part, acetoxy silicone sealant. Cell fixture caulking specified in Section 07 92 12

.5 Exposed interior control joints in drywall: Sealant type: acrylic latex.

.6 Concealed joints in sound attenuated walls and ceilings: acoustic Sealant.

.7 Colour of sealants: selected by Engineer from manufacturer's standard range to match adjacent surfaces.

2.4 JOINT CLEANER

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

.2 Primer: as recommended by manufacturer.

3 Execution

3.1 PROTECTION

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

3.2 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 been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

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

3.6 APPLICATION

.1 Sealant.
- .1 Apply sealant in accordance with manufacturer's written instructions.
- .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
- .3 Apply sealant in continuous beads.
- .4 Apply sealant using gun with proper size nozzle.
- .5 Use sufficient pressure to fill voids and joints solid.
- .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
- .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
- .8 Remove excess compound promptly as work progresses and upon completion.

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

.3 Cleanup.
- .1 Clean adjacent surfaces immediately and leave work neat and clean.
- .2 Remove excess and droppings, using recommended cleaners as work progresses.
- .3 Remove masking tape after initial set of sealant.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 05 41 00 - Structural Metal Stud Framing for building-in frames in exterior metal framed walls.

.2 Section 05 50 00 - Metal Fabrications

.3 Section 07 92 10 - Caulking of joints between frames and other building components.

.4 Section 08 71 10 - Finish hardware, including weather-stripping.

.5 Section 08 80 50 - Glazing.

.6 Section 09 22 16 - Non-structural Metal Framing for for building-in frames in interior walls.

.7 Section 09 91 23 - Painting.

1.2 REFERENCE STANDARDS

.1 ASTM International:
- .1 ASTM A 653/A653M-10, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 ASTM A 794-10 - Standard Specification for Commercial Steel (CS), Sheet, Carbon (0.16 % Maximum to 0.25 % Maximum), Cold-Rolled.
- .3 ASTM A659/659M-10 - Standard Specification for Commercial Steel (CS), Sheet and Strip, Carbon (0.16 Maximum to 0.25 Maximum Percent), Hot-Rolled.

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

.3 Canadian Steel Door Manufacturers' Association, (CSDMA):
- .1 CSDMA, Specifications for Commercial Steel Doors and Frames, 2006.
- .2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Doors, 2009.

.4 CSA International:
- .1 G40.20/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 CSA W59-03 (R2009), Welded Steel Construction (Metal Arc Welding) (Metric Version).

.5 Underwriters Laboratories Canada (ULC):
- .1 CAN/ULC-S702-97, Thermal Insulation, Mineral Fibre, for Buildings.
- .2 CAN4-S104M80, rev. 1985.
- .3 CAN4-S105M1985 Rev 1992.

.6 National Fire Protection Association (NFPA).
- .1 (NFPA) 80- Standard for Fire Doors and Other Opening Protectives 2010 Edition.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

.1 Steel fire doors and frames: listed and labeled by an organization accredited by Standards Council of Canada in conformance with CAN4-S104M, and CAN4-S105M for ratings stated or indicated.

.2 Install labeled steel fire rated doors and frames to National Fire Protection Association (NFPA) 80, except where specified otherwise.

1.4 SUBMITTALS

.1 Submit shop drawings and test reports in accordance with Section 01 01 50.
.1 Clearly indicate each type of door and frame, material core thickness, mortises, reinforcements, anchorages, glazing, location of exposed fasteners and hardware arrangements.
.2 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and in door schedule.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50 - General Instructions; Construction/Demolition Waste Management and Disposal clause.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

.5 Divert unused wood materials from landfill to either recycling, reuse or composting facility.

2 Products

2.1 MATERIALS

.1 Sheet Steel (WGCS): tension leveled steel to ASTM A924, galvanized to ASTM A653 Coating designation ZF120 paintable galvaneal finish.

.2 Hot Rolled Carbon Steel Sheet (HRCS): commercial quality, to ASTM A659/A659M, for concealed reinforcement for materials, 2.7 mm minimum thickness.

.3 Glazing Stops: 1.2 mm base metal thickness commercial grade steel to ASTM A653M with ZF120 zinc wiped finish, screw fixed. Commercial grade steel of thickness and design listed by ULC for fire rated assemblies.

.4 Cold rolled carbon steel sheet (CRCS) commercial quality, TO ASTM A794, shop prime coated.

2.2 COMPONENTS

.1 Frames:

.1 Single door frames: 1.6 mm base thickness steel.
.2 Paired door frames: 2 mm base thickness steel.
.3 Glazing frames: 1.6 mm base thickness steel.

.2 Doors:
.1 Interior doors: 1.2 mm base thickness steel.
.2 Exterior doors: 1.6 mm base thickness steel

.3 Frame floor anchors and channel spreaders: minimum 1.6 mm thick base steel.

.4 Guard boxes: minimum 0.8 mm thick base steel.

.5 Steel frame anchors: thickness and design listed by ULC for labeled door and frame assemblies. Twist in stud anchor with base anchor for door frames in stud walls.

.6 Hinge, lock, strike, flush bolt and surface applied hardware reinforcing: 3.5 mm minimum base metal thickness.

.7 Door bumpers: black neoprene single stud.

.8 Reinforcing channel: to CAN/CSA G40.21, Type 300 W.

.9 Primer: to CAN/CGSB-1.181, zinc rich.

.10 Top caps: galvanized steel for all exterior doors, 0.9 mm base metal thickness.

2.3 DOOR TYPES

.1 (HCM) Doors: flush steel with full honeycomb core of 25 mm size bonded resin - impregnated kraft reinforcement, longitudinal edges mechanically locked and adhered, top and bottom edges with 1.6 mm projection welded channel, with reinforcement and prepared for hardware.

.2 (SCM) Doors: vertically stiffened with 0.9 mm interlocking steel stiffeners at 150 mm oc and welded to each face at 150 mm oc, all voids filled with semi-rigid fibrous insulation minimum density 24 kg/m^3 conforming to CAN/ULC S702, Type 1, with all steel hardware reinforcements, steel top cap for exterior doors, prepared for hardware.

2.4 FABRICATION

.1 Fabricate doors and frames as detailed; in accordance with Canadian Steel Door and Frame Manufacturer's Association (CSDFMA), "Canadian Manufacturing for Steel Doors and Frames"; for hollow steel construction; ULC requirements, reviewed shop drawings and specified standards, except where specified otherwise. Fabricate frames for glazing in similar manner as for door frames.

.2 Mortise, reinforce, drill and tap doors and frames and reinforcements to receive hardware using templates provided by finish hardware supplier. Refer to Section 08 71 10 for mounting heights.

.3 Touch up galvanized finish damaged during fabrication.

.4 Attach accredited labels to doors and frames indicated in Door Schedule as fire rated.

.5 Locate screw fixed glazing stops to secure side of glazed installations using Robertson head fasteners on Office side of wall.

.6 Prepare doors for cylinder, thumb turn lever where mortised doors are scheduled.

2.5 FRAMES

.1 Cut mitres and joints accurately and weld continuously on inside of frame profile.

.2 Grind welded corners to a flat plane, fill with metallic paste filler and sand to uniform smooth finish.

.3 Protect strike and hinge reinforcements in masonry walls using guard boxes welded to frames.

.4 Weld in two channel spreaders per frame, to ensure proper frame alignment.

.5 Provide adjustable jamb anchors for fixing at floor. Provide for anchorage of ULC frames to floor.

.6 Reinforce head of frames wider than 1200 mm; reinforce exterior frame assemblies to resist wind loading.

.7 Frame face reinforcement for all frames for exterior single doors: weld 6 mm thick x 25 mm wide x 925 mm long to interior of frame face on latch side and centered on latch. Tack weld at ends and along each side at 150 mm oc.

.8 Install 3 bumpers on strike jamb for each single door and 2 bumpers at head for pairs of door.

.9 Fill frames in exterior walls and frames in insulated interior walls, with fibreglass insulation.

2.6 DOORS

.1 Assemble components using spot or arc welding.

.2 Make provision for louvers and glazing where indicated and provide necessary glazing stops.

.3 Glazing Stops:
- .1 Glazed screens: 1.2 mm base metal thickness commercial grade steel, screw fixed.
- .2 Interior doors: 1 mm cold rolled steel, primed, with provision for 6 mm glazing.
- .3 Exterior doors: 1 mm cold rolled steel, primed, with provision for 22 mm thermal glazing.

.4 Spot weld longitudinal door edges, fill continuously and grind smooth to conceal edge seams. Lock seam exposed edges are permissible for HCM doors.

.5 Equip exterior doors with flush steel top caps to prevent water accumulation.

.6 Astragals specified in Section 08 71 10.

.7 Touch up doors with primer where galvanized finish damaged during fabrication.

3 Execution

3.1 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation. Install door frames anchored to steel stud framed walls accordance with reviewed shop drawings.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreaders at third points of door opening to maintain frame width. Remove temporary spreaders after frames are built-in.

.4 Make allowance for deflection to ensure structural loads are not transmitted to frames.

.5 Install fire rated door and frame assemblies in accordance with National Fire Codes, Volume 4, produced by NFPA 80.

.6 Fill frames with fibreglass insulation for all exterior door/frame assemblies specified with weather-stripping and interior frames in wall types 2, 2a, 4 and 4a.

.7 Caulk perimeter of frames between frame and adjacent material in accordance with Section 07 92 10.

.8 Maintain continuity of air/vapour barrier at exterior door frames.

3.2 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions.

.2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
- .1 Hinge side: 1.0 mm.
- .2 Latch side and head: 1.5 mm.
- .3 Finished floor: 13 mm.

.3 Adjust operable parts for correct function.

.4 Install louvers, glass and steel glazing stops.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 11 – Rough Carpentry.

.2 Section 07 27 10 – Air / Vapour Barriers.

.3 Section 08 80 50 – Aluminum Windows.

.4 Section 07 92 10 – Joint Sealing.

1.2 REFERENCES

.1 American Architectural Manufacturers Association (AAMA)

.1 AAMA 609/610-09, Cleaning and Maintenance Guide for Architecturally Finished Aluminum.

.2 ASTM International

.1 ASTM E330-[02], Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 1.40-97, Anticorrosive Structural Steel Alkyd Primer.

.2 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.

.3 CAN/CGSB-12.20-M89, Structural Design of Glass for Buildings.

.4 CSA International

.1 CSA G40.20/G40.21[04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.5 Environmental Choice Program (ECP)

.1 CCD-045-95, Sealants and Caulking Compounds.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 01 50 – General Instructions.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for doors and frames 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 British Columbia, Canada.

.2 Indicate materials and profiles and provide full-size, scaled details of components for each type of door and frame. Indicate:

.1 Interior trim and exterior junctions with adjacent construction.

.2 Junctions between combination units.

.3 Elevations of units.

.4 Core thicknesses of components.

.5 Type and location of exposed finishes, method of anchorage, number of anchors, supports, reinforcement, and accessories.

.6 Location of caulking.

.7 Each type of door system including location.

.8 Arrangement of reinforcing for hardware and joints.

.9 Arrangement of hardware and required clearances.

.4 Manufacturers Reports:

.1 Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in Part 3 - FIELD QUALITY CONTROL.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 01 50 – General Instructions.

.2 Operation and Maintenance Data: submit operation and maintenance data for cleaning and maintenance of aluminum finishes for incorporation into manual.

1.5 QUALITY ASSURANCE

.1 Certifications: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 01 50 General Instructions 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 Apply temporary protective coating to finished surfaces. Remove coating after erection. Use coatings that are easy to remove and residue free.

.2 Leave protective covering in place until final cleaning of building.

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect aluminum doors and frames from [nicks, scratches, and blemishes].

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DESIGN CRITERIA

.1 Design frames and doors in exterior walls to:

.1 Accommodate expansion and contraction within service temperature range of -35 to 35 degrees C.

.2 Limit deflection of mullions to maximum 1/175th of clear span when tested to ASTM E330 under wind load of 1.2 kPa, submit certificate of tests performed.

.3 Movement within system.

.4 Movement between system and perimeter framing components or substrate.

.2 Size glass thickness and glass unit dimensions to limits in accordance with CAN/CGSB-12.20.

.3 Design door system to provide average thermal resistance of:

.1 Vision glass areas: U of 0.41.

.4 Include continuous air barrier and vapour retarder through door system. Primarily in line with inside pane of glass and heel bead of glazing compound.

2.2 MATERIALS

.1 Aluminum extrusions: to Aluminum Association alloy AA6063-T6 anodizing quality.

.2 Sheet aluminum: to Aluminum Association alloy AA1100-H14 or AA5005-H32 or H34 anodizing quality.

.3 Steel reinforcement: to CSA G40.20/G40.21, grade 300 W.

.4 Fasteners: stainless steel, finished to match adjacent material.

.5 Weatherstrip: replaceable mohair backed wool pile.

.6 Door bumpers: black neoprene.

.7 Door bottom seal: adjustable door seal of anodized extruded aluminum frame and vinyl weather seal, surface mounted with drip cap, closed ends.

.8 Isolation coating: alkali resistant bituminous paint.

.9 Glass: tempered glass to CAN/CGSB-12.1, Type 2, Class B.

.10 Glazing materials: Insulating glass units, refer to section 08 80 50.

.11 Sealants: colour selected by Departmental Representative in accordance with Section 07 92 10 - Joint Sealing.

2.3 EXTERIOR ALUMINUM DOORS

.1 Construct doors of porthole extrusions with minimum wall thickness of 2.3 mm.

.2 Door stiles nominal 175 mm wide plus or minus 6 mm.

.3 Top rail nominal 175 mm wide plus or minus 6 mm.

.4 Bottom and midrail nominal 300 mm wide plus or minus 6 mm.

.5 Reinforce mechanically-joined corners of doors to produce sturdy door unit.

.6 Glazing stops: interlocking snap-in type for dry glazing. Exterior stops: tamperproof type.

.7 Supply thermally broken doors for exterior.

.8 Hardware: Refer to Section 08 71 10.

2.4 EXTERIOR ALUMINUM FRAMES

.1 Construct thermally broken frames of aluminum extrusions with minimum wall thickness of 1.8 mm.

.2 Frame members 50.8 mm x 114.3 mm nominal size, for centre glazing with tamperproof stops.

.3 Thermal break with 6.4 mm separation consisting of a two-part chemically curing, high-density polyurethane, mechanically and adhesively joined to aluminum storefront sections.

2.5 ALUMINUM FINISHES

.1 Clear anodic finish: to designation AA-M12C22A31, Architectural Class II.

.2 Appearance and properties of anodized finishes designated by Aluminum Association as Architectural Class 1, Architectural Class 2, and Protective and Decorative.

2.6 STEEL FINISHES

.1 Finish steel clips and reinforcing steel with steel primer to CGSB 1.40 zinc coating to CAN/CSA-G164.

2.7 FABRICATION

.1 Doors and framing to be by same manufacturer.

.2 Fabricate doors and frames to profiles and maximum face sizes as indicated. Provide minimum 22 mm bite for insulating glazed units.

.3 Provide structural steel reinforcement as required.

.4 Fit joints tightly and secure mechanically.

.5 Conceal fastenings.

.6 Mortise, reinforce, drill and tap doors, frames and reinforcements to receive hardware using templates provided under Section 08 71 10 - Door Hardware.

.7 Isolate aluminum from direct contact with dissimilar metals, concrete and masonry.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for aluminum doors and frames 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 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Set frames plumb, square, level at correct elevation in alignment with adjacent work.

.3 Anchor securely.

.4 Install doors and hardware in accordance with hardware templates and manufacturer's instructions.

.5 Adjust door components to ensure smooth operation.

.6 Make allowances for deflection of structure to ensure that structural loads are not transmitted to frames.

.7 Glaze aluminum doors and frames in accordance with Section 08 80 50 - Glazing.

.8 Seal joints to provide weathertight seal at outside and air, vapour seal at inside.

.9 Apply sealant in accordance with Section 07 92 10 - Joint Sealing. Conceal sealant within the aluminum work except where exposed use is permitted by Departmental Representative.

3.3 FIELD QUALITY CONTROL

.1 Have manufacturer of products supplied under this Section review Work involved in handling, installation/application, protection and cleaning of its product[s], and submit written reports in acceptable format to verify compliance of Work with Contract.

.2 Manufacturer's Field Services: 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:

.1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.

.2 Upon completion of Work, after cleaning is carried out.

.4 Obtain reports within 3 days of review and submit.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 01 50 General Instructions.

.1 Leave Work area clean at end of each day.

.2 Perform cleaning of aluminum components in accordance with AAMA 609.1 - Voluntary Guide Specification for Cleaning and Maintenance of Architectural Anodized Aluminum.

.3 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.4 Clean aluminum with damp rag and approved non-abrasive cleaner.

.5 Remove traces of primer, caulking, epoxy and filler materials; clean doors and frames.

.6 Clean glass and glazing materials with approved non-abrasive cleaner.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 01 50 General Instructions.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by aluminum door and frame installation.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 01 01 50 - General Instructions: Submittal Procedures, Construction/Demolition Waste and Disposal, Closeout Submittals.

.2 Section 05 50 00 - Metal Fabrication; Steel (plate, angle and channel) door frames.

.3 Section 08 71 10 Door Hardware - Supply of master keyed cylinders.

.4 Division 26 - Electrical power supply.

1.2 SUMMARY OF WORK

.1 Doors 107a, 112a and 114c:
- .1 Insulated rolling steel shutter doors including; curtains, bottom bars, guides, brackets, hoods, power operating mechanisms and specified features.

1.3 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)
- .1 ASTM A167-99 (2009) Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
- .2 ASTM A 653/A653M - 11, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process.
- .3 ASTM A 924/A924M - 10a, Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

.2 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-1.38-2000, Interior Enamel Undercoat.
- .2 CAN/CGSB-1.213-95, Etch Primer (Pretreatment Coating) for Steel and Aluminum.

1.4 DESIGN CRITERIA

.1 Design rolling shutter door curtain and assembly to withstand windload of 960 Pa within door opening area.

.2 Insulated rolling service door: motor operated, emergency hand chain, interior face mounted.

.3 All rolling insulated service doors designed to a standard maximum of 25 cycles per day and an overall maximum of 50,000 operating cycles for the life of the door. Rolling door to operate at a speed of 200 mm per second.

1.5 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 01 50 - General Instructions; Submittal Procedures clause.

.2 Shop Drawings:
- .1 Submit shop drawings in accordance with Section 01 01 50 - General Instructions; Submittal Procedures clause.

.2 Indicate type of rolling service door, arrangement of hardware, operating mechanism and required clearances.

.3 Manufacturer's Instructions:
.1 Submit manufacturer's installation instructions.

1.6 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for overhead coiling counter doors and hardware for incorporation into manual specified in Section 01 01 50 - General Instructions; Closeout Submittal clause.

.2 Submit a written 2 year warranty for materials and workmanship.

1.7 QUALITY ASSURANCE

.1 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Installation by factory approved installers.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Dispose of corrugated cardboard, polystyrene, plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

.3 Remove from site and dispose of packaging materials at appropriate recycling facilities

.4 Divert unused metal materials from landfill to metal recycling facility approved by Engineer.

2 Products

2.1 MATERIALS

.1 Insulated rolling doors.
.1 Constructed of interconnected strip steel slats conforming to ASTM A-653. The slats size designated by the manufacturer to meet design criteria measuring 76 mm high by 22 mm deep) consisting of a 0.76 mm exterior slat and a 0.76 mm interior slat separated by 20 mm of rigid insulation.
.2 Bottom bar: two 3 mm steel angles mechanically joined together and includes safety edge system. Finish on the bottom bar: one (1) coat of rust-inhibiting primer and custom colour to match door
.3 Door guides: 3 steel angles bolted together with 9.5 mm fasteners to form a channel for the curtain to travel with extruded vinyl snap-on weather-stripping continuously along the exterior leg of each guide. Continuous wall angle fastened to the wall structure Finish guide angles with one (1) coat of rust-inhibiting prime paint.
.4 Brackets: constructed of steel not less than 6 mm thick and bolted to the wall angle with minimum 12 mm fasteners. Finish the brackets with one (1) coat of rust-inhibiting prime paint.
.5 Barrel: steel tubing not less than 150 mm diameter with oil tempered torsion springs

capable of correctly counter balancing the width of the curtain and designed to limit the maximum deflection to 2.5 mm per meter of opening width. Spring adjustment by means of an exterior wheel. Finish the barrel with one (1) coat of rust-inhibiting prime paint.

.2 Hood: fabricated from 0.6 mm galvanized steel and formed to fit the curvature of the brackets and containing a waterproof baffle to control air infiltration. Finish the hood with a thermosetting custom colour polyester top coat with a minimum thickness of .6 mils each side.

.3 Safety edge system:

.1 Rolling door safety edge system as designed by the manufactured to include the following features:

.1 For installation on the bottom bar of the door to automatically reverse the door if the device detects an obstruction in the downward travel of the door.

.2 The safety edge to consist of a rubber boot attached below the bottom bar with an electrical switch secured to the back of the bottom bar and operates by air wave technology that creates an air wave when safety edge is compressed along its length and reverses the direction of the rolling door. Air wave will not be interfered by temperature, barometric pressure, water infiltration, or cuts in the rubber boot.

.3 Connect safety edge to the motor operator with a coil cord.

2.2 FINISHES

.1 The door curtain finish to consist of the following:

.1 Hot dipped galvanized Z275 coating in accordance with ASTM A-653.

.2 Bonderized coating for prime coat adhesion

.3 Corrosion inhibiting primer 5 µm per side.

.4 The custom colour finish: with no corrosion when the material is subjected to salt spray resistance test ASTM B-117 for 1000 hours. Factory applied Thermosetting Powder Coating applied with a minimum thickness of 5 µm. Color as selected by the Departmental Representative and chosen from custom color selection. Rolling service door and sectional overhead door of same colour.

2.3 ELECTRICAL OPERATOR

.1 Electrical motors, controller units, remote pushbutton stations, relays and other electrical components: to CSA and ULC approval with EEMAC enclosures Class 1.

.2 Power supply: 208V, 3 phase, 1/2 hp.

.3 Motor: high starting torque, instant reversing, capacity to operate service door at 200 mm per second, removable without affecting emergency chain device or setting of limit switches. Equip motor with overload protection, centrifugal clutch and electric brake.

.4 Motor size matching gear reducer with gears running in oil bath.

.5 Controller units with integral motor reversing starter, 3 heater elements for overload protection, including pushbuttons and control relays as applicable.

.6 Control system, (all components from one manufacturer):

.1 Exterior control: three-position key cylinder actuated switch. Locate switch in exterior wall adjacent to each Rolling Door. Provide one master key switch to shut out exterior

key switch and locate in office as directed by the Departmental Representative. Master switch will not affect interior control stations.

.2 Interior control: momentary-contact, three button control stations with push button controls labeled "open", "close" and "stop".

.7 Design brake to stop and hold doors in any position.

.8 Include hand chain interlocked auxiliary operator to disconnect motor mechanically and electrically when engaged and allow manual operation of door.

.9 Safety switch: electro mechanical, electro pneumatic device full length of bottom rail of bottom section of door, to reverse door to open position when coming in contact with object on closing cycle.

.10 Mounting brackets: galvanized steel, size and thickness to suit conditions.

3 Execution

3.1 INSTALLATION

.1 Install insulated service doors in accordance with manufacturer's printed instructions.

.2 Install electrical motors, controller units, pushbutton stations, relays and other electrical equipment required for all service door operation.

.3 Installation includes electric wiring from power supply located near door.

.4 Install master keyed cylinder specified in Section 08 71 10 - Door Hardware.

.5 Adjust door operating components to ensure smooth opening and closing of doors.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 01 01 50 - Final cleaning.

.2 Section 06 10 11 - Rough Carpentry for frame and wood blocking at rough openings.

.3 Section 07 27 10 - Air/Vapour Barrier.

.4 Section 07 46 13 - Wall Cladding Assembly for flashing and trim.

.5 Section 07 92 10 - Joint Sealing.

.6 Section 08 11 16 – Aluminum Doors and Frames.

.7 Section 08 80 50 - Glazing.

1.2 REFERENCED STANDARDS

.1 CSA International (CSA):
- .1 CAN/CSA 12.20-M89 Structural Design of Glass for Buildings.
- .2 CAN/CSA-A440-M00(R2005) Windows.

.2 Canadian General Standards Board (CGSB):
- .1 CAN/CGSB-12.1-M90 Tempered or Laminated Safety Glass.
- .2 CAN/CGSB-12.8-M90 Insulating Glass Units.
- .3 CGSB 19-GP-14-M76 (1984) Sealing Compound, One-Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976)
- .4 CAN/CGSB 79.1M91 - Insect Screens.

.3 ASTM International (ASTM)
- .1 ASTM C509-06 Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
- .2 ASTM D3656-07 - Standard Specification for Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns.
- .3 ASTM A153/A153M-09 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

1.3 SUBMITTALS

.1 Submit shop drawings, test reports and maintenance data in accordance with Section 01 01 50.
- .1 Indicate materials and details in scale full size for head, jamb and sill, profiles of components, interior and exterior trim, junction between combination units, elevations of unit, anchorage details, location of isolation coating, description of related components and exposed finishes, fasteners, and caulking.

.2 Submit test reports from approved independent testing laboratories, certifying compliance with specifications, for:
- .1 Windows classifications.
- .2 Anodized finish.
- .3 Air tightness.

.4 Water tightness.
.5 Wind load resistance.
.6 Condensation resistance.

.3 Provide operation and maintenance data for aluminum windows for incorporation into manual.

2 Products

2.1 MATERIALS

.1 Materials: to CAN/CSA-A440 supplemented as follows:
.1 All aluminum windows by same manufacturer.
.2 Sash: thermally broken.
.3 Main frame: aluminum, thermally broken frame section with thermal break, 19 mm x 127 mm with integral exterior stop and removable snap in interior stops.
.4 Glass and glazing materials: tempered safety Low-e glass on No.2 surface, double sealed with argon fill between glass, in accordance with Section 08 80 50, Clause 2.1.3 and its paragraphs.
.5 Glazing seals:
.1 Exterior Glazing: macro-polyisobutylene tape with a continuous built in shim; highly adhesive and elastic.
.2 Interior Glazing: extruded thermoplastic elastomers gasket
.6 Bedding compound: to CGSB 19-GP-14M, one compound butyl polyisobutylene polymer base, solvent curing.
.7 Sill flashing: 1 mm thickness aluminum flashing directly under window frame.
.8 Isolation coating: alkali resistant bituminous paint.
.9 Sealants: in accordance with Section 07 92 10, colour selected by Departmental Representative.

2.2 WINDOW TYPE AND CLASSIFICATION

.1 Exterior Window Types:
.1 Aluminum framed fixed glazed units, incorporating thermal break, extruded aluminum snap in glazing stops and sealed double glazing.
.2 Glazing: double sealed, with Low-e glass and Argon gas.

.3 Classification rating: to CAN/CSA-A440.
.1 Air leakage: fixed.
.2 Water leakage: B5.
.3 Wind load resistance: C3.
.4 Condensation resistance: Temperature Index, I 50.

.2 Interior Window Types:
.1 Construct non-thermally broken frames of aluminum storefront extrusions with minimal wall thickness of 1.8 mm.
.2 44.5 mm x 114 mm framing system for centre plane single glazing as scheduled.
.3 Frame members for integral exterior stop and removable snap in interior stops.

2.3 FABRICATION

.1 Fabricate in accordance with CAN/CSA-A440 supplemented as follows:
.1 Fabricate units square and true with maximum tolerance of plus or minus 1.5 mm for

units with a diagonal measurement of 1800 mm or less and plus or minus 3 mm for units with a diagonal measurement over 1800 mm.

.2 Face dimensions detailed are maximum permissible sizes.

.3 Brace frames to maintain squareness and rigidity during shipment and installation.

.4 Finish steel clips and reinforcement with 380 g/m2 zinc coating to ASTM A153.

.5 Frame members for integral exterior stop and removable snap in interior stops.

.6 Fabricate frames to profiles and maximum face sizes as indicated.

.7 Fit joints tightly and secure mechanically.

.8 Conceal fastenings.

.2 Sash aluminum extrusion thickness: based on published wind load charts to meet specified wind load for locality.

.3 Manufacturer's nameplates on windows are not acceptable.

2.4 ALUMINUM FRAME FINISHES

.1 Anodic Oxide Treatments: processed in accordance with AAMA designations.

.1 Factory finish: Clear anodic oxide treatment to AA-M12C22A31, Architectural Class II designation is for #17 Clear anodized finish (0.0004).

2.5 ISOLATION COATING

.1 Isolate aluminum from following components, by means of isolation coating:

.1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.

.2 Concrete, mortar and masonry.

.3 Wood.

2.6 GLAZING

.1 Factory glaze hopper windows in accordance with CAN/CSA-A440 with double sealed tempered safety glass with Low-e and Argon gas, in accordance with manufacturer's instructions.

2.7 AIR BARRIER

.1 Caulking perimeter joint between window frame and peel and stick membrane is acceptable.

3 Execution

3.1 WINDOW INSTALLATION

.1 Install windows in accordance with CAN/CSA-A440. Install aluminum flashing under sill frame and extend to overlap wall finish cap flashing.

.2 Arrange components to prevent abrupt variation in colour.

.3 Set frames plumb, square, level at correct elevation in alignment with adjacent work.

.4 Anchor securely.

.5 Make allowances for deflection of structure to ensure that structural loads are not transmitted to frames.

.6 Glaze aluminum frames in accordance with Section 08 80 50 - Glazing.

3.2 CAULKING

.1 Seal joints at head and jambs, between window frames and metal trim/head flashing with sealant to provide weather tight seal at outside. Caulk between sill upstand and interior window frame.

.2 Apply sealant in accordance with Section 07 92 10 - Sealants. Conceal sealant within window units except where exposed use is permitted by Departmental Representative.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 08 11 14 - Steel Doors and Frames.

.2 Section 08 11 16 – Aluminum Doors and Frames.

.3 Section 08 33 13 – Rolling Shutter Doors.

1.2 REFERENCE STANDARDS

.1 Standard hardware location dimensions in accordance with the Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by the Canadian Steel Door and Frame Manufacturer's Association

.2 ANSI/BHMA A156.1-2006, Standard for Butts and Hinges.

.3 ANSI/BHMA A156.3-2008, Exit Devices.

.4 ANSI/BHMA A156.4-2000, Standard for Door Controls (Closers).

.5 ANSI/BHMA A156.6-2005, Architectural Door Trim.

.6 ANSI/BHMA A156.7-2009, Template Hinge Dimensions.

.7 ANSI/BHMA A156.8-2005, Door Controls - overhead Stops and Closers.

.8 ANSI/BHMA A156.13-2005 Standard for Mortised Locks and Latches Series 1000.

.9 ANSI/BHMA A156.16- 2002 Auxiliary Hardware.

.10 ANSI/BHMA A156.18-2006 Materials and Finishes.

.11 ANSI/BHMA A156.22-2005, Standard for Door Gasketing Systems.

1.3 HARDWARE LIST

.1 Submit detailed hardware schedule (indicating each door) in accordance with drawings, indicated hardware functions, codes/acceptable product list, and Section 01 01 50. Submit manufacturer's literature for proposed hardware items. Include any additional hardware indicated or required. Indicate proposed hardware, including make, model, material, function, finish and other pertinent information.

1.4 MAINTENANCE DATA

.1 Brief maintenance staff regarding proper care, cleaning and general maintenance.

.2 Provide maintenance data, parts list, and manufacturer's instructions for each type door closers, locksets, and door holders for incorporation into maintenance manual specified in Section 01 01 50.

1.5 REQUIREMENTS REGULATORY AGENCIES

.1 Use ULC/ULI listed and labeled hardware for doors frames in fire separations and exit doors.

.2 Only ULI listed products with the additional identifier reflecting compliance with Canadian Standards will be accepted.

1.6 MAINTENANCE MATERIALS

.1 Supply 2 sets of wrenches for door closers.

1.7 DELIVERY AND STORAGE

.1 Store finishing hardware to site as directed.

.2 Package each item of hardware including fastenings separately or in like groups of hardware. Label each package as to item definition and location.

.3 Maintain inventory list with hardware schedule.

1.8 GUARANTEE

.1 Provide a manufacturer's written guarantee stating that the door closers specified in this Section are guaranteed against malfunction for a period of 60 months from the date of Interim Certificate of Completion.

2 Products

2.1 HARDWARE ITEMS

.1 Only door hardware meeting the requirements of specified standards are acceptable for use on this project, except as specified otherwise. Specified brands listed within the door hardware specification are to provide quality and functional intentions, only the locksets and lock cores are hard specified to match to existing facility Stanley Best equipment. Equal alternates for other components will be reviewed at time of submission for applicability.

.2 Use one manufacturer's products only for all similar items.

.3 Hardware material finish codes: ANSI/BHMA A156.18 as indicated.

2.2 DOOR HARDWARE

.1 Co-ordinate door hardware listing with Door, Frame and Hardware Schedule.

.2 Hinges and butts:

.1 Hinges: to ANSI/BHMA A156.1 type, numbers and sizes listed in hardware schedule, full mortise template hinges finished to 626, exterior 630.

.2 Hinges on selected doors to be "**NRP**" Type (non-removable-pin) as scheduled.

.3 All hinges with minimum leaf thickness of 3.4 mm and of 5 knuckle 2 ball bearing, except where specified as plain bearing (PB) or four ball bearing (4BB).

.4 Electric hinges to above requirements with concealed electric (CE) connection.

.3 Latch and lock sets:
- .1 Mortise locks and latches: to ANSI/BHMA A156.13, series 1000 mortise lock, grade 1, and security grade 2 for exterior doors, designed for function and keyed as stated in Hardware Schedule. Acceptable product Best Access Series 45H.
- .2 Lever handles: plain design with Return.
- .3 Escutcheons: rectangular full height screwless escutcheons for locksets with deadbolts, round roses for locksets without deadbolts.
- .4 Normal strikes: box type, lip projection not beyond jamb.
- .5 Cylinders: key into keying system as directed.
- .6 Finished to 626 for interior locks and 630 for exterior and as noted.

.4 Closers: provide adjustable back check for 90° to 180° opening. Finish to be 628 satin aluminum, powder coated finish.
- .1 Surface mounted overhead door closers: to ANSI/BHMA A156.4, door mounted, top jamb or parallel mounted, non-handed, non-sized with site adjustable spring tension from size 2-6, with heavy duty forged steel arms, full rack and pinion hydraulic action, adjustable closing speed, adjustable back-checking action, high strength cast iron cylinder walls with stable hydraulic fluid to make winter/summer adjustments unnecessary.
- .2 Provide through bolts for attachment to doors. Closer housing of smooth rectangular design approximately 90 mm high.
- .3 Finish to C28 in lacquer or polyester powder coat finish.
- .4 Provide closers with the following accessories as noted in schedule.
  - .1 CS: Cushion stop arm.
  - .2 HO: Hold open arm.
  - .3 PA: Parallel arm.
- .5 Products with universal mounting and adjustments to take into account changing door configurations.

.5 Auto Operator:
- .1 Surface mounted overhead operator: to ANSI/BHMA A117.1 & A156.19
- .2 Finish: Clear Anodized Aluminum
- .3 Accessible Push Buttons: ADA Hard wired push plate access control
- .4 Panic Hardware with electric retraction of latch, Von Duprin QEL series or equal
- .5 Key Switch incorporated into panic hardware to turn off automatic operator. Stanley 1-E74 cylinder
- .6 Door Operation:
  - .1 Key Switch Mechanism locks/unlocks door and deactivates auto operator
  - .2 When door is unlocked, pushing the accessible push button activates both the inner and outer vestibule doors simultaneously. The QEL panic hardware depresses and the auto operator engages opening the doors.
  - .3 When door is locked panic hardware enables exiting from building without auto operation.
- .7 Refer to Electrical drawing for wiring diagram. Low voltage wiring requirements specified in Division 27. Coordinate installation of control wiring with Division 27.

.6 Normal strikes: box type, lip projection not beyond jamb, ANSI dimensions, finish to match lockset.

.7 Overhead door stop/holder: to ANSI/BHMA A156.8 surface mounted type with shock absorber and hold open device to degree noted.

.8 Surface bolts, top and bottom of door: ANSI/BHMA A156.16 steel, 626 finish, 300 mm long with mortise bolt keepers.

.9 Weather-stripping:
- .1 Door bottom seal: weather seal with drip cap of 32 mm high aluminum frame and replaceable nylon brush weather seal, surface mounted on exterior door as indicated in schedule.
- .2 Jamb seals: adjustable trim of aluminum extrusion minimum 20 x 6 mm with EPDM sponge insert.
- .3 Thresholds: to indicated width x full width of door opening, aluminum extruded mill finish, fluted surface, fitted to door frame opening size and profile, with thermal break, maximum 12 mm rise, one or two piece.

.10 Sound seals: Seals tested to ASTM E1408-91.
- .1 Double seals for jamb frame: aluminum frame and replaceable vinyl bulb stripping, adjustable, purpose made for reducing sound transmission. Acceptable Product: Pemko# 322SN or 350R with Pemko S88 BL seals adhered to frame.
- .2 Door bottom seal: surface mounted assembly to door bottom, with automatic drop strip, adjustable to door undercut, purpose made to reduce sound transmission. Acceptable Product: Pemko # 430L, 4301 or 412 or Approved Equal.
- .3 Threshold for Sound Attenuated doors, size 12 mm rise x 125 mm wide, with panic bar stop and continuous vinyl seal, smooth surface.

.11 Smoke Seals:
- .1 Self-adhesive back, silicone bulb, tested in accordance with UL 1784-2001Air Leakage Tests of Door Assemblies, and meet the performance criteria for allowable air leakage as specified in NFPA 105-99 Installation of Smoke Control Door Assemblies. Pemko # S88.
- .2 Threshold for smoke seal doors, size 4.8 mm rise x 50 to 75 mm wide, smooth surface.
- .3 Bottom seal: auto drop strip, adjustable, concealed for HM doors and semi-mortised mounted for wood doors.

.12 Astragals:
- .1 Security astragal for scheduled paired doors of primed steel flat bar, 50 mm wide x 3 mm thickness, full length of door, sex-bolt mounted (or exposed security Torx head screws) with Pemko S88 seals at meeting style.

.13 Latch Guard:
- .1 Heavy gauge formed steel plate cover to protect lock strike area, 300 mm high, through bolt mounting formed to suit mortised locksets with standard strikes.

.14 Architectural door trim:
- .1 Door stops: to ANSI/BHMA A156.16, L02141 floor mounted, L02101 wall mounted concealed fastening and for exterior doors 75 mm high stops with two fasteners, 626 or 630 finish.
- .2 Kick plates: to ANSI/BHMA A156.6, stainless steel, 1.2 mm thick x 305mm or 915mm high x door width, installed both sides of door, No 4 finish.
- .3 Door pulls and plate: to ANSI/BHMA A156.6, stainless steel materials, 25 φ x 250 mm long pull with concealed mounting, 100 x 400 plate size, with through-bolt mounting.
- .4 Door push plate: to ANSI/BHMA A156.6, stainless steel materials, 100 x 400 plate size, with through-bolt mounting.

2.3 KEYING

.1 Order all permanent cylinders for all locksets. Order key cylinders and keys from BEST ACCESS SYSTEMS, 7-pin removable core system to match keyway for William Head Institution. Include three keys with each permanent cylinder.

.1 Provide all exterior locksets with removable core construction cylinders. Key all construction cores alike. Provide three keys to operate construction cores or temporary locksets.

2.4 DOOR SCHEDULE

.1 Quantities shown in schedule are for one opening only. Include all hardware for each door listed, except as noted. Refer to Drawing A-901 for Door Schedule.

3 Execution

3.1 INSTALLATION

.1 Install hardware in accordance with manufacturer's printed instructions.

.2 Re-adjust doors and hardware to function properly just prior to interim acceptance of building.

3.2 DEMONSTRATION

.1 Maintenance Staff Briefing:

.1 Brief maintenance staff regarding:

.1 Proper care, cleaning, and general maintenance of projects complete hardware

.2 Description, use, handling, and storage of keys.

.3 Use, application and storage of wrenches for door closers, locksets, and power operating hardware.

.2 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.3 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

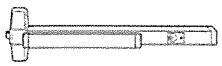
.2 Clean hardware with damp cloth and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.

.3 Remove protective material from hardware items where present.

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

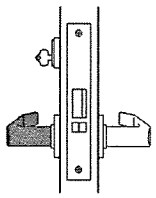
3.4 HARDWARE SETS

GROUP 1	EXTERIOR DOUBLE DOOR	SCM DOOR & FRAME
6	Hinges	2BB 114x102 NRP
1	Panic Hardware	9827 EO
1	Panic Hardware Elec	QEL 9827 EO
1	Power Supply	PS 902-2RS-FA
1	Core	
1	Keyswitch	
1	Closer	(Inactive Leaf) + HO
1	Auto Operator	(Active Leaf)
1	Weather Seal	
1	Astragal	
1	Door Bottom Seal	
2	Flush Bolts	
1	Threshold	200 Depth x Door Width
4	Kick Plate	305 High x Door Width

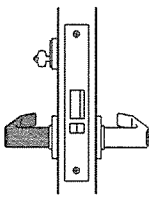


GROUP 2	INTERIOR VESTIBULE DOUBLE DOOR	SCM DOOR & FRAME
6	Hinges	2BB 114x102 NRP
1	Panic Hardware	9827 EOF LBR
1	Panic Hardware Elec	QEL 9827 L-F LBR
1	Power Supply	PS 902-2RS-FA
1	Auto Operator	(Active Leaf)
1	Closer	(Inactive Leaf) + HO
4	Kick Plate	305 High x Door Width

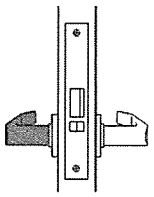
GROUP 3	EXTERIOR DOOR	SCM DOOR & FRAME
3	Hinges	2BB 114x102 NRP
1	Lockset	45H-7-F07-15-M-630
1	Core	
1	Closer	HO
1	Weather Seal	
1	Door Bottom Seal	
1	Threshold	200 Depth x Door Width
2	Kick Plate	915 High x Door Width



GROUP 4	EXTERIOR DOUBLE DOOR	SCM DOOR & FRAME
6	Hinges	2BB 114x102 NRP
1	Lockset	45H-7-F07-15-M-630
1	Cores	
2	Closer	HO
1	Weather Seal	
1	Astragal	
1	Door Bottom Seal	
2	Flush Bolts	
1	Threshold	200 Depth x Door Width
4	Kick Plate	915 High x Door Width

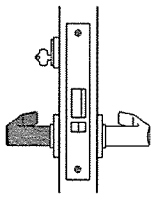


GROUP 5	EXTERIOR DOOR	SCM DOOR & FRAME
3	Hinges	2BB 114x102 NRP
1	Lockset	45H-7-F31-15-M-630*
1	Closer	HO
1	Weather Seal	
1	Door Bottom	
1	Threshold	200 Depth x Door Width
2	Kick Plate	915 High x Door Width

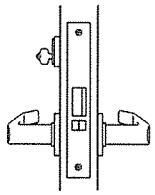


*Delete exterior lever (no exterior hardware)

GROUP 6	INTERIOR DOOR	HCM DOOR & FRAME
3	Hinges	2BB 114x102 NRP
1	Lockset	45H-7-F07-15-M-630
1	Core	
1	Closer	
2	Kick Plate	305 High x Door Width
1	Wall Stop	

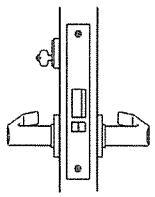


GROUP 7	INTERIOR DOOR	HCM DOOR & FRAME
3	Hinges	2BB 114x102 NRP
1	Lockset	45H-7-F05-15-M-630
1	Core	
1	Closer	
2	Kick Plate	915 High x Door Width
1	Wall Stop	

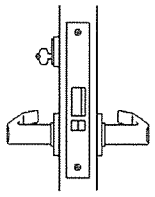


Door 114 to receive weather seal in addition to the above hardware for dust control.

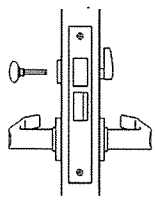
GROUP 8	INTERIOR DOOR	HCM DOOR & FRAME
3	Hinges	2BB 114x102 NRP
1	Lockset	45H-7-F05-15-M-630
1	Core	
2	Kick Plate	915 High x Door Width
1	Floor Stop	



GROUP 9	INTERIOR DOUBLE DOOR	HCM DOOR & FRAME
6	Hinges	2BB 114x102 NRP
2	Lockset	45H-0-F05-15-M-630
1	Core	
2	Closer	
2	Flush Bolts	
4	Kick Plate	915 High x Door Width

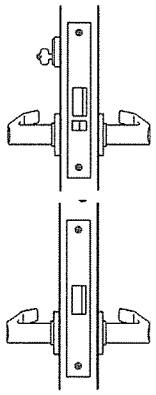


GROUP 10	INTERIOR DOOR	HCM DOOR & FRAME
3	Hinges	2BB 114x102 NRP
1	Lockset	45H-0-F19-15-M-630-VIN
1	Closer	
2	Kick Plate	305 High x Door Width
1	Wall Stop	



GROUP 11	INTERIOR DOOR	HCM DOOR & FRAME
3	Hinges	2BB 114x102 NRP
1	Lockset	45H-7-F05-15-M-630
1	Core	
1	Wall Stop	

GROUP 12	INTERIOR DOOR	HCM DOOR & FRAME
3	Hinges	2BB 114x102 NRP
1	Passage Set	45H-7-F01-15-M-630
1	Closer	
1	Wall Stop	



END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 08 11 14 - Steel Doors and Frames.
.2 Section 08 11 16 – Aluminum Doors and Frames.
.3 Glazing of:
  .1 Windows - Section 08 50 50.
  .2 Framed mirrors - Section 10 28 10.

1.2 REFERENCES

.1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.

.2 CAN/CGSB-12.8-97 Insulating Glass Units.

.3 CAN/CGSB-12.11-M90, Wired Safety Glass.

.4 CAN/CGSB-12.20-M89, Structural Design of Glass for Buildings

.5 CAN/CGSB-19.13-M87 Sealing Compound, One-Component, Silicone Base, Solvent Curing.

.6 Environmental Choice Program (ECP).
  .1 CCD-045-95, Sealants and Caulking.

.7 Glass Association of North America (GANA).
  .1 GANA Glazing Manual - 50th Anniversary Edition (2008).

.8 Glass Association of North America (GANA)
  .1 Laminated Glazing Reference Manual, 2006 Edition.

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:
  .1 Provide continuity of building enclosure vapour and air barrier using glass and glazing materials as follows:
    .1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.
  .2 Size glass to withstand wind loads, dead loads and positive and negative live loads acting normal to plane of glass to a design pressure for locality as measured in accordance with ANSI/ASTM E330.
  .3 Limit glass deflection to 1/200 with full recovery of glazing materials.

1.4 SUBMITTALS

.1 Submit shop drawings or catalogue illustrations of accessories in accordance with Section 01 01 50.

.2 Provide maintenance data for plastic glazing for incorporation into Operation and Maintenance Manual specified in Section 01 01 50.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50 - General Instructions; Construction/Demolition Waste Management and Disposal clause.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility approved by Engineer.

.5 Divert unused wood materials from landfill to either recycling, reuse or composting facility.

2 Products

2.1 GLASS MATERIALS

.1 Flat, clear float glass (annealed): to CAN/CGSB 12.3M, glazing quality of thickness indicated.

.2 Low emissivity (LOW E) glass on #2 surface of insulating glass unit.
- .1 Metallic coating: soft, sputtered.
- .2 Light transmittance: 71%.
- .3 Shading co-efficient: 54.
- .4 U-Value: winter 0.25 maximum, summer 0.23 maximum.

.3 Insulating glass units:
- .1 Factory sealed double glazed units for doors: To CAN/CGSB 12.8M, double glazed sealed unit with two panes of 5 mm tempered safety glass to 22 mm total thickness.
- .2 Factory sealed double glazed units for windows: nominal 22 mm overall thickness to CAN/CGSB-12.20-M, using tempered safety glass with Low-e coating on #2 surface, 12 mm separation with argon gas fill and certified with Insulated Glass Manufacturer's Association of Canada (IGMAC), glazed in accordance with manufacturer's instructions. Glass thickness to National and Local Building Code requirements and climatic conditions of project location.

.4 Wired glass: to CAN/CGSB 12.11M, type 1, square wire mesh style, 6 mm thick.

.5 Fire rated glass:
- .1 Type and thickness: As approved by certified listed ULC design systems specified fire rating, 8 mm thickness.
- .2 Tested for positive pressure test standards UL 10C, UBC 7-2 and UBC 7-4
- .3 Ground and polished both sides.
- .4 Label each piece with UL logo and fire rating.
- .5 Fire rated glazing tape supplied by glazing manufacturer.

.6 Safety glass:
- .1 To CAN2 12.1M, transparent, 6 mm thickness, Type 2 tempered or Type 1 laminated, Class B-float, category II, concealed edge.

2.2 GLAZING AND SEALING COMPOUND MATERIALS

.1 Sealant compound: glazing sealant: purpose made for glazing use, compatible with hermetically sealed insulating glass units sealants, colours selected by Engineer where exposed to view.

.2 Glazing tape: Preformed macro-polyisobutylene tape with continuous integral Neoprene shim, paper release, black colour, width x thickness recommended by sash manufacturer to suit installation.

.3 Setting blocks: Setting blocks: Neoprene or EPDM, 80-90 Shore A durometer hardness to ASTM D 2240, to suit glazing method, glass light weight and area.

.4 Spacer shims: neoprene, 40-60 Shore "A" durometer hardness as required.

.5 Primer-sealers and cleaners: to glazing manufacturer's standard.

3 Execution

3.1 WORKMANSHIP

.1 Remove protective coatings and clean contact surfaces with solvent and wipe dry.

.2 Apply primer-sealer to contact surfaces.

.3 Place setting blocks as per manufacturer's instructions.

.4 Install glass, rest on setting blocks, and ensure full contact and adhesion at perimeter.

.5 Install removable stops, without displacing tape or sealant.

.6 Provide edge clearance of 3 mm minimum for glass in accordance with manufacturer's instructions.

.7 Insert spacer shims to centre glass in space. Place shims at 600 mm oc and keep 6 mm below sight line.

.8 Apply cap bead of clear silicone sealant at exterior void and between stop and glazing.

.9 Apply sealant to uniform and level line, flush with sightline and tooled or wiped with solvent to smooth appearance.

.10 Do not cut or abrade laminated glass.

3.2 INSTALLATION: INTERIOR/EXTERIOR - DRY METHOD (TAPE AND TAPE)

.1 Perform work in accordance with IGMAC and GANA Glazing Manual for glazing installation methods.

.2 Cut glazing tape to length; install on glazing light. Seal corners by butting tape and sealing junctions with sealant.

.3 Place setting blocks at 1/3 points, with edge block maximum 150 mm from corners.

.4 Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.

.5 Install removable stops without displacing glazing tape. Exert pressure for full continuous contact.

.6 Trim protruding tape edge.

.7 Exterior glazing: fill gaps between light and applied stop with sealant to depth equal to bite on glazing, to uniform and level line.

.8 Applicable –pressed metal window frames and metal doors.

3.3 INSTALLATION: EXTERIOR DRY/DRY METHOD (GASKET AND GASKET)

.1 Seal all inside corners of frames with small joint sealant.

.2 Place setting blocks at one-quarter points along glazing channel.

.3 Apply stops to frame and insert glass.

.4 Unpack and lay out gaskets on flat warm area to permit recovery of shape.

.5 Install gaskets under compression from corners inward.

.6 Applicable – aluminum entrances and storefronts.

3.4 FINISHING

.1 Immediately remove sealant and compound droppings from finished surfaces. Remove labels after work is completed.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 06 10 11 - Rough Carpentry, for wood blocking and backing.

.2 Section 07 21 16 - Blanket Insulation for acoustic insulation.

.3 Section 08 11 14 - Steel Doors and Frames.

.4 Section 09 22 16 - Non-Structural Metal Framing

.5 Division 23 - Trim for recessed mechanical fixtures.

1.2 REFERENCED STANDARDS

.1 ASTM C475 / C475M - 02(2007) Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.2 ASTM C 754-09a, Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.3 ASTM C840 - 08 Standard Specification for Application and Finishing of Gypsum Board.

.4 ASTM C 919-08 Standard Practice for Use of Sealants in Acoustical Applications.

.5 ASTM C954 - 07 Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

.6 ASTM C1002 - 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.

.7 ASTM C1047 - 09 Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.8 ASTM C1177 / C1177M - 08 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

.9 ASTM C1178 / C1178M - 08 Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.

.10 ASTM C1280 - 09 Standard Specification for Application of Gypsum Sheathing.

.11 ASTM C1396 / C1396M - 09a Standard Specification for Gypsum Board.

2 Products

2.1 GYPSUM BOARD

.1 Plain: to ASTM C 1396, 16 mm and 12.5 thick, Type "X" 1220 mm wide x maximum practical length, ends square cut, edges tapered.

.2 Moisture resistant gypsum board: Glass mat water-resistant gypsum board to ASTM C1178/C1178M, 15.8 mm thick, 1200 mm wide x maximum practical length.

.3 Gypsum sheathing board for exterior walls: to ASTM C1177/C1178M composed of silicone treated gypsum core and fibreglass matte facings with primer coating, 12.7 mm thickness, panel sizes 1220 mm wide x maximum practical length, FSR 0 and SDC 0 to ASTM E 84, non-combustible when tested to ASTM E 136.

.4 Shaft wall: Assembled system comprised of steel supports, shaft liner coreboard and fire rated gypsum wall board providing indicated hourly fire-resistance rating in accordance with published tested assemblies of U.L.C. or WHI.

.1 Shaft Liner Coreboard: Silicone treated gypsum core sheathing with inorganic fiberglass mats meeting ASTM C1658 or ASTM C1396, thickness 19 mm or 25 mm, 610 mm wide with double beveled edges, lengths as required. Acceptable product Georgia Pacific Dens-Glass Shaftliner Panel, CGC Sheetrock Brand Glass-Mat Liner Panels.

.2 Fire Rated Gypsum Board Facing: Refer to 2.1.2.

.3 Steel Framing Supports: Fabricated from hot-dipped zinc coated steel, ASTM A446, Grade 'A' to conform to ASTM C645. Zinc coating Z180 to ASTM A653/A653M. 'I' studs, 'J' tracks, 'T' splines, 'L' runners and fasteners of design and thickness to appropriate shaft wall system.

.4 Gypsum Board Screws: To ASTM C1002, self-drilling, self-threading, case hardened screws with Philips type head, suitable for penetration of 0.91 mm thick steel and as required for appropriate fire rating design.

.5 Sheet metal Screws: Self-drilling, self-tapping, pan head sheet metal screws 12.7 mm x No. 8 with rust resistant finish.

.6 Joint Treatment Material: Joint compound, joint tape and taping compound to conform to ASTM C475.

.7 Fire Resistive Sealant: Low modulus, high performance, one part silicone rubber sealant conforming to CAN 2-19.13-M82 and listed by ULC as firestop sealant when tested in accordance with CAN4-S115-M85. Sealant to have FT rating in accordance with CAN4-S115-M85 for the required fire endurance rating of the system.

2.2 FASTENINGS AND ADHESIVES

.1 Steel drill screws: to ASTM C 1002, ASTM C 954, galvanized for exterior use.

.2 Laminating compound: to ASTM C 840, asbestos free.

.3 Stud adhesive: to CAN/CGSB 71.25M.

2.3 ACCESSORIES

.1 Casing beads, corner beads fill type: 0.5 mm base thickness commercial grade sheet steel to ASTM C1047 with ZF75 wiped zinc finish

.2 Acoustic sealant: to ASTM C 919.

.3 Paintable Sealant: acrylic base to CAN/CGSB 19.17M.

.4 Joint compound: ASTM C 840, asbestos-free.

.5 Insulating strip: rubberized, moisture resistant, 3 mm thick closed cell neoprene strip, 12 mm wide, with self-sticking permanent adhesive on one face, lengths as required.

.6 Metal furring runners, hangers, tie wires, inserts, and anchors: to ASTM C 754.

.7 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.

3 Execution

3.1 ERECTION

.1 Do application and finishing of gypsum board in accordance with ASTM C 840 except where specified otherwise.

.2 Do application of gypsum sheathing in accordance with ASTM C 1280.

.3 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C 840 except where specified otherwise.

.4 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.5 Install work level to tolerance of 1:1200.

.6 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles.

.7 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.8 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.

.9 Install wall furring for gypsum board wall finishes, shim furring to ensure tolerance levels are met, in accordance with ASTM C 840, except where specified otherwise.

.10 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.11 Furr beams, columns, pipes and exposed services where indicated.

3.2 GYPSUM BOARD APPLICATION

.1 Do not apply gypsum board until framing and strapping, anchors, blocking, electrical and mechanical work are approved.

.2 Apply single layer gypsum board to furring or framing using screw fasteners. Maximum spacing of screws 300 mm oc. Use double screws 30 mm apart, 300 mm oc pairs, for ceilings.

.3 Apply type X gypsum board where indicated and for fire rated assemblies.

.4 Apply 12 mm diameter bead of acoustic sealant to walls/ceilings, to perimeter of Washrooms, 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, pipes, in partitions where perimeter sealed with acoustical sealant. Seal butt joints and corners of panels. Seal exposed joint at perimeter of ceiling/wall junction with a paintable acrylic sealant.

.5 Gypsum board sheathing: installed to exterior face of steel studs framing in accordance with ASTM C1280.

3.3 SHAFT WALL APPLICATION

.1 Install shaft wall system by skilled mechanics as required to provide a fire-endurance assembly rating as applicable.

.2 Coordinate and cooperate with elevator, plumbing, mechanical, fireproofing and other trades to ensure proper sequence of construction and to maintain shaft wall fire rating.

.3 Install tracks, studs, other framing supports, shaft liner core board and fire-resistant gypsum board facing boards in accordance with shaft wall manufacturer's directions and the applicable fire design test to meet fire rating specified.

.4 Maximum height for shaft walls to be in accordance with shaft wall manufacturers limiting heights printed table.

.5 Reinforce and frame all openings in shaft walls to adequately carry loads by the use of additional framing members and bracing.

.6 Install pressed steel frames in shaft walls. Screw-fix frame anchor clips to jamb, header, and/or sill members. Fix to prevent movement of frame relative to stud. Fix door frame to floor using floor anchor clips as required to suit structure.

.7 Spot-grout one-piece frames at quarter points after shaft liner is installed. Apply joint compound just before inserting face layer into frame. Do not terminate panels against rim return. Provide additional bracing from jamb strut-studs to structure.

.8 Install acoustical insulation within shaft wall framing members full height of walls where required by shaft wall fire rated assembly being used.

.9 As shaft walls are being erected, apply single bead of fire resistive sealant to close off all voids and joints and cracks between first layer of gypsum board facing and abutting perimeter construction and around joints at penetrations in shaft walls to provide effective air and sound seal.

.10 Apply sealant in accordance with manufacturer's directions to achieve fire and smoke seal as listed in ULC design for joint firestop system for required fire endurance rating of shaft wall.

.11 Install corner beads to all external corners using longest practical lengths. Fix at maximum 150 mm centres.

.12 Install casing beads and miscellaneous trim at all openings and wherever gypsum board abuts a dissimilar material using longest practical lengths. Fix at maximum 300 mm centres.

.13 Reinforce field joints and internal corners with a suitable paper tape embedded in joint filler.

.14 Mix and apply joint filler.

.15 Allow ample time between coats for drying.

.16 Sand all joints and other filled areas to give a smooth surface ready for decoration.

3.4 EXTERIOR SHEATHING APPLICATION

.1 Install exterior sheathing over framing to details illustrated on drawings.

.2 Install fire rated exterior sheathing over cladding supports where indicated on drawings.

.3 Install sheathing in accordance with manufacturer's written instructions and applicable instructions in ASTM C 1280.

.4 Install sheathing with coloured side out.

.5 Use maximum lengths possible to minimize joints.

.6 Attach sheathing to framing with screws spaced at minimum 200 mm centres at perimeter framing supports and at 200 mm centres along intermediate framing in field. Locate screws 10 mm from edges and ends of sheathing panels.

.7 Drive fasteners to bear tight against and flush with surface of sheathing. Do not countersink screws.

3.5 ACCESSORIES

.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 oc.

.2 Install casing beads around perimeter of exposed gypsum board ceilings.

.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated.

3.6 ACCESS DOORS

.1 Install access doors and panels to electrical and mechanical fixtures specified in respective Sections.

.2 Rigidly secure frames to furring or framing systems.

3.7 TAPING AND FILLING

.1 Finish face panel joints and internal angles of exposed gypsum board with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces. Corner joints at perimeter of ceiling to be trimmed with casing bead with 10 mm joint and sealed with acrylic sealant.

.2 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.

.3 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with Association of the Wall and Ceiling Industries (AWCI) International Recommended Specification on Levels of Gypsum Board Finish:

.1 Level of finish for concealed surfaces:
  .1 Level 1: Embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable.
.2 Level of finish for painted surfaces:
  .1 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.

.4 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.5 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for painting.

3.8 SCHEDULES

.1 Construct fire rated assemblies where indicated – Refer to wall types list on Drawing A001.
  .1 0 hour fire rated partition assembly.
  .2 1 hour fire rated partition assembly.
  .3 2 hour rated partition assembly.

.2 Construct sound rated assemblies where indicated.
  .1 One layer 16 mm Type X gypsum board each side on metal studs.
    .1 Sound rated insulation in cavity. (Section 07 21 16)
    .2 Acoustic caulking at perimeter of wall and at penetrations.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 01 01 50 - General instructions for Waste Management and Disposal.

.2 Section 06 11 10 - Rough Carpentry for blocking and wall backing.

.3 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).
.1 ASTM C 645-09a, Specification for Nonstructural Steel Framing Members.
.2 ASTM C 754-09a, Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
.3 ASTM A 653/A653 M-09a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.4 ASTM A1003 / A1003M - 09 Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

.2 Canadian Standards Association (CSA)
.1 CSA W59-M1989 (R1998), Welded Steel Construction (Metal Arc Welding).

1.3 SYSTEM REQUIREMENTS

.1 Performance Requirements: Fabricate and install systems as indicated but not less than that required to comply with ASTM C754 under the following conditions:
.1 Gypsum board partitions:
.1 Standard systems: Maximum deflection of l/240 of partition height.
.2 Interior suspended ceilings and bulkheads: Maximum deflection of l/360 of distance between supports.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50 - General Instructions for Waste Management and Disposal, and with Waste Reduction Work plan.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal all paper, plastic, polystyrene, corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility approved by Engineer.

.5 Immediately remove from site and transport to reclamation point.

2 Products

2.1 MATERIALS

.1 Non-loadbearing channel stud framing:
.1 Lightweight interior studs: to ASTM C645, depths indicated or scheduled, roll formed

using minimum 0.53 mm base metal thickness hot-dipped galvanized or electro-galvanized sheet steel, with knurled faces for screw attachment of finishes to follow, knock-out service holes at 460 mm centers.

.2 Heavy duty interior studs: to ASTM A 653/A653M, grade D, ZF75 zinc coating designation, to depths indicated or scheduled, roll formed using minimum 1.0 mm base metal thickness sheet steel, for attachment of sheet steel by welding, knock-out service holes at 460 mm centers.

.2 Floor and top brackets:

.1 For lightweight interior studs: to paragraph 2.1.1, thickness to match studs, widths to accept stud depths x 32 mm flange height.

.2 For heavy duty interior studs: to paragraph 2.1.2, thickness to match studs, widths to accept stud depths x 32 mm flange height.

.3 Metal channel stiffener: 19 mm size x 2 mm base metal thickness and as detailed 1.4 mm thick cold rolled steel channel profile coated with rust inhibitive coating.

.4 Fasteners:

.1 Hardened steel power driven nails or drilled in Tapcon type screws for fastening into concrete.

.2 Welding in accordance with Section 05 50 00.

3 Execution

3.1 ERECTION

.1 Install metal framing systems to ASTM C 754. Restrain system to support gravity and lateral loads.

.2 Align partition tracks at floor and ceiling and secure at 610 mm o.c. maximum except as noted otherwise.

.3 Place lightweight steel studs vertically at 610 mm o.c. in top and bottom track, and not more than 50 mm from abutting walls, and at each side of openings and corners.

.1 Cross brace steel studs as required to provide rigid installation.

.2 Fasten top track to ceiling suspension system or structure as indicated.

.3 Allow for 3 mm clearance for deflection between top track and stud.

.4 Fasten each stud to top and bottom tracks with screws, pop-rivets, by crimping or other approved method.

.4 Place heavy duty studs, supporting security mesh, vertically at 302 mm o.c. in top and bottom track, and not more than 50 mm from abutting walls, and at each side of openings and corners.

.1 Fasten bottom track to concrete using approved anchors, spaced 610 mm oc.

.2 Fit studs within top track without fastening allowing for 6 mm clearance for deflection.

.3 Fasten top track to structure.

.4 Fasten 1.6 mm sheet steel panels to exterior side of rooms indicated, welded to HD studs with 25 mm long stitch weld at each stud and at maximum 300 mm oc along studs and at bottom track or use approved screws . Install sheet steel panels with long dimension of panel perpendicular to studs. Plug weld sheet steel to studs in field of panels, at 300 oc. Butt ends of panels at studs to accommodate stitch welds or use screws. All joins between sheet panels to occur at studs.

.5 Erect studs to 1:1000 tolerance.

.6 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

.7 Cut studs short, by 6 to mm for structural steel deflection or use double, nesting top track below structural steel elements. Structural steel deflection must occur within top tracks and must not transfer deflection loads onto studs. Fasten top track to structural steel component and install nesting track into top track without fastening and allowing for 6 mm deflection.

.8 Co-ordinate erection of studs with installation of special supports or anchorage for work specified in other Sections.

.9 Provide continuous horizontal channel reinforcement at 1220 mm above finished floor.

.10 Provide 40 mm stud, solid 19 mm plywood in accordance with Section 06 11 10, or furring channel secured between studs for attachment of fixtures and wall mounted door stops, attached to steel stud partitions.

.11 Install steel studs or furring channel between studs for attaching electrical and other device boxes.

.12 Extend partitions to structure above except where noted otherwise on drawings.

3.2 CLEANING

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

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 01 01 50 - General instructions for Waste Management and Disposal.

.2 Section 09 21 16 - Gypsum Board Assemblies.

.3 Section 23 37 13 - Trim for recessed mechanical fixtures.

.4 Section 26 50 00 - Trim for recessed light fixtures.

1.2 REFERENCE STANDARDS

.1 ASTM C636/C636M-08 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels

.2 ASTM C635 / C635M - 07 Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

.3 ASTM E580 / E580M - 10a Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.

.4 CAN-ULC S102-07 - Standard Test Method for Burning Characteristics of Building Materials and Assemblies.

1.3 DESIGN CRITERIA

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

.2 Seismic Performance: Provide acoustical ceiling system that has been engineered by an independent party and found to be compliant with the NBCC Part 4 or to 2003 International Building Code, Seismic Category D.

1.4 SAMPLES

.1 Submit duplicate 300 x 300 mm samples of acoustical units in accordance with Section 01 01 50.

1.5 MAINTENANCE MATERIALS

.1 Deliver acoustical units for maintenance use amounting to 2% of gross ceiling area for each pattern and type required for project in accordance with Section 01 01 50. Store where directed and identify contents.

.2 Maintenance materials to be same production run as installed materials.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50 - General Instructions; Construction/Demolition Waste Management and Disposal clause.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

.5 Divert unused wood materials from landfill to either recycling, reuse or composting facility.

2 Products

2.1 MATERIALS

.1 Intermediate duty system to ASTM C635.

.2 Basic materials for suspension system: commercial quality cold rolled steel zinc coated.

.3 Suspension system: non fire rated, made up as follows:
- .1 Two directional exposed tee bar grid.

.4 Exposed tee bar grid components: shop painted satin sheen white. Components die cut. Main tee with double web, rectangular bulb and 25 mm rolled cap on exposed face. Cross tee with rectangular bulb; web extended to form positive interlock with main tee webs; lower flange extended and offset to provide flush intersection.

.5 Hanger wire: galvanized soft annealed steel wire, 2.6 mm diameter.

.6 Hanger inserts: purpose made.

.7 Accessories: splices, clips, wire ties, retainers and wall moulding flush reveal, to complement suspension system components, as recommended by system manufacturer.

.8 Acoustic units for suspended ceiling system, to CAN/CGSB-92.1M:
- .1 Type 3, mineral composition with standard painted finish.
- .2 Pattern D fissure size "F", non-directional, with tegular edge and 24 mm wide reveal across middle of tile.
- .3 Flame spread rating of 25 or less.
- .4 Smoke developed 50 or less.
- .5 Noise reduction coefficient (NRC) designation of 0.50 to 0.60.
- .6 STC rating: minimum 35.
- .7 Light reflectance: minimum 75%.
- .8 Edges: square.
- .9 Colour: factory white finish.
- .10 Size: Imperial 610 x 1220 x 19 mm thick.
- .11 Shape: flat.

3 Execution

3.1 ACOUSTICAL CEILING INSTALLATION

.1 Install suspension system to manufacturer's instructions and according to ASTM C636, and

ASTM E580 for seismic restraint. Ensure that hangers do not obstruct or damage tile during removal and replacement of individual tiles.

.2 Do not erect ceiling system until work above ceiling has been approved by Departmental Representative.

.3 Lay out system according to reflected ceiling plan.

.4 Ensure suspension system is coordinated with location of related components.

.5 Install wall mould to provide correct level ceiling heights.

.6 Completed suspension system to support super-imposed loads, such as lighting fixtures diffusers, grilles and speakers.

.7 Support light fixtures diffusers with additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.8 Frame openings for light fixtures, air diffusers, speakers and at changes in ceiling heights.

.9 Interlock cross members to main runners to provide rigid assembly.

.10 Make finished ceiling systems square to adjoining walls and level to tolerance of 1:1000.

.11 Install acoustical panels in ceiling suspension system.

.12 Scribe acoustical units to fit adjacent work. Butt joints tight, install wall mould at junction of acoustical ceilings and other construction to entire length of such junctions.

.13 Provide tegular edge at all edges of tile cut to size and supported by wall angles. Duplicate tegular edge, in depth and width profile, using sharp utility knife and steel straight edge. Paint exposed cut edges white to match tile finish with approved paint.

3.2 **CLEANING**

.1 Touch up scratches, abrasions, voids and other defects in system finish.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 01 01 50 - General Instructions: Submittal Procedures clause and Construction/Demolition Waste Management and Disposal.

.2 Section 03 35 00 - Concrete Finishing.

1.2 REFERENCE STANDARDS

.1 ASTM International:

.1 ASTM D2047 - 11 Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.

.2 ASTM E648 - 10e1 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.

.3 ASTM E662 - 12a Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

.4 ASTM E682 - 92(2011) Standard Practice for Liquid Chromatography Terms and Relationships.

.5 ASTM F710 - 11 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

.6 ASTM F970 - 07(2011) Standard Test Method for Static Load Limit.

.7 ASTM F1303 - 04(2009) Standard Specification for Sheet Vinyl Floor Covering with Backing.

.8 ASTM F1869 - 11 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

.9 ASTM F2034 - 08 Standard Specification for Sheet Linoleum Floor Covering.

.2 CAN-ULC S102-07 - Standard Test Method for Burning Characteristics of Building Materials.

1.3 SUBMITTALS

.1 Provide maintenance data for resilient flooring for incorporation into maintenance manual specified in Section 01 01 50.

.2 Submit duplicate 152 x 76 mm samples of resilient flooring for colour selection by Departmental Representative in accordance with Section 01 01 50.

1.4 ENVIRONMENTAL REQUIREMENTS

.1 Air temperature and structural base temperature at flooring installation area must be above 20°C for 72 h before, during and 48 h after installation.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50 - General Instructions; Construction/Demolition Waste Management and Disposal clause.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

.5 Divert unused wood materials from landfill to either recycling, reuse or composting facility.

2 Products

2.1 MATERIALS

.1 Provide nonlayered and nonbacked homogeneous sheet vinyl flooring, 1.83 m wide, having a nominal total thickness of 2.0 mm consisting of through-grain vinyl granules with pattern and color uniformly distributed throughout entire thickness. The pattern shall merge subtle color accents with a detailed terrazzo-like visual providing a monolithic appearance. Vinyl sheet flooring to meet wear-layer gauge and composition, flexibility, indentation, and solvent resistance requirements of Federal Specification L-F-475a(3),Type II, Grade A. Flooring to consist of PVC resins, plasticisers, stabilizers, and fillers formulated to resist wear, chemical attack and scuffing; conforming to the following additional minimum requirements.

- .1 Full load limit: 151 kg.
- .2 Static load limit to ASTM F970: 363 kg/cm² short term and 57 kg/cm² long term.
- .3 Gloss: 60° specular, 16.
- .4 Wear resistance: 58,000 cycles By Taber Abrader with H18 and 1,000 gram weight.
- .5 Fire test data: ASTM E648-0.45 watts/cm² or more, Class 1; ASTM E662 smoke test, 450 or less;
- .6 Slip resistance: to ASTM D2047 - Coefficient of slip resistance minimum 0.5.
- .7 Colour: Refer to A-902 Finish Schedule for colours.
- .8 Acceptable product, Tarkett Melodia 2.0 or Approved Equal.

.2 Resilient base: top set coved and toeless, 3 mm thick, rubber composition 100 mm high including premoulded end stops and premoulded external corners, of colour selected by Departmental Representative.

.3 Slip Resistant Sheet Vinyl Safety Flooring as scheduled in clause 3.5 Schedule: To ASTM F1303, Type 2, Grade 1, sheet vinyl flooring with moisture resistant backing Class A. Static coefficient of slip resistance in excess of 0.6 when tested in accordance with ASTM D2047, colour selected by Departmental Representative. Acceptable Product: Altro Designer 25 Safety Flooring or Approved Equal.

.4 Provide vinyl rod produced by the manufacturer of the resilient flooring and intended for heat welding of seams. Color compatible with field color of flooring as selected by Departmental Representative.

.5 Colors will be selected from the range currently available from the resilient flooring manufacturer. Refer to A-902 Finish Schedule for colours.

.6 Primers and adhesives: waterproof, of types recommended by resilient flooring manufacturer for specific material on applicable substrate, on grade.

.7 Underlayment and Patching Compounds: Use only grey colored Portland cement based underlayments; patching compounds are used for filling cracks, holes and leveling. White gypsum materials are not acceptable.

.8 Edge strips: PVC extruded, smooth, with lip to extend under floor finish, shoulder flush with top of adjacent floor finish. Provide cove former and cap seal at flash cove base for slip resistant sheet vinyl flooring specified in paragraph 2.1.3 and as scheduled in clause 3.5.

.9 Resilient Rubber stair treads and tile:

.1 Treads: rubber, 41 mm square vertical nosing, full tread depth, full tread width, 6.4 mm thick (tapered), radial surface pattern, of solid integral colour and with one or two contrasting carborundum strips set into rubber tread as selected by Departmental Representative from manufacturer's standard range of colours.

.2 Landings: rubber tile to CSA A126.4, homogeneous plain pattern, radial studded surface design of 1 mm height, 3.5 mm thick 905 x 905 mm size, in standard colour selected by Departmental Representative.

.10 Sealer: type recommended by resilient flooring material manufacturer for material type and location.

3 Execution

3.1 INSPECTION

.1 Ensure floors are dry and acceptable to manufacturer's recommendations.

.2 Perform moisture condition test in each areas. A minimum of 1 test per 100 m², prior to installation. Moisture emissions from concrete subfloors must not exceed 1.4 kg per 93 m² per 24 hours for acrylic adhesive and polyurethane adhesive via the Calcium Chloride Test Method (ASTM F1869). If subfloor moisture exceeds the allowable maximum for installing flooring, contact the flooring distributor for a solution.

3.2 SUB-FLOOR PREPARATION

.1 Remove ridges and bumps.

.2 Meet ASTM F710 Standard for Concrete or other monolithic floors.

.3 Maintain air temperature and structural base temperature at flooring installation area between 18C and 26C for 48 hours before, during and 24 hours after installation.

.4 Perform alkali tests to ensure pH levels of concrete subfloor surface do not exceed pH 9.9. Concrete must be neutralized if above pH 9.9.

.5 Do not proceed with work until results of moisture condition and/or pH tests are acceptable.

.6 Apply subfloor filler to low spots and cracks to achieve floor level to a tolerance of 1:1000, allow to cure. Do not install sheet flooring over gypsum-based toppings, underlayments, leveling or patching compounds.

3.3 FLOORING APPLICATION

.1 Install sheet vinyl flooring and safety flooring in accordance with the current manufacturer's installation instructions with heat welded seams.

.2 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.

.3 Lay flooring in single piece with pattern parallel to building lines.

.4 Drains: Fit sheet vinyl flooring and mechanically fasten to drain outlets to ensure a permanent, watertight installation.
.1 Install round flash clamping ring type drains to accommodate vinyl flooring. Install drains to fit flush with surrounding floor surface.

.5 Cut flooring neatly around fixed objects.

.6 Continue flooring over areas which will be under built-in furniture.

.7 Terminate flooring at centerline of door in openings where adjacent floor finish or colour is dissimilar.

.8 Install pvc/rubber reducer strips at unprotected or exposed edges where flooring terminates or where floor finish is not flush due to difference in floor finish thickness.

.9 Install resilient stair treads on full width of stair tread and rubber tile on all intermediate landings using polyurethane adhesive, in accordance with manufacturer's instructions.

.10 Install safety flooring with 150 mm high flash cove base with cap seal in rooms as scheduled in clause 3.5.

.11 Elevator cab:
.1 Install sheet vinyl floor in elevator cab. Cut accurately to elevator wall finish allowing 2 mm gap and seal with colour matched sealant, flush with floor surface.

3.4 BASE APPLICATION

.1 Set base in adhesive tightly against wall, floor surfaces. Use lengths as long as practicable and not less than 500 mm long.

.2 Install straight and level to maximum variation of 1:1000.

.3 Scribe and fit to door frames and other obstructions. Use premoulded end pieces at flush doorframes except as approved otherwise by Departmental Representative.

.4 Miter internal corners. Use premoulded sections or special wrap around type base for external corners.

.5 Use coved type base as scheduled in clause 3.5.

3.5 RESILIENT FLOORING SCHEDULE

.1 Sheet vinyl flooring as per paragraph 2.1.1 and 100 mm rubber base as per paragraph 2.1.3:
.1 Refer to A-902 Finish Schedule.

.2 Non-slip sheet vinyl flooring as per paragraph 2.1.2 with 150 mm flash cove base:
.1 Refer to A-902 Finish Schedule.

.3 Rubber flooring as per paragraph 2.1.9:
.1 Install rubber treads on stairs to second floor office and to all stair treads in main entry stair hall from main floor to roof penthouse level. Install stair tread at uppermost

landing of each flight at all stairs, cut into specified floor finish. Use reducer strip where rubber treads butt to SV flooring.

.2 Refer to A-902 Finish Schedule.

.3 Install rubber tile at two intermediate landings at main stair hall stairs.

3.6 CLEANING AND SEALING

.1 Cleaning: Remove temporary coverings and protection of adjacent work areas.

.1 Repair or replace damaged installed products.

.2 Clean installed products in accordance with manufacturer's instructions prior to occupancy.

3.7 PROTECTION OF FINISHED WORK

.1 Cover and protect finished installation from damage from other trades using a non-staining, temporary floor protection system, such as a reusable textured plastic sheeting.

.2 Protection:

.1 Protect the newly installed flooring from foot traffic for 24 hours and heavy rolling traffic for 72 hours.

.2 Protect installed product and finish surfaces from damage during construction.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 01 01 50 - Submittal Procedures, Waste Management and Disposal.

.2 Section 05 50 00 - Metal Fabrications.

.3 Section 06 23 00 - Architectural Woodwork and Finish Carpentry.

.4 Section 09 91 25 - Staining.

1.2 DESCRIPTION OF WORK

.1 Refer to finish schedules and notes on drawings for finishing of new work and existing surfaces.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM):
  .1 ASTM D 3960-05, Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.

.2 Architectural Painting Specifications Manual, Master Painters Institute (MPI).

.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.

1.4 QUALITY ASSURANCE

.1 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.

.2 Conform to latest MPI requirements for interior painting work including preparation and priming.

.3 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.

.4 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 and shall be compatible with other coating materials as required.

.5 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Departmental Representative.

.6 Standard of Acceptance:
  .1 Walls: No defects visible from a distance of 1000 mm at 90° to surface.
  .1 Bulkheads/Ceilings: No defects visible from at 45° to surface when viewed using final lighting source.

.2 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.5 SAMPLES

.1 Submit sample colours of each paint type specified in accordance with Section 01 01 50.

.2 Submit duplicate mm sample panels of each paint, stain, clear coating, special finish, type colour texture specified.

.3 Submit full range of available colours where colour availability is restricted.

.4 Use 10 mm D-Fir plywood for finishes over natural wood surfaces. Use 12.5 mm gypsum board for finishes over smooth surfaces.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 01 50.

.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 Departmental Representative. After completion of operations, return areas to clean condition to approval of Consultant.

.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.

1.7 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

.1 Provide paint products meeting MPI "Environmentally Friendly"E2, E3 rating based on VOC (EPA Method 24) content levels.

1.8 SITE REQUIREMENTS

.1 Heating, Ventilation and Lighting:
- .1 Ventilate enclosed spaces in accordance with Section 01 01 50.
- .2 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.
- .3 Where required, provide continuous ventilation for seven days after completion of application of paint.
- .4 Coordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.
- .5 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.
- .6 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities is 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.
- .2 Perform no painting work when the maximum moisture content of the substrate exceeds:
  - .1 15% for wood.
  - .2 12% for gypsum board.
- .3 Conduct moisture tests using a properly calibrated electronic Moisture Meter.
- .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 Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

1.9 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 form Departmental Representative for any changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants in and about the occupied floors in building.

1.10 WASTE MANAGEMENT

.1 Separate and recycle waste materials in accordance with Section 01 01 50 General Instructions.

.2 Non-water based opaque and transparent 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 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 Set aside and protect surplus and uncontaminated finish materials: Deliver to or arrange collection by employees, individuals, or organizations for verifiable re-use or re-manufacturing.

.8 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

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 Only qualified products with E2, E3 "Environmentally Friendly" rating are acceptable for use on this project.

.4 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes must meet a minimum "Environmentally Friendly" E2 rating.

2.2 COLOURS

.1 Departmental Representative will provide Colour Schedule after Contract award.

.2 Where specific products are available in a restricted range of colours, selection will be based on the limited range.

.3 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 MPI values:

loss Level	Description	Units @ 60 degrees	Units @ 85 degrees
G1	Matte or Flat finish	0 to 5	10 max.
G2	Velvet finish	0 to 10	10 to 35
G3	Eggshell finish	10 to 25	10 to 35
G4	Satin finish	20 to 35	35 min.
G5	Semi-Gloss finish	35 to 70	
G6	Gloss finish	70 to 85	

High-Gloss finish	> 85

.2 Gloss level ratings of painted surfaces as specified.

2.5 INTERIOR PAINTING SYSTEMS

.1 Hardwood plywood and solids at casework and casings:
- .1 INT 6.4J Polyurethane varnish G4 finish.

.2 Gypsum Board wall surfaces for Offices:
- .1 INT 9.2A Latex G3 finish (over latex sealer).

.3 Gypsum Board wall surfaces for Storage, Washrooms and Service rooms etc.:
- .1 INT 9.2A Latex G5 finish (over latex sealer).

.4 Gypsum Board ceilings surfaces:
- .1 INT 9.2A Latex G1 finish (over latex sealer).

.5 Plywood painted wall surfaces: Flame Spread Rating 150 maximum.
- .1 INT 6.4P - Fire retardant, pigmented G1 gloss level coating (ULC rated).
- .2 Acceptable product:
  - .1 First layer: Sealer over plywood - Safecoat 725 Sealer/over coater.
  - .2 Second layer: Safecoat Intumescent Coating to DFT of 5 mils minimum.
  - .3 Top layer: Sealer over plywood - Safecoat 725 Sealer/over coater. (For clean ability)

.6 Metal doors, PS frames, steel columns to u/s of beams and miscellaneous metal items etc.
- .1 INT 5.1R High performance architectural latex coating G4 gloss level.
- .2 INT 5.3B Waterborne light industrial G4 gloss level.

.7 Exposed metal roof deck, platform floor deck, joists and beams metal items etc.
- .1 INT 5.3F Alkyd dry fall finish.

2.6 EXTERIOR PAINTING SYSTEMS

.1 Cementitious Composition Board:
- .1 EXT 3.3A Latex G1 gloss level finish.

.2 Exterior steel doors and frames:
- .1 EXT 5.3B - Alkyd G4 gloss level finish.

.3 Structural Steel columns and Metal Fabrications:
- .1 EXT 5.1D - Alkyd G4 gloss level finish (over alkyd primer).

.4 Steel columns, O.H. door frames, misc. metal items:
- .1 EXT 5.1T - Polyurethane, pigmented finish (over self-priming epoxy).

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

.3 Maximum moisture content as follows:
- .1 Gypsum Board: 12%.
- .2 Wood: 15%.

3.3 PROTECTION

.1 Protect interior and exterior building surfaces not to be painted from paint spatters, markings and other damage. If damaged, clean and restore such surfaces as directed by Departmental Representative.

.2 Cover or mask windows and other ornamental hardware adjacent to areas being painted to prevent damage and to protect from paint drops and splatters. Use non-staining coverings.

.3 Protect items that are permanently attached such as Fire Labels on doors and frames.

.4 Protect factory finished products and equipment.

.5 Remove electrical cover plates, light fixtures, surface hardware on doors, accessories and other surface mounted equipment, fittings and fastenings prior to undertaking any painting operations by General Contractor. Securely store and re-install items after painting is completed by General Contractor.

.6 As painting operations progress, place "WET PAINT" signs in all 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.
- .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.
- .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, or vacuum cleaning.

.6 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.

.7 Do not apply paint until prepared surfaces have been accepted by Departmental Representative.

3.5 APPLICATION

.1 Method of application to be as approved by Departmental Representative. Apply paint by brush, roller, airless sprayer. 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 Consultant Departmental Representative.
- .5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray application:
- .1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
- .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

.3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.
.4 Brush out immediately all runs and sags.
.5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Departmental Representative.

.5 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects.

.8 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.

.9 Finish closets and alcoves as specified for adjoining rooms.

.10 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 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

.3 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.4 Do not paint over nameplates.

.5 Keep sprinkler heads free of paint.

.6 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

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 each applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.3 Co-operate with inspection firm and provide access to all areas of the work.

3.8 RESTORATION

.1 Clean and re-install all items that were removed before undertaking 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 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.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 01 01 50 - Submittal Procedures, Waste Management and Disposal.

.2 Section 07 46 23: Wood Siding.

1.2 DESCRIPTION OF WORK

.1 Prestaining of cedar siding, with base coat only, prior to installation.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM):
.1 ASTM D 3960-05, Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.

.2 Architectural Painting Specifications Manual, Master Painters Institute (MPI).

.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.

1.4 QUALITY ASSURANCE

.1 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in staining work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.

.2 Conform to latest MPI requirements for exterior staining work including preparation and priming.

.3 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.

.4 Other stain materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and shall be compatible with other coating materials as required.

.5 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Departmental Representative.

1.1 SAMPLES

.1 Submit sample colours of each stain type specified in accordance with Section 01 01 50.

.2 Submit duplicate length sample panels of each stain, clear coating, special finish, type colour texture specified.

.3 Use 19 mm x 150 mm x 400 mm lengths of rough sawn Western Red Cedar as base for sample finishes.

.4 Submit one sample with foundation base stain and one sample with base plus two stain top coats.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 01 50.

.2 Labels shall clearly indicate:
- .1 Manufacturer's name and address.
- .2 Type of stain 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 Departmental Representative. After completion of operations, return areas to clean condition to approval of Consultant.

.10 Remove stain 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.

1.3 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

.1 Provide stain products meeting MPI "Environmentally Friendly"E2, E3 rating based on VOC (EPA Method 24) content levels.

1.4 SITE REQUIREMENTS

.1 Heating, Ventilation and Lighting:
- .1 Ventilate enclosed spaces in accordance with Section 01 01 50.
- .2 Perform no staining 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 stain application until stain has cured sufficiently.
- .3 Where required, provide continuous ventilation for seven days after completion of application of stain.
- .4 Coordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of stain as required.
- .5 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.
- .6 Perform no staining work unless a minimum lighting level of 323 Lux is provided on surfaces to be stained. Adequate lighting facilities is 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 staining work when:
  - .1 Ambient air and substrate temperatures are below 10 ° C.
  - .2 Substrate temperature is over 32 ° C unless stain is specifically formulated for application at high temperatures.
  - .3 Substrate and ambient air temperatures are expected to fall outside MPI or stain manufacturer's prescribed limits.
- .2 Perform no staining work when the maximum moisture content of the substrate exceeds:
  - .1 15% for wood.
  - .2 12% for gypsum board.
- .3 Conduct moisture tests using a properly calibrated electronic Moisture Meter.
- .4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:
- .1 Apply stain 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 stain only to adequately prepared surfaces and to surfaces within moisture limits noted herein.
- .3 Apply stain only when previous coat of stain is dry or adequately cured.

1.1 SCHEDULING OF WORK

.1 Submit work schedule for various stages of staining to Departmental Representative for approval. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization form Departmental Representative for any changes in work schedule.

1.2 WASTE MANAGEMENT

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

.2 Non-water based opaque and transparent 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 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 stain and place in designated containers and ensure proper disposal.
- .3 Return solvent and oil soaked rags used during staining 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 stain cans are to be dry prior to disposal or recycling (where available).

.6 Where paint recycling is available, collect waste stain by type and provide for delivery to recycling or collection facility.

.7 Set aside and protect surplus and uncontaminated finish materials: Deliver to or arrange collection by employees, individuals, or organizations for verifiable re-use or re-manufacturing.

.8 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

2 Products

2.1 MATERIALS

.1 Stain materials: Base Coat: Prior to Installation.
- .1 Cedar Board and Batten Siding: Sansin Foundation Weathered Wood 04 or Approved Equal.
- .2 Cedar Slats: Sansin Foundation Natural Cedar 1101 or Approved Equal.

.2 Stain Materials: Two Top Coats: Post installation.
- .1 Cedar Board and Batten Siding: Sansin SDF Weathered Wood 04 or Approved Equal.
- .2 Cedar Slats: Sansin SDF Natural Cedar 1101 or Approved Equal.

.3 Stain materials for stain systems shall be products of a single manufacturer.

2.2 MIXING AND TINTING

.1 Where thinner is used, addition shall not exceed stain manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based stains.

.2 Thin stain for spraying according in strict accordance with stain manufacturer's instructions. If

directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Departmental Representative.

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

3 Execution

3.1 GENERAL

.1 Perform preparation and operations for staining in accordance with MPI Painting Specifications Manual except where specified otherwise.

.2 Apply stain materials in accordance with stain manufacturer's written application instructions.

3.1 PROTECTION

.1 Protect interior and exterior building surfaces not to be stained from stain spatters, markings and other damage. If damaged, clean and restore such surfaces as directed by Departmental Representative.

.2 Cover or mask windows and other ornamental hardware adjacent to areas being stained to prevent damage and to protect from stain drops and splatters. Use non-staining coverings.

.3 Protect items that are permanently attached such as Fire Labels on doors and frames.

.4 Protect factory finished products and equipment.

3.2 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.
.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 staining, water-based cleaners should be used in place of organic solvents.
.6 Use trigger operated spray nozzles for water hoses.
.7 Many water-based stains cannot be removed with water once dried. However, minimize the use of kerosene or any such organic solvents to clean up water-based stains.

.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, stain, 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 Do not apply stain until prepared surfaces have been accepted by Departmental Representative.

3.3 APPLICATION

.1 Method of application to be as approved by Departmental Representative. Apply stain by brush, roller, airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:
.1 Apply stain in a uniform layer using brush and/or roller of types suitable for application.
.2 Work stain into cracks, crevices and corners.
.3 Stain surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Stain 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 Consultant Departmental Representative.
.5 Remove runs, sags and brush marks from finished work and restain.

.3 Spray application:
.1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing stain to be applied, and equipped with suitable pressure regulators and gauges.
.2 Keep stain ingredients properly mixed in containers during stain application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
.3 Apply stain in a uniform layer, with overlapping at edges of spray pattern.
.4 Brush out immediately all runs and sags.
.5 Use brushes to work stain into cracks, crevices and places which are not adequately stained by spray.

.4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Departmental Representative.

.5 Apply coats of stain as a continuous film of uniform thickness. Reastain thin spots or bare areas before next coat of stain is applied. Coat all sides and ends of siding.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

3.4 FIELD QUALITY CONTROL

.1 Field inspection of staining operations to be carried out by independent inspection firm as designated by Departmental Representative.

.2 Advise Departmental Representative when each applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.3 Co-operate with inspection firm and provide access to all areas of the work.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 05 55 00 - Metal Fabrications, for fabricated metal rough-in components.

1.2 REFERENCE STANDARDS

.1 ASTM A 269-08, Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

.2 ASTM A 167- (2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.3 CSA W59-03 (R2008), Welded Steel Construction (Metal Arc Welding).

.4 ASTM A666 - 03 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

.5 ASTM A276-08a Standard Specification for Stainless Steel Bars and Shapes.

1.3 SUBMITTALS

.1 Submit samples in accordance with Section 01 01 50 Section 01 01 50, General Instructions for Submittals.

.2 Submit Product Data in accordance with Section 01 01 50, General Instructions for Submittals.
- .1 Indicate, by large scale details, all materials, finishes, dimensions, anchorage and assembly.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:
- .1 Deliver, store, handle and protect materials in accordance with Section 01 01 50 - General Instructions, Common Product Requirements clause.

.2 Storage and Protection:
- .1 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job site.
- .2 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50 - General Instructions for Construction/Demolition Waste Management and Disposal clause.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material in appropriate on-site containers for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility approved by Departmental

Representative.

2 Products

2.1 MATERIALS

.1 Sheet steel: commercial grade, stretcher levelled sheet steel to ASTM A 653/A653M with Z275 zinc coating.

.2 Stainless steel sheet: to ASTM A666 type 302 or 304 with No. 4 finish, minimum 0.75 mm thick.

.3 Stainless steel tubing: ASTM A 269, ANSI Type 304, commercial grade, seamless welded, 1.2 mm wall thickness.

.4 Fasteners: screws and bolts hot dip galvanized. Expansion shields fibre, lead or rubber as recommended by fixture manufacturer for component and its intended use.

2.2 FINISHES

.1 Stainless steel: to ANSI No. 4 satin lustre finish.

2.3 FIXTURES

.1 Surface mounted toilet tissue dispenser: NIC – provide backing only.

.2 Paper Towel dispenser: NIC – provide backing only.

.3 Grab bars: 32 mm dia x 1.2 mm wall tubing of stainless steel, 75 mm diameter wall flanges, concealed screw attachment, flanges welded to tubular bar, provided with steel back plates and all accessories. Grab bar material and anchorage to withstand downward pull of 2.2 kN. Refer to A-801.

.3 Wall mounted soap dispenser: Wall mounted Soap Dispenser: Owner supplied fixture, Contractor to provide backing in wall at soap dispenser locations designated on plans.

.4 Waste receptacles for washrooms and at counters with sinks: NIC.

.5 Mop rail: (for Janitor Room) extruded aluminum with three (3) rubber gripper inserts.

.6 Mirrors: No. 1 quality 6 mm laminated float glass, electrolytically silver-plated, with 10 year guarantee against silver spoilage; sizes as indicated, framed in type 304, 19 mm x 19 mm heavy gauge stainless steel angle frame, one piece roll formed type. Corners of frame helical welded and ground and polished smooth. Provide with companion vandal-proof concealed fastening, locking fasteners and wall hangers.

.1 Corners: protected by friction-absorbing filler strips.

.2 Back: protected by full-size, shock-absorbing, water-resistant, nonabrasive, 5mm thick polyethylene padding.

.7 Sanitary Napkin Disposal: Surface mounted, stainless steel, locking, removable 1.2 gal. plastic receptacle.

.8 Clothes Hook: Stainless steel, 50 mm x 50 mm flange with 30 mm x 30 mm hook, 50 mm depth, concealed fasteners.

.9 Bench: Stainless steel base with stained wood top.

2.4 FABRICATION

.1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.

.2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.

.3 Brake form sheet metal work with 1.5 mm radius bends.

.4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

.5 Back paint components where contact is made with building finishes to prevent electrolysis.

.6 Hot dip galvanize ferrous metal anchors and fastening devices to ASTM A123.

.7 Shop assemble components and package complete with anchors and fittings.

.8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates or rough-in measurements as required.

.9 Provide steel anchor plates and components for installation on steel stud walls and building framing.

3 Execution

3.1 INSTALLATION

.1 Install and secure fixtures rigidly in place as follows:
- .1 Stud walls: Install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.
- .2 Install grab bars on built-in anchors provided by bar manufacturer.
- .3 Use tamper proof screws/bolts for fasteners.
- .4 Fill units with necessary supplies shortly before final acceptance of building.

3.2 LOCATION AND QUANTITY

.1 Locate accessories in washrooms, Janitor rooms, at counters with sinks and where indicated. Exact locations to be determined by Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 11 – Rough Carpentry.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-44.40-01, Steel Clothing Locker.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit submittals in accordance with Section 01 01 50 General Instructions.

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for metal lockers 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 British Columbia.

.2 Indicate on drawings: type and class of locker, thicknesses of metal, fabricating and assembly methods, assembled banks of lockers, tops rods, hooks, shelves, bases, trim, numbering, filler panels, end/back panels, doors ,handles, locking method, ventilation method and finishes.

.4 Samples:

.1 Submit duplicate 50 x 50 mm samples of colour and finish on actual base metal.

.2 Samples will be returned for inclusion into work.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 01 50 – General Instructions and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements:

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

.3 Storage and Handling Requirements:

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

.2 Store and protect metal lockers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse packaging materials in accordance with Section 01 01 50 – General Instructions.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Lockers: to CAN/CGSB-44.40, Type 1-Single full-height lockers - A bank of two or more lockers, freestanding.

- .1 Size: 305 mm wide x 460 mm deep x 1829 mm high, steel thickness No .24 MSG.
- .2 Assembly: welded construction.
- .3 Top: sloped.
- .4 Doors: one-piece double-wall envelope construction steel thickness No .20 MSG, door swing left.
- .5 Door handle: recessed handle steel with nickel-plated finish.

2.2 ACCESSORIES

.1 Locking system: padlocks supplied by others.

.2 Options: to CAN/CGSB-44.40, hanger rods, steel with nickel-plated finish, steel base, steel end panels, steel trim including corner angles, jamb trim, fillers, number plates, coat hooks, metal nickel finish.

2.3 FINISH

.1 Two coats baked polyester enamel or power coating to manufacturer's standard. Colour selected by consultant from manufacturer's standard colour options.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates and surfaces to receive metal lockers previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's instructions prior to metal locker installation.

.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 from Departmental Representative.

3.2 INSTALLATION

.1 Assemble and install lockers in accordance with manufacturer's written instructions.

.2 Securely fasten lockers to grounds and nailing strips.

.3 Install wall trim around recessed locker banks.

.4 Install filler panels (false fronts) where indicated and where obstructions occur.

.5 Install finished end, back panels to exposed ends, backs of locker banks.

.6 Install locker numbers.

3.3 ADJUSTING

.1 Adjust metal lockers for correct function and operation in accordance with manufacturer's written instructions.

.2 Lubricate moving parts to operate smoothly and fit accurately.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 01 50 – General Instructions.

.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 Section 01 01 50 – General Instructions.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 01 50 – General Instructions.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by metal locker installation.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 01 01 50 - General Instructions: Submittal Procedures clause and Construction/Demolition Waste Management and Disposal.

1.2 REFERENCES

.1 ASTM International (ASTM)
- .1 ASTM A 653/A 653M-10, Standard Specification for Steel Sheet, Zinc-Coated, (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- .2 ASTM A 307-10, Specification for Carbon Steel Bolts and Studs, 60,000psi Tensile.

.2 Canadian Standards Association (CSA)
- .1 CSA-G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 CSA W59-03 (R2009), Welded Steel Construction (Metal Arc Welding).

1.3 DESIGN REQUIREMENTS

.1 N2: Heavy-Duty Storage System:
- .1 Design and construct heavy duty storage system to support uniform load of 1134 kg per shelf. Shelves consisting of steel plated wire decks
- .2 Design shelving with 4 interlocking adjustable shelves on a heavy duty steel frame with cross member. Connect multiple racks.
  - .1 Safety lock pins.
  - .2 Hard nylon feet pads on upright support frames.
- .3 Powder coated shelves and upright frame.
- .4 Manufacturer to engineer the storage system to loading requirements and supply the Letters of Assurance, Schedule B and subsequently the Schedule C-B after installation.

.2 N3: Flammable Storage Cabinets:
- .1 Designed to meet OSHA and NFPA 30 standards, FM approved.
- .2 1 mm thick galvanized double wall cabinet welded construction with 38 mm insulating air space. 341 L capacity, 1092 mm W x 1651 mm H x 864 mm D exterior dimensions.
- .3 Self-latching doors with fail-safe three-point stainless steel bullet latching system conforming to NFPA 1 and International Fire Code.
- .4 U-Loc handle with cylinder lock.
- .5 Haz-alert reflective warning labels, trilingual
- .6 Spill proof galvanized steel shelves that direct spills to back and bottom of 51 mm leakproof bottom sump.
  - .1 Two shelves adjustable on 76 m centres.

.7 Dual vents with flame arresters.

.8 Four adjustable, self-levelling feet.

.9 Grounding connector.

.10 Chemical resistant lead free, epoxy/polyester powder-coat finish in safety yellow.

1.4 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 01 50 - General Instructions, Submittals clause.
- .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 01 50 - General Instructions, Submittals clause. Indicate VOC's:
  - .1 For finishes, coatings, primers and paints.

.2 Shop Drawings
- .1 Submit shop drawings in accordance with Section 01 01 50 - General Instructions, Submittals clause.
- .2 Indicate layout, product materials, core thicknesses, finishes, connections, and joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:
- .1 Deliver, store, handle and protect materials in accordance with Section 01 01 50 - General Instructions, Common Product Requirements clause.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50 - General Instructions for Construction/Demolition Waste Management and Disposal clause.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material in appropriate on-site containers for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CSA-G40.21, Grade 300W.

.2 Welding materials: to CSA W59.

.3 Bolts and anchor bolts: to ASTM A307; corrosion resistant types to ASTM A325M, Type 3.

Provide all required anchoring devices including anchor clips, bar and strap anchors, expansion bolts and shields, and other devices designed to support and secure work.

2.2 COMPONENTS

.1 N2: Fabricate storage rack components from steel to 610 mm deep shelving with 1829 mm high posts/end frames braced together, spaced approximately 1.95 m on center to meet design requirements. Weld or bolt angle floor plates to posts and provide two fasteners per plate for fastening to floor.

.1 Provide wall connectors at intervals and heavy angle guard protectors at exposed ends of row.

.2 N3: Pre-manufactured Flammable Safety Storage Cabinet by proprietary manufacturer.

3 Execution

3.1 INSTALLATION

.1 Assemble and install pallet rack system in room indicate in accordance with manufacturer's engineered drawings and written instructions.

.1 Fasten posts to floor with expansion anchors and use wall connectors at each bay on top tier.

.2 Install manufactured flammable safety cabinet where indicated. Anchor unit to wall with galvanized L brackets.

CLEANING

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 05 55 00 - Metal Fabrications, for fabricated metal rough-in components.

1.2 WORK INCLUDED

.1 Supply and install of benches.

1.3 SUBMITTALS

.1 Submit manufacturer's product data and samples in accordance with Section 01 01 50.
- .1 Provide list of components showing quantity and material description. Show assembly drawing indicating component configuration with dimensions.
- .2 Samples to be representative of colour and type of material.

1.4 DESIGN CRITERIA

.1 Prefabricate modular benches with modular mobile cabinets from component parts of one manufacturer to configuration and dimensions as indicated.

.2 Bench to meet the following requirements:
- .1 Countertop: solid maple 45 mm thickness, 2440 long x 635 mm deep x 965 mm high.
- .2 Frame: all steel frame with tubular steel legs, powder coated finish. Space for three modular mobile storage units under bench. Legs with threaded 70 mm diameter leveller pads with nylon pads.
- .3 Rated bench weight capacity: 454 kg.
- .4 1 year limited warranty on maple top, lifetime limited warranty on frame.

.3 Modular mobile storage units with doors:
- .1 All welded steel cabinet 876 mm high x 711 mm wide x 635 mm deep, two hinged doors with checkered plate finish, full length magnetic catches, handle and lock on each door, with four 125 x 50 mm solid rubber casters with 2 swivel and 2 locking front castors, sliding internal shelf with ball bearing slides extends 500 mm beyond cabinet.
- .2 Rated weight capacity:
  - .1 Cabinet top: 636 kg.
  - .2 Sliding shelf: 30 kg.
- .3 Bumpers: rubber, on sides and back.
- .4 Work surface: solid maple.
- .5 Finish: powder coated finish.

.4 Modular mobile storage units with drawers:
- .1 All welded steel cabinet 876 mm high x 711 mm wide x 635 mm deep, with four 125 x 50 mm solid rubber casters with 2 swivel and 2 locking front castors, sliding drawers of one 50 mm height, three 102 mm height and one 25 mm height with checkered plate finish, full width handle, with ball bearing slides extends 500 mm beyond cabinet, key locks all drawers.
- .2 Rated weight capacity:
  - .1 Cabinet top: 636 kg.
  - .2 Sliding drawers: 30 kg.
- .3 Bumpers: rubber, on sides and back.
- .4 Work surface: solid maple.

.5 Finish: powder coated finish.

2 Products

2.1 MANUFACTURED PRODUCT

.1 Benches: Gladiator work bench Mod # GAWB09MTRG or Approved Equal. (Seven required)

.2 Modular mobile drawer unit: Gladiator Geardrawer Mod # GAGD275DRG or Approved Equal. (One per bench)

.3 Modular mobile door unit: Gladiator Gearbox Mod # GAGD272DRG or Approved Equal. (Two per bench)

3 Execution

3.1 INSTALLATION

.1 Assemble benches in accordance with manufacturer's assembly drawings and instructions.

.2 Level bench by adjusting leg pads.

.3 Touch-up minor scratches with paint to match existing finish.

END OF SECTION

1 General

1.1 REFERENCES

.1 ASTM D1784-11 Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

1.2 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 01 50 - General Instructions for Product Data and Samples.

.2 Indicate dimensions in relation to window jambs, operator details, top rail, conditions between adjacent blinds, corner conditions anchorage details, hardware and accessories details.

.3 Submit one representative working sample of vertical louvre blind in accordance with Section 01 01 50.

.4 Submit duplicate samples of manufacturer's standard colours, patterns and textures of specified vane and rail materials for selection by Departmental Representative.

1.3 DESIGN CRITERIA

.1 Vanes for vertical louvre blinds to have flame-spread ratings and degree of flame resistance required by the National Fire Code 2010.
- .1 Flame spread rating: 25 maximum.
- .2 Degree of flame resistance: inherently flame retardant.

2 Products

2.1 MATERIALS

.1 Top Rail:
- .1 Heavy duty.
- .2 Extruded aluminum 6063-T5 alloy.
- .3 Full length, one piece track with capped ends.
- .4 Provide valance to match vanes and mounting clips.
- .5 Size: maximum practical length as recommended by manufacturer.
- .6 Plain top rail.
- .7 Colour and finish: as selected by Departmental Representative.

.2 Vanes for blinds: 90 mm wide x length to suit window assembly.
- .1 Extruded PVC with linear striation design as selected by Departmental Representative.

2.2 COMPONENTS

.1 Carrier trucks and wheels: heavy duty, acetal resin moulded material.

.2 Gears, sprocket wheels, end caps: acetal resin moulded, spur and worm gears, self-lubricating with ratio recommended by manufacturer for particular unit type, replaceable shaft.

.3 Bead chain: nickel plated brass or stainless steel.

.4 Vane spacer links: type 301 stainless steel, flexible to space and stabilize each truck.

.5 Brackets sized to support weight of blind plus forces applied to operate blind and designed to facilitate installation and removal of top rail, complete with hardware necessary for secure attachment of brackets to adjoining construction and to head rails.

.6 Track: extruded aluminum 45 mm wide x 38 mm high minimum 1 mm thickness finished in matching colour as selected by Departmental Representative. Provide brackets with valence to match vanes.

2.3 OPERATION

.1 Traversing: manual operation, free hanging to operate either left to right or, right to left for single windows or bi-parting as approved by Departmental Representative.
- .1 Control opening and closing of blind with nylon cord, tensioned by cord weight or cord tension pulley and without binding vanes at any angle.
- .2 Fabricate vanes to stack, uniform, in tight space allowing maximum clear window opening. Track mounted to wood casing at window head.

.2 Rotation control: use bead chain to activate gear assembly to rotate all vanes simultaneously full 180° and hold them in fixed position until reset. Vane overlap 8 mm minimum.

.3 Fabricate vanes to completely fill openings indicated, from top to bottom and jamb to jamb.

.4 Locate rotation control chain and traversing cord on stack end of window.

3 Execution

3.1 INSTALLATION

.1 Install blinds surface mounted to underside of lintel at window head at exterior walls of Offices only, in accordance with manufacturer's instructions.

.2 Secure top rail with cadmium plated steel wood screws into wood casing at window opening.

.3 Install blinds square, plumb, true to line with operable parts adjusted for correct function.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Structural drawings: Cast-In-Place Concrete.

.2 Section 08 11 00: Metal Doors and Frames.

1.2 SUMMARY

.1 Recessed entrance mat grille ground floor exterior entrances.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D 1784-99, Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

.2 The Aluminum Association

.3 The Carpet and Rug Institute (CRI)

.4 The National Floor Safety Institute (NFSI)

1.4 SHOP DRAWINGS

.1 Submit Shop Drawings in accordance with Section 01 33 00 - Submittals.

.2 Indicate layout of grid and frame, including details indicating construction relative to adjacent materials, direction of traffic, spline locations, profiles, anchors and accessories.

1.5 CLOSEOUT SUBMITTALS

.1 Submit maintenance data in form of manufacturer's printed instructions for cleaning and maintaining floor grids in accordance with Section 01 77 00 – Contract Closeout.

1.6 QUALITY ASSURANCE

.1 Flammability in accordance with ASTM E648, Class 1, Critical Radiant flux, minimum 0.45 watts/m2.

.2 Slip resistance in accordance with ASTM D-2047-96, Coefficient of Friction, minimum 0.60 wet.

.3 Structural aluminum alloys 6105-T5 and 6016-T6 for rail components.

1.7 DELIVERY STORAGE AND HANDLING

.1 Deliver materials to Project site ready for use and fabricated in as large sections and assemblies as practical.

.2 Deliver in original, unopened factory packaging clearly labelled to identify manufacturer.

1.8 SITE CONDITIONS

.1 Field measurements: check actual openings for grids by accurate field measurements before fabrication. Record actual measurements on final Shop drawings.

.2 Coordinate fabrication schedule with construction schedule.

.3 Coordinate frame installation with concrete construction to ensure recess and frame anchorage are accurate and that base is level and flat.

.4 Install frame after building enclosure is complete and related interior finish work is in progress.

1.9 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction Waste Management and Disposal.

.2 Do not dispose of unused sealant and adhesive materials into landfill. Divert materials to municipal hazardous materials depot.

.3 Divert unused carpet, metal and wiring materials from landfill to recycling facility.

.4 Collect and separate for disposal packaging material for recycling in accordance with Construction Waste Management Plan.

PART 2 Products

2.1 MATERIALS

.1 Recessed Entrance Mat Grilles:

.1 Wires and support bars: ASTM A276, 304 mil finish stainless steel.

.1 Surface wires 2.28 mm x 3.8 mm wires electrically welded with 1.8 mm support bars spaced 5.97 mm on centre. 3.68 mm spacing between wires.

.2 Tread wires resistance welded at each joint.

.3 19 mm pan depth.

.4 Hidden lockdowns.

.5 Capacity: Rolling load of 500 lb/wheel.

.6 Fasteners: Non-corrosive screws and anchors.

.2 Base frame: Recessed mechanically fastened angle frame.

.1 Frame: Stainless steel #4 satin finish.

.2 31.9 mm x 19 mm x 3.2 mm stainless steel angle frame.

.3 Latex screed between angle frame.

.4 3 mm x 31 mm x 31 mm stainless steel hold-down plates, fastened with screws into expansion shield set into concrete c/w flat washer.

PART 3 Execution

3.1 EXAMINATION

.1 Confirm areas and conditions are acceptable for installation, substrate level to tolerance of 3.2 mm over 3.2 m.

.2 Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

.1 Provide template of grid assemblies to ensure proper installation.

.2 Verify floor mat sizes by on site measurements.

.3 Coordinate top of mat surfaces with bottom of door swings to provide adequate clearance.

3.3 INSTALLATION

.1 Install in accordance with manufacturer's recommendations.

.2 Set grid at height recommended by manufacturer for most effective cleaning action.

.3 Coordinate top of grid surface with bottom of doors that swing across surface to provide clearance between door bottom and grid.

.4 Provide necessary shims, spacers and anchors for proper location and securement of frames to concrete.

.5 Install hold down plates according to manufacturer's recommedations.

3.4 PROTECTION

.1 After installing frame and pan in concrete work, provide temporary filler of plywood in recess and cover frames with plywood protective flooring.

.2 Maintain protection until construction traffic has ended and Project is near Substantial Completion.

.3 Wait until time of Substantial Completion of Project to install floor grids.

3.5 CLEAN UP

.1 As work proceeds and at the completion of the work clean up and remove from site all debris and left over materials resulting from the work of this Section.

.2 Dispose of waste materials in conformance with Construction Waste Management Plan.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Hydraulic passenger elevator.

1.2 RELATED SECTIONS

.1 Section 03 30 05 - Cast-in-Place Concrete: elevator pits and shaft ceiling.

.2 Section 05 12 23 - Structural Steel: Support steel, divider beams, and hoist beams.

.3 Section 05 50 00 - Metal Fabrications.

.4 Section 09 65 18 - Resilient Flooring: finished flooring in elevator car.

.5 Section 09 91 23 - Painting: field painting of elevator entrances over primer.

.6 Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC): Heating, cooling, and ventilation of machine room and machinery space.

.7 Section 26 05 00 - Common Work Results for Electrical: Light outlets, convenience outlets, light switches, and conduits.

.8 Section 26 24 17 - Panel boards Breaker Type: Disconnect switches.

.9 Section 26 50 00 - Light fixtures.

.10 Section 27 30 00 - Voice Communications: Telephone outlets and elevator telephones.

.11 Section 28 31 02 - Multiplex Fire Alarm System: Heat, smoke, and products of combustion sensing devices.

1.3 REFERENCES

.1 ASME A17.1-2010/CSA B44-10 - Safety code for elevators and escalators.

.2 CSA B44.2-10 - Maintenance requirements and intervals for elevators, dumbwaiters, escalators, and moving walks

.3 NBC 2010, and local codes and regulations except where specified otherwise.

.4 Comply with requirements of CAN/CSA-B651-04, Accessible Design for the Built Environment.

.5 ISO 9001-2000 - Quality Management Systems - Requirements.

1.4 DESIGN REQUIREMENTS

.1 Arrange elevator components in machine room so equipment can be removed for repairs or replaced without dismantling or removing other equipment components.

1.5 SUBMITTALS

.1 Comply with Section 01 01 50 - General Instructions for - Submittal Procedures.

.2 Product Data: Submit manufacturer/installer's product data, including installation instructions.

.3 Shop Drawings: Submit manufacturer/installer's shop drawings, including plans, elevations, sections, and details, indicating location of equipment, loads, dimensions, tolerances, materials, components, fabrication, fasteners, hardware, finish, options, accessories, and other information to render totally functional elevators.

.4 Samples: Submit manufacturer/installer's samples of standard colors and finishes of finish materials.

.5 Operation and Maintenance Manual: Submit manufacturer/installer's operation and maintenance manual; including operation, maintenance, adjustment, and cleaning instructions; trouble shooting guide; renewal parts catalogs; and electrical wiring diagrams.

.6 Warranty: Provide a one year limited warranty covering replacement of defective parts excluding labor. Preventive maintenance agreement required.

1.6 QUALITY ASSURANCE

.1 Manufacturer/Installer's Qualifications: Specialize in manufacturing and installing elevator equipment, with a minimum of 5 years successful experience.

.2 Regulatory Requirements:
- .1 Elevator design, clearances, construction, workmanship, materials, and installation, unless specified otherwise, shall be in accordance with ASME A17.1-2010/CSA B44, handicap accessibility, NBCC 2010, and other codes having legal jurisdiction.
- .2 Follow elevator design and manufacturing procedures certified in accordance with ISO 9001-2000 to meet product and service requirements for quality assurance for new products.

.3 Pre-installation Meeting:
- .1 Convene pre-installation meeting before start of installation of elevators.
- .2 Ensure attendance of parties directly affecting work of this section, including Contractor, Departmental Representative, and elevator manufacturer/installer.
- .3 Review examination, installation, field quality control, adjusting, cleaning, protection, and coordination with other work.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Delivery: Deliver materials to site in manufacturer/installer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer/installer.

.2 Storage: Store materials in clean, dry area indoors in accordance with manufacturer/installer's instructions.

.3 Handling: Protect materials during handling and installation to prevent damage.

1.8 PROJECT CONDITIONS

.1 Temporary Electricity:
- .1 Arrange for temporary 3-phase electricity to be available for installation of elevator components.
- .2 Comply with Section 01 01 50 - General Instructions for Temporary Utilities.

.2 Temporary Use of Elevator:
- .1 Departmental Representative will negotiate with manufacturer/installer for temporary use of elevator, if required.
- .2 Temporary use of elevator: in accordance with terms and conditions of manufacturer/installer's temporary acceptance form.

1.9 SCHEDULING

.1 Coordinate elevator work with work of other trades, for proper time and sequence to avoid construction delays.

1.10 WARRANTY

.1 Manufacturer/installer shall guarantee materials and workmanship of equipment installed under these specifications and make good, defects not due to ordinary wear or to improper use, which may develop within 1 year after completion of installation or acceptance thereof by beneficial use, whichever is earlier.

1.11 MAINTENANCE SERVICE

.1 Elevator maintenance service: performed by elevator manufacturer/installer.

.2 Provide elevator with regular maintenance for period of 12 months after completion of work specified herein or acceptance thereof by beneficial use, whichever is earlier.

.3 Include systematic examination, adjustment, and lubrication of elevator equipment. Repair or replace parts whenever required. Use parts produced by manufacturer of original equipment. Replace wire ropes when necessary to maintain required factor of safety.

.4 Provide emergency call back service for this maintenance period.

.5 Perform maintenance work using competent and qualified personnel approved by elevator manufacturer or original installer.

2 PRODUCTS

2.1 MANUFACTURER/INSTALLER

.1 Elevator: installed by installers approved by elevator manufacturer.

2.2 ELEVATOR SYSTEM AND COMPONENTS

.1 Hydraulic Passenger Elevator - Limited Use/Limited Application: LU/LA Hydraulic Elevator, 635 kg capacity cable hydraulic elevator:

.1 Capacity: 635 kg.
.2 Car Size: Maximum of 1.67 sm. 1220 by 1372 mm with one side right sliding doors.
.3 Travel: 3580 mm.
.4 Stops: 2.
.5 Speed: Nominal 0.15 m/sec.
.6 Pit Depth: Minimum 355 mm required.
.7 Overhead: Total overhead clearance (Refuse Space) 3330 mm above the finished upper landing floor.
.8 Drive system: drive System: 1:2 Cable Hydraulic, Heavy Duty car sling with roller guide shoes running on 8 lb. per foot steel T-rails, Quiet submersed pump and motor (5 HP), Factory pre-set and tested 2-speed valve for smooth start and stop.
.9 Power requirements:
  .1 208V – 30 A.
  .2 A Separate 115-Volt, 15 Amp Circuit is required for car lighting.
.10 Controls:
  .1 Manufacturer designed PLC Controller with integrated self-diagnostics.
  .2 Key control access to car control panel and call stations.
  .3 Push button at car and landings with Braille markings.
  .4 Automatic car light switch upon entry.
  .5 Digital floor indicator in Car.
  .6 Car arrival lanterns in car door jamb.
  .7 Arrival gong.
.11 Car and Hoistway Doors: Nominal opening 914 by 2032 mm two-speed horizontal sliding hoistway and car bi-pass doors.
.12 Safety features:
  .1 Emergency back-up power with a manual lowering device.
  .2 Safety brake system.
  .3 Car operator with integral gate switch.
  .4 Automatic bi-directional floor leveling.
  .5 Emergency alarm button in car, Emergency keyed stop switch in car.
  .6 Over speed valve.
  .7 Final limit switch.
  .8 Low oil protection timer circuit.
.13 Standard features:
  .1 Car direction lantern comes with audio and visual signals.
  .2 Full height photo-electric door sensors.
  .3 Automatic home park feature.
.14 Options:
  .1 Integrated hands free telephone.
  .2 Keyed hoistway access.
.15 Machine room location; Level 1 floor.

2.3 CAB DESIGN

.1 Cab Design:
  .1 Interior Walls: Plastic Laminate panel sections in colour selected by Departmental Representative
  .2 Cab Frame: Mild steel, black.
  .3 Ceiling Finish: sheet steel, powder coated white.
  .4 Handrail finish: Stainless Steel, brushed finish.
  .5 Car Operating Panel Finish:
    .1 Stainless Steel, brushed finish.

.6 Floor: Unfinished plywood.
.7 Lighting: Four recessed halogen down lights.
.1 White trim.
.8 Car Direction Lantern: Stainless car direction lantern complete with auto and visual signaling device indicating direction of travel and arrival at selected floor.
.9 Car doors: When open the doors provide a 915 mm by 2032 mm clear opening.
.1 Two Speed Horizontal Sliding equipped with full height photo-electric door sensors, color as follows:
.1 Stainless steel, brushed finish.

2.4 HOISTWAY ENTRANCES

.1 Hoistway Entrances: When open the doors provide a 915 mm by2032 mm clear opening.
.1 Two Speed Horizontal Sliding equipped with full height photo-electric door sensors, finish as follows:
.1 Stainless Steel, brushed finish.

.2 Hall Call Stations:
.1 Hall Station Type:
.1 Keyed Push Button.
.2 Finish:
.1 Stainless Steel, brushed finish.

3 EXECUTION

3.1 EXAMINATION

.1 Examine hoistways, hoistway openings, pits, and machine rooms before starting elevator installation.

.2 Verify elevator shaft is constructed in accordance with ASME17.1 /CSA B-44 and all local codes.

.3 Verify elevator shaft and machine room temperature is designed to have maintainable temperatures between 16 degrees C and 43 degrees C.

.4 Verify machine room if required provided with lighting, light switch and convenience outlet and conforms to CEC and clear space requirements and local codes.

.5 Verify elevator shaft and openings are of correct size and within tolerance.

.6 Verify electrical power is available and of correct characteristics.

.7 If preliminary work is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

.1 Clean surfaces thoroughly prior to installation.

.2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best

result for the substrate under the project conditions.

3.3 INSTALLATION

.1 Install elevators in accordance with manufacturer/installer's instructions and ASME A17.1-/CSA B44.

.2 Install system components and connect to building utilities.

.3 Accommodate equipment in space indicated.

.4 Startup equipment in accordance with manufacturer's instructions.

.5 Adjust for smooth operation.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in compliance with ASME A17.1 /CSA B-44 and as required by authorities having jurisdiction.

.2 Schedule tests with agencies, Departmental Representative and contractor present.

3.5 FIELD SERVICES

.1 Obtain required permits to perform tests. Perform tests required by regulatory agencies.

.2 Schedule tests with agencies Departmental Representative and contractor present.

.3 Submit test and approval certificates issued by jurisdictional authorities.

3.6 ADJUSTING

.1 Adjust for smooth acceleration and deceleration of car so not to cause passenger discomfort.

.2 Adjust automatic floor leveling feature at each floor to provide stopping zone of 6 mm.

3.7 CLEANING

.1 Remove protective coverings from finished surfaces.

.2 Clean surfaces and components ready for inspection.

3.8 PROTECTION

.1 Protect installed products until completion of project.

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

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 35 33	Health and Safety Requirements
.3	Section 23 05 00	Common Work Results – Mechanical

1.2 References

.1 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)

- .1 ANSI/NFPA 10-2013, Standard for Portable Fire Extinguishers.
- .2 ANSI/NFPA 13-2013, Installation of Sprinkler Systems.
- .3 ANSI/NFPA 25-2014, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.

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

- .1 Material Safety Data Sheets (MSDS).

.3 Underwriter's Laboratories of Canada (ULC).

.4 Fire Commissioner of Canada FC 403, "Sprinkler System".

1.3 Design Requirements

.1 Design automatic wet and dry pipe fire suppression sprinkler systems in accordance with required and advisory provisions of NFPA 13, by hydraulic calculations for uniform distribution of water over design area.

.2 The "Authority Having Jurisdiction" will be designated by the Departmental Representative.

.3 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings.

.4 Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.

.5 Devices and equipment for fire protection service: ULC approved for use in sprinkler systems.

.6 Design systems for earthquake protection for buildings in seismic zone applicable.

.7 Location of Sprinkler Heads:

- .1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13.
- .2 Uniformly space sprinklers on branch.

.8 Water Distribution:

- .1 Make distribution uniform throughout the area in which sprinkler heads will open.

.9 Water Supply:

- .1 Base hydraulic calculations on static and residual pressures indicated on drawings. For design purpose, the available water supply pressures shall be de-rated by a 10% safety factor.

.10 Sprinkler drawings and specifications are to give the bidder concept of the work involved. The design intent shall not be changed. Significant design features such as the location of exposed pipes and the method of zoning the sprinkler system may not be changed without prior discussion and approval by the Engineer. Field changes may be required to accommodate lighting, and hidden obstructions. Possible additional sprinkler heads may be required if blind spaces and ceiling drops have not been noted and/or dry type heads may have to be implemented if the area is not frost free.

.11 The contractor shall make access to blind spaces in a professional manner. Honeycombing required to establish joist locations and/or similar endeavours to establish sound pipe hangers, are acceptable.

1.4 Submittals

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions.

.2 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 01 50 – General Instructions.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 01 50 – General Instructions.

.2 Shop drawings: submit drawings stamped sealed and signed by professional engineer registered or licensed in Province of B.C, and Letters of Assurance s. Indicate:

.1 Materials.

.2 Finishes.

.3 Method of anchorage

.4 Number of anchors.

.5 Supports.

.6 Reinforcement.

.7 Assembly details.

.8 Accessories.

.3 Drawings: Sprinkler heads and piping system layout.

.1 Prepare detail working drawings of system layout in accordance with NFPA 13 using full size contract drawings.

.2 Show data essential for proper installation of each system.

.3 Show details, plan view, elevations, and sections of systems supply and piping.

.4 Show piping schematic of systems supply, devices, valves, pipe, and fittings.

.4 Design Data:

.1 Calculations of sprinkler system design.

.2 Indicate type and design density of each system.

.3 Samples

.1 Submit samples of following:

.1 Each type of sprinkler head.

.2 Signs.

.4 Assurance of Professional Design and Commitment for Field Review.

.1 Provide Assurance commitment letters (Schedules B-1 and B-2) at the commencement of the project, in accordance with the building code and for submission to the Departmental Representative and review by the Authority Having Jurisdiction.

.2 Provide Assurance of Professional Field Review and Compliance (Schedule C-B) at the completion of the project.

.5 Closeout Submittals:

.1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 01 50 – General Instructions in accordance with ANSI/NFPA 13.

.2 Manufacturer's Catalog Data, including specific model, type, and size for:

.1 Pipe and fittings.

.2 Sprinkler heads.

.3 Pipe hangers and supports.

.4 Mechanical couplings.

.3 Field Test Reports:

.1 Preliminary tests on piping system.

.2 Formal tests and inspections

.4 Records:

.1 As-built drawings of each system.

.1 After completion, but before final acceptance, submit complete set of as-built drawings (prints) of each system for record purposes.

.2 Submit drawings in digital file versions with title block similar to full size contract drawings.

.5 Operation and Maintenance Manuals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

.2 Provide detailed hydraulic calculations including summary sheet, and Contractors Material and Test Certificate for aboveground piping and other documentation for incorporation into manual specified in Section 01 01 50 – General Instructions in accordance with ANSI/NFPA 13.

1.5 Quality Assurance

.1 Qualifications:

.1 Installer: company or person specializing in sprinkler systems with documented experience.

.2 All work shall be carried out by Sprinkler Pipe Fitters who carry a "Certificate of Qualification" for this trade as issued by the Ministry of Labour.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

.3 Inspections and Tests:

.1 All inspections, examinations and tests required by the "Authorities and Agencies having jurisdiction" specified shall be arranged and paid for by the fire protection contractor, as necessary to obtain complete and final acceptance of the fire protection system.

.2 Provide Contractor's Material and Test Certificates and all required test papers as may be requested by all parties having jurisdiction and duly witnessed by Departmental Representative, showing proof of:

.1 Underground hydrostatic test of 1400 kPa (200 PSI).

.2 Flushing of underground main through 100mm (4") drain pipe.

.3 Hydrostatic test of overhead piping @ 1400 kPa (200 PSI).

.4 Verification of all alarm and trouble devices installed under this contract.

.3 Provide the services of the Professional Engineer who designed the fire protection systems for "Field Review" of the installation. Construction period review reports shall be submitted during the construction period.

.4 If welding is required, the Contractor shall submit a copy of the welder's certification to the Engineer for Record purposes prior to starting work.

1.6 Maintenance

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 01 50 – General Instructions.

.2 Provide spare sprinklers and tools as required by ANSI/NFPA 13.

1.7 Delivery, Storage and Handling

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 01 50 – General Instructions.

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

.2 Storage and Protection:

.1 Store materials indoors in dry location.

.2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

.3 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

PART 2 PRODUCTS

2.1 Pipe, Fittings & Valves

.1 Pipe:

.1 Piping shall meet or exceed one of the following standards:

.1 Black and Hot-Dipped Galvanized Welded and Seamless Steel Pipe – ASTM A795

.2 Welded and Seamless Steel Pipe – ANSI/ASTM A53

.3 Wrought Steel Pipe – ANSI B36.19M

.4 Elec.-Resistance Welded Steel Pipe – ASTM A135

.2 All thickness for pressures up to 2070 kPa (300 psi) shall be as follows:

.1 Joined by shop welding or roll grooving:

.1 Up to and incl. 125mm (5") – Schedule 10

.2 150mm (6") – 3.40mm (0.134)

.3 200mm, 250mm (8", 10") – 4.78mm (0.188")

.2 Joined by threaded fittings or cut grooves:

.1 up to 200mm (8") – Schedule 40

.2 200mm (8") and larger – Schedule 30

.2 Fittings and joints to ANSI/NFPA 13:

.1 Ferrous: screwed, welded, flanged or roll grooved.

.2 Copper tube: screwed, soldered, brazed. Not permitted in any inmate areas.

.3 System piping 50mm (2") and smaller shall be Schedule 40 and threaded joints, or Schedule 10 lightwall with grooved joints, material and IPS dimensions conforming to NFPA 13. Larger sizes shall be Schedule 10 and joined by welding or groove joining methods in accordance with NFPA 13.

.4 All grooved products shall be of one manufacturer. All grooved end fittings shall be of "full flow" design and manufactured from ductile iron conforming to ASTM A-536. Grooved coupling shall be designed with angle bolt pads to provide a rigid joint except where flexibility is required. "Flush cap" or "flush seal" gaskets shall be used with couplings in dry pipe systems.

.5 Cast iron floor and ceiling plates with set screws shall be provided whenever pipe passes through walls, floors and partitions. In finished areas, plates shall be chrome plated.

.6. CPVC piping is not acceptable for this project.

.3 Valves:

.1 ULC listed for fire protection service.

.2 Up to NPS 2: bronze, screwed ends, O. S. & Y. gate.

.3 NPS 2 1/2 and over: cast iron, flanged or roll grooved ends, indicating butterfly valve; OS & Y gate.

.4 Swing check valves.

.5 Ball drip.

.6 All water supply and zone isolation valves shall be monitored with tamper switches. Electric wiring for control and alarm components will be provided Under Division 16.

.7 Valves controlling water supply and alarm shut-off shall be of O. S. & Y. type with rising stem or approved gear operated butterfly valves with supervisory switch. Where a grooved piping system is installed, grooved end isolation/control valves may be used. Valves shall be supervised by a factory installed double throw/double pole switch.

.8 All O. S. & Y. gate vales shall be monitored with tamper switches. Electric wiring for control and alarm components shall be provided under Division 16.

.4 Pipe hangers:

.1 ULC listed for fire protection services.

.2 Hanger standards shall conform to Section 3-10 of NFPA 13. Use "C" clamps complete with lock nuts and restraining straps. Hangers shall be supplied and installed in accordance with NFPA 13. C-type clamps used to attach hangers to the building structure shall be equipped with lock nuts and retaining straps.

.3 Sway bracing shall be installed as per Section 3-5.3.5 of NFPA 13.

2.2 Sprinkler Heads

.1 General: to ANSI/NFPA 13 and ULC listed for fire services.

.2 All sprinklers in suspended ceiling areas shall be chrome finish recessed type with chrome flush type escutcheon plates. All sprinklers in open ceiling areas shall be of brass finish upright or pendent types. All sidewall sprinklers shall be chrome finish horizontal type.

.3 Sprinkler shall be protected from mechanical injury by standard guards where necessary. The proximity of sprinklers to heating units shall be taken into consideration in determining the temperature rating.

.4 Adjacent to each sprinkler alarm valve, provide one (1) 12-sprinkler capacity Underwriters approved cabinet complete with various type and temperatures of sprinklers in ratio to the numbers installed of each type along with a standard sprinkler wrench.

2.3 Pipe Sleeves

.1 Provide pipe sleeves where piping passes through walls, floors, and roofs.

.2 Secure sleeves in position and location during construction.

.3 Provide sleeves of sufficient length to pass through entire thickness of walls, floors, and roofs.

.4 Provide 2.5 cm minimum clearance between exterior of piping and interior of sleeve or core-drilled hole.

.1 Firmly pack space with mineral wool insulation.

.2 Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to firm but pliable mass, provide mechanically adjustable segmented elastomeric seal.

.3 In fire walls and fire floors, seal both ends of pipe sleeves or core-drilled holes with ULC listed fill, void, or cavity material.

.5 Sleeve s in Masonry and Concrete Walls, Floors, and Roofs:

.1 Provide hot-dip galvanized steel, ductile-iron, cast-iron sleeves.

.2 Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in core-drilled hole are completely grouted smooth.

.6 Sleeves in Other Than Masonry and Concrete Walls, Floors, and Roofs:

.1 Provide 0.61 mm thick galvanized steel sheet.

2.4 Escutcheon Plates

.1 Provide split hinged type metal plates for piping passing through walls, floors, and ceilings in exposed spaces.

.2 Provide polished chromium-plated finish on copper alloy plates in finished spaces.

.3 Provide paint finish on metal plates in unfinished spaces.

2.5 Spare Parts Cabinet

.1 For storage of maintenance materials, spare sprinkler heads and special tools.

.2 Construct to sprinkler head manufacturer's standard.

2.6 Signs

.1 Attach properly lettered and approved metal signs to each valve and alarm device to ANSI/NFPA 13.

.2 Permanently fix hydraulic design data nameplates to riser of each system.

2.7 Portable Fire Extinguisher

.1 Provide Ansul dry chemical, multi-purpose fire extinguishers with U.L. rating 2-A:10-B:C.

.2 Provide extinguishers in all fire extinguisher cabinets as located on the Architectural drawings. Provide wall bracket and mount additional surface mounted extinguishers, where shown on Mechanical drawings. Locations of extinguishers and minimum travel distances shall comply with NFPA 10 regulations.

2.8 Dry Pipe Valve

.1 ULC listed.
.2 Cast iron, flanged type, sized to suit water main.
.3 Components:
  .1 Accelerator.
  .2 Air maintenance device with low pressure alarm.
  .3 Alarm pressure switch with supervisory capability.
  .4 Pressure gauges.
  .5 Drain valve.
  .6 Test valve with associated piping.
  .7 Shut off valve - OS & Y with tamper-proof device wired back to fire alarm panel.

2.9 Compressed Air Supply

.1 Automatic Air Compressor.
.2 ULC listed.
.3 Capacity:
  .1 To restore normal air pressure in system within 30 minutes for low differential systems.
  .2 To provide air pressure of 140 kPa in excess of calculated trip pressure of dry pipe valve] [in accordance with instruction sheet furnished with dry pipe valve.
.4 Piping: ferrous, NPS 3/4 screwed joints and fittings, to ANSI/NFPA 13

2.10 Inspector's Test Connection

.1 Locate inspector's test connection at hydraulically most remote part of each system, provide test connections approximately 3m above floor for each sprinkler system or portion of each sprinkler system equipped with alarm device.

.2 Provide test connection piping to location where discharged without property damage.

.3 Provide discharge orifice of same size as corresponding sprinkler orifice.

2.11 Backflow Prevention

.1 Provide a double check valve assembly as indicated on the Fire Protection Drawings.

.2 Backflow prevention stations shall be listed by Underwriter's Laboratories Canada (U.L.C.).

.3 Backflow prevention stations shall be in complete accordance with CSA B64.10-M88 "Selection, Installation, Maintenance and Field Testing" and American Water Works Association - Western Canada Section and Pacific Northwest Section - 1990 Fifth Edition.

.4 Complete testing of all reduced pressure principle backflow prevention devices shall be carried out under this Section prior to final acceptance of fire protection systems. A certificate shall be submitted duly signed and witnessed that testing was satisfactory.

2.12 Supervisory Switches

.1 General: to ANSI/NFPA 13 and ULC listed for fire service.

.2 Valves:

.1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.

.3 Pressure or flow switch type:

.1 With normally open and normally closed contacts and supervisory capability.

.2 Provide switch with circuit opener or closer for automatic transmittal of alarm over facility fire alarm system.

.3 Connect into building fire alarm system.

2.13 Pressure Gauges

.1 Provide pressure gauges at the following locations:

- dry pipe valve
- compressor
- pump suction and discharge
- top of all standpipe risers

.2 Pressure gauges shall be ULC listed stem mount or wall mount type with Bourdon phosphor bronze tube, brass socket, 6 mm [1/4"] lower connection, aluminum case in black enamel finish, chrome removable slip ring, stainless steel rotary type movement, minimum 90mm [3 1/2"] dial of 1% of full scale range and pressure range to suit application, with lever handle cock and brass 6 mm [1/4"] NPT snubber to suit service.

2.14 Flow Switches

.1 Provide alarm indication for each system or zone indicated. Flow switches shall be vane type with retard for pipes 50mm [2"] or larger; without retard for smaller pipe sizes.

.2 All zones shall have a flow switch, an isolation valve and an integral test and drain.

2.15 Fire Department Connection

.1 Provide connections approximately 1.5 m above finish grade, location as indicated.

.2 To ANSI/NFPA 13 and ULC S543 listed, Siamese type.

.3 Polished bronze exposed of approved two-way type with 2.5 inch National Standard female hose threads with plug, chain, and identifying fire department connection escutcheon plate.

.4 Thread specifications: compatible with local fire department.

PART 3 EXECUTION

3.1 Manufacturer's Instruction

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 Above Ground Piping Systems

.1 Provide fittings for changes in direction of piping and for connections.

.1 Make changes in piping sizes through tapered reducing pipe fittings, bushings will not be permitted.

.2 Perform welding in shop; field welding will not be permitted.

.3 Conceal piping in areas with suspended ceiling.

3.3 Pipe Installation

.1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.

.2 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.

.3 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.

.4 Inspect piping before placing into position.

.5 Install spare parts cabinet as indicated.

.6 Valve identification:

.1 Identify drain valve and auxiliary valves.

3.4 Field Painting

.1 Clean, pre-treat, prime, and paint new systems including piping, conduit, hangers, supports, miscellaneous metalwork, and accessories.

.2 Apply coatings to clean, dry surfaces, using clean brushes.

.3 Clean surfaces to remove dust, dirt, rust, and loose mill scale.

.4 Immediately after cleaning, provide metal surfaces with 1 coat of pretreatment primer applied to minimum dry film thickness of 0.3 ml, and one coat of zinc chromate primer applied to minimum dry film thickness of 1.0 ml.

.5 Shield sprinkler heads with protective covering while painting is in progress.

.6 Upon completion of painting, remove protective covering from sprinkler heads.

.7 Remove sprinkler heads which have been painted and replace with new sprinkler heads.

.8 Provide primed surfaces with following:

.1 Piping in Finished Areas:

.1 Provide primed surfaces with 2 coats of paint to match adjacent surfaces.

.2 Provide valves and operating accessories with 1 coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil.

.3 Provide piping with 50 mm wide red enamel bands self-adhering red plastic bands spaced at maximum of 6 m intervals throughout piping systems.

.2 Piping in Unfinished Areas:

.1 Finish painting not required in spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and spaces where walls or ceiling are not painted or not constructed of a pre-finished material.

.2 Provide piping with 50 mm wide red enamel bands self-adhering red plastic bands spaced at maximum of 6 m intervals.

3.5 Field Quality Control

.1 Site Test, Inspection:

.1 Perform test to determine compliance with specified requirements in presence of Engineer.

.2 Test, inspect, and approve piping before covering or concealing.

.3 Preliminary Tests:

.1 Hydrostatically test each system at 200 psig for a 2 hour period with no leakage or reduction in pressure.

.2 Flush piping with potable water in accordance with NFPA 13.

.3 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.

.4 Test alarms and other devices.

.5 Test water flow alarms by flowing water through inspector's test connection. When tests have been completed and corrections made, submit signed and dated certificate in accordance with NFPA 13.

.4 Formal Tests and Inspections:

.1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.

.2 Submit written request for formal inspection at least 15 days prior to inspection date.

.3 Repeat required tests as directed.

.4 Correct defects and make additional tests until systems comply with contract requirements.

.5 Furnish appliances, equipment, instruments, connecting devices, and personnel for tests.

.6 Authority of Jurisdiction, will witness formal tests and approve systems before they are accepted.

.7 Altered and relocated sprinkler system to be inspected and tested in conformance with NFPA 125.

3.6 Placing In Service

.1 When the entire fire protection system has been completed to the satisfaction of the Departmental Representatives and when operating and maintenance instructions have been provided, the Fire Protection Contractor shall, in the presence of the Engineer, demonstrate the complete operation and maintenance required to the operating personnel. A complete operational test conducted on the entire installation for the purpose of verification of compliance with all applicable standards and codes shall be carried out.

.2 Three copies of a complete operating manual shall be provided, which must include the following:

.1 Detailed instructions for the normal maintenance of all installed equipment including operational procedures, frequency of operational checks, service instructions and trouble-shooting instructions.

.2 Valve schedule for all valves including location, service type and normal position for all systems.

.3 Schematic showing the location of each excess pressure pump breaker, inspectors test valves, low point drains and flow switches where applicable.

.4 Warranties and certificates.

.5 Manufacturer's operating and maintenance manuals.

.6 Description of the operation of each system and the function of each piece of equipment.

.7 Lubrication schedule for all lubricated equipment including recommended lubricants.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 35 33	Health and Safety Requirements
.3	Section 23 05 05	Installation of Pipework
.4	Section 23 05 29	Hangers & Supports for Piping & Equipment
.5	Section 23 05 48	Vibration & Seismic Controls for Ductwork, Piping & Equipment
.6	Section 23 05 93	Testing, Adjusting and Balancing
.7	Section 23 07 19	Thermal Insulation for Piping

1.2 References

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).

- .1 ANSI/ASME B16.15-2011, Cast Bronze Threaded Fittings, Classes 125 and 250.
- .2 ANSI/ASME B16.18-2012, Cast Copper Alloy Solder Joint Pressure Fittings.
- .3 ANSI/ASME B16.22-2013, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .4 ANSI/ASME B16.24-2011, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.

.2 American Society for Testing and Materials International, (ASTM).

- .1 ASTM A307-12, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .3 ASTM B88M-13, Standard Specification for Seamless Copper Water Tube (Metric).

.4 Canadian Standards Association (CSA International).

- .1 CSA B242-05 (R2011), Groove and Shoulder Type Mechanical Pipe Couplings.

.5 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

- .1 MSS-SP-70-2006, Gray Iron Gate Valves, Flanged and Threaded Ends.
- .2 MSS-SP-71-2005, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
- .3 MSS-SP-80-2008, Bronze Gate, Globe, Angle and Check Valves.

.6 National Sanitation Foundation (NSF) / American National Standards Institute (ANSI).

- .1 NSF/ANSI 61, Drinking Water System Components.

1.3 Submittals

.1 Submittals in accordance with Section 01 01 50 – General Instructions

.2 Provide maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.4 Health and Safety

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.5 Waste Management and Disposal

.1 Separate waste materials for reuse and recycling in accordance with 01 01 50 – General Instructions.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Place materials defined as hazardous or toxic in designated containers.

.4 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.5 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan

.6 Fold up metal banding, flatten and place in designated area for recycling.

1.6 Quality Assurance

.1 All potable water system components shall conform to NSF/ANSI Standard 61.

PART 2 PRODUCTS

2.1 Piping

.1 Domestic hot, cold and hot recirculation water systems, within building.

.1 Above ground:

.1 Copper tube, hard drawn, type L: to ASTM B88M to NPS 4 size.

.2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.

.2 Water service pipe NPS6 or large in building shall be Ductile Iron, minimum Pressure Class 350 designed and manufactured in accordance with ANSI/AWWA C150/A21.50 and C151/A21.51. All pipe shall be cement –mortar lined in accordance with ANSI/AWWA C104/A2.4 and grooved to BS 4772/2531 standards.

.3 Underground water supply piping 100mm [4"] or larger shall be AWWA C900 PVC pressure pipe with compatible fittings. Provide concrete thrust blocks for joint restraint at changes of pipe direction.

2.2 Fittings

.1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ANSI B16.24.

.2 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15.

.3 Cast copper, solder type: to ANSI B16.18.

.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

.5 Roll grooved: to CSA B242.

2.3 Joints

.1 Rubber gaskets, 1.6mm thick: to ANSI/AWWA C111/A21.11.

.2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

.3 Solder: 95/5 tin copper alloy or brazing.

.4 Teflon tape: for threaded joints.

.5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gaskets suitable for temperature range of -34°C to 120°C [-30°F to 250°F].

.6 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.

2.4 Gate Valves

.1 NPS2 and under, soldered:

.1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc.

.2 NPS2 and under, screwed:

.1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc.

.3 NPS2-1/2 and over, in mechanical rooms, flanged:

.1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS & Y bronze trim.

.4 NPS2-1/2 and over, other than mechanical rooms, flanged:

.1 Non-rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet.

2.5 Globe Valves

.1 NPS2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet.

.2 Lockshield handles: as indicated.

.2 NPS2 and under, screwed:

.1 To MSS-SP-80, Class 150, 1MPa, bronze body, screwed over bonnet, renewable composition disc.

.2 Lockshield handles: as indicated.

2.6 Swing Check Valves

.1 NPS 2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.

.2 NPS2 and under, screwed:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, re-grindable seat.

.3 NPS2-1/2 and over, flanged:

.1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, renewable seat, bronze disc, bolted cap.

2.7 Ball Valves

.1 NPS2 and under, screwed:

.1 Class150.

.2 Bronze body, chrome plated brass ball, PTFE Teflon adjustable packing, brass gland and PTFE Teflon seat, steel lever handle.

.2 NPS2 and under, soldered:

.1 To ANSI B16.18, Class 150.

.2 Bronze body, chrome plated brass ball, PTFE Teflon adjustable packing, brass gland and PTFE Teflon seat, steel lever handle, with NPT to copper adaptors.

2.8 Drain Valves

.1 Drain valves shall be provided with cap and chain.

.2 Drain and hose valves 20mm (3/4") and smaller:

.1 Sediment Faucets.

.2 Ball valves.

2.9 Plumbing Piping

.1 Water supply piping under concrete slabs or in walls shall be encased in standard weight flexible polyethylene pipe one size larger than copper tubing. All joints to be wrapped in plastic wrapping tape.

2.10 Dielectric Unions

.1 Insulating dielectric unions and flange unions shall be installed when adapting between dissimilar metallic pipe for domestic water supply piping, and domestic water storage tanks. Elsewhere, unions and adaptors for copper piping shall be cast brass pressure fittings.

2.11 Expansion Joints

.1 Domestic and industrial water: Annular close pitch corrugated metal hose with Type 316L stainless steel butt welded tube. Type 304 single stainless steel outer brain, flanged, welded or screwed ends. Suitable for 1034 kPa (150 psi) working pressure and 50mm traverse.

2.12 Strainers

.1 NPS 2 and under: Full pipeline size, 1,034 kPa (150 psi) SWP bronze, with screwed ends and a removable plug type screen retainer.

.2 NPS 2-1/2 and over: Full pipeline size, 860 kPa (125 psi) SWP cast iron, with flanged ends and a bolted screen retainer.

2.13 Balancing Fittings:

.1 Sizes: Calibrated balancing valves, as specified this section.

.2 NPS 2 and under: Globe type, Y-pattern, bronze body, EPDM O-ring and NPT connections.

.3 Flow measuring valve shall be fitted with meter readout ports with check valves and caps, digital handwheel with memory stop indicator, NPS 20 hose connection, and a nameplate bearing manufacturer's name and calibrated nameplate.

.4 Furnished with preformed rigid polyurethane insulation.

PART 3 EXECUTION

3.1 Installation

.1 Install in accordance with Section 23 05 05 - Installation of Pipework, Section 23 05 29 – Hangers & Supports for Piping & Equipment, and Section 23 05 48 – Vibration & Seismic Controls for Ductwork Piping & Equipment.

.2 Install in accordance with National Plumbing Code and local authority having jurisdiction.

.3 Cut square, ream and clean tubing and tube ends, clean recesses of fittings and assemble without binding.

.4 Assemble all piping using fittings manufactured to ANSI standards.

.5 Install tubing close to building structure to minimize furring, conserve headroom and space. Group exposed piping and run parallel to walls.

.6 Install CWS piping below and away from HWS and HWR and all other hot piping so as to maintain temperature of cold water as low as possible.

.7 Connect to fixtures and equipment in accordance with manufacturer's instructions unless otherwise indicated.

.8 Buried tubing:

.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.

.2 Bend tubing without crimping or constriction. Minimize use of fittings.

3.2 Valves

.1 Isolate equipment, fixtures and branches with gate or ball valves.

.2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

3.3 Pressure Tests

.1 Test pressure: 1.5 times maximum system operating pressure, and not less than 860 kPa.

3.4 Balancing

.1 Balance domestic hot water recirculation system shall be balanced by TAB Contractor under Division 23. Refer to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for applicable procedures.

3.5 Pre- Start-Up Inspections

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that pressure booster systems are operating properly.

.4 Ensure that air chambers, expansion compensators are installed properly.

3.6 Disinfection

.1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction and approval of Departmental Representative.

.2 Upon completion, provide a "Chlorination Certificate" at project closeout and provide a copy in the O&M Manual.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 35 33	Health and Safety Requirements
.3	Section 23 05 00	Common Work Results for Mechanical
.4	Section 23 05 05	Installation of Pipework
.5	Section 23 05 29	Hangers & Supports for Piping & Equipment
.6	Section 23 05 48	Vibration & Seismic Controls for Ductwork Piping & Equipment
.7	Section 23 07 19	Thermal Insulation for Piping

1.2 References

.1 American Society for Testing and Materials International, (ASTM).

- .1 ASTM B32-08, Standard Specification for Solder Metal.
- .2 ASTM B306-13, Standard Specification for Copper Drainage Tube (DWV).
- .3 ASTM C564-12, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.2 Canadian Standards Association (CSA International).

- .1 CAN/CSA-B70-12, Cast Iron Soil Pipe, Fittings and Means of Joining.
- .2 CSA-B125-12, Plumbing Fittings.

1.3 Submittals

.1 Submittals in accordance with Section 01 01 50 – General Instructions.

.2 Provide maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.4 Health and Safety

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.5 Waste Management and Disposal

.1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Place materials defined as hazardous or toxic in designated containers.

.4 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.5 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.6 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 PRODUCTS

2.1 Copper Tube and Fittings

.1 Above ground sanitary storm and vent, Copper Type DWV to: ASTM B 306.

.1 Fittings.

.1 Cast brass: to CAN/CSA-B125.

.2 Wrought copper: to CAN/CSA-B125.

.2 Solder: tin-lead, 50:50, type 50A or lead free, tin-copper alloy 95:5, type TA to ASTM B 32.

2.2 Cast Iron Piping and Fittings

.1 Buried sanitary, storm and vent, cast iron (minimum NPS 2) to: CAN/CSA-B70.

.1 Joints.

.1 Mechanical joints.

.1 Neoprene or butyl rubber compression gaskets: to ASTM C 564 or CAN/CSA-B70.

.2 Stainless steel clamps.

.2 Above ground sanitary, storm and vent: Cast iron to CAN/CSA-B70.

.1 Joints.

.1 Mechanical joints.

.1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

2.3 ABS Piping

.1 Drainage piping under the building, provided that such piping does not pass through any fire separations, may be as follows, at the contractor's option:

.1 Underground sanitary drainage piping under building, 150mm in diameter and smaller, certified to the current version of CSA B181.1, ABS Drain, Waste and Vent Pipe and Fittings. Piping shall be solid wall in construction. Cell core piping is not acceptable.

.2 The use of ABS piping inside building is not permitted.

2.4 PVC Piping

.1 Drainage piping under the building may be as follows, at the contractor's option:

.1 Underground sanitary drainage piping under building, 100mm in diameter or larger, certified to the current version of CSA B181.2, PVC Drain, Waste and Vent Pipe and Fittings.

.2 The use of PVC drain pipe inside building is not permitted.

PART 3 EXECUTION

3.1 Installation

.1 Install in accordance with Section 23 05 05 - Installation of Pipework, Section 23 05 29 – Hangers & Supports for Piping & Equipment, and Section 23 05 48 – Vibration & Seismic Controls for Ductwork Piping & Equipment.

.2 Install in accordance with National Plumbing Code and local authority having jurisdiction.

.3 Install buried pipe on 150 mm bed of clean washed sand, shaped to accommodate hubs and fittings, to line and grade as indicated. Backfill with 150 mm of clean washed sand.

.4 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.

3.2 Testing

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.3 Performance Verification

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.

.2 Open, cover with linseed oil and re-seal.

.3 Verify that cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:

.1 Verify domes are secure.

.2 Ensure weirs are correctly sized and installed correctly.

.3 Verify provisions for movement of roof system.

.4 Ensure that fixtures are properly anchored, connected to system and effectively vented.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 35 33	Health and Safety Requirements
.3	Section 01 91 00	Commissioning
.4	Section 22 42 01	Plumbing Specialties and Accessories
.5	Section 23 05 00	Common Work Results for Mechanical
.6	Section 23 05 48	Vibration & Seismic Controls for Ductwork, Piping and Equipment

1.2 References

.1 Canadian Standards Association (CSA International)

- .1 CSA B51-2014, Boiler, Pressure Vessel, and Pressure Piping Code.
- .2 CAN/CSA C22.2 No.110-94 (R2004), Construction and Test of Electric Storage Tank Water Heaters.
- .3 CAN/CSA-C191-04, Performance of Electric Storage Tank Water Heaters for Household Service.
- .4 CAN/CSA-C309-M90 (R2009), Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.

.2 National Sanitation Foundation (NSF) / American National Standards Institute (ANSI).

- .1 NSF/ANSI 61, Drinking Water System Components.

1.3 Submittals

.1 Submittals in accordance with Section 01 01 50 – General Instructions.

.2 Provide maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.4 Health and Safety

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.5 Waste Management and Disposal

.1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Place materials defined as hazardous or toxic in designated containers.

.4 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.5 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan

.6 Fold up metal banding, flatten and place in designated area for recycling.

1.6 Quality Assurance

.1 All potable water system components shall conform to NSF/ANSI Standard 61.

PART 2 PRODUCTS

2.1 Gas-Fired Instantaneous Domestic Hot Water Heater

.1 General: Wall-mounted, gas fired, condensing, fully modulating, instantaneous domestic hot water heater. Power vent, direct ignition.

.2 Designed and constructed to ANSI/ASME Boiler and Pressure vessel Code.

.3 Boiler/burner package to bear ULC, CGA label.

.4 Maximum input: 58 kW [199 MBH]

.5 Minimum input: 2.8 kW [9.5 MBH]

.6 AFUE: 95%

.7 DHW flow rate at 27.8°C [50°F] temperature rise: 0.48 L/s [7.6 gpm]

.8 Features:

.1 Air-fuel ratio sensor.

.2 Exhaust and water temperature safety control.

.3 Overheat cutoff fuse.

.4 Internal freeze-protection system

.5 Manual reset high limit switch

.6 Stainless steel heat exchanger

.7 Water flow sensor, electronic water control and bypass control

.9 Venting: direct vent sealed combustion. Hot water heater to be complete with direct-vent conversion kit, and flue gas backflow preventer. Provide concentric venting kit where indicated.

.1 Combustion air intake:

.1 Where direct vent is specified, provide PVC intake piping.

.2 Provide optional air intake filter for non-ducted application.

.2 Venting pipe shall be of either:

.1 Category III or Type BH, double wall stainless steel grade AL 29-4C (inner) listed to UL1738/S636 and shall be able to handle positive pressure and flue gas condensate. Outer jacket is permitted to be constructed of Type 304 or Type 430 stainless steel.

.2 System 636 CPVC piping. Grey (high temperature) shall be used.

The chimney must be designed by a chimney manufacturer including all connector pieces, roof flashing, storm collar, and condensate drain connections.

.10 Maximum operating pressure: 1,034 kPa (150 psi)

.11 Furnished with Temperature Remote Controller that serves two functions:

.1 Allows output temperature to be adjusted within 37.2°C (99°F) to 75°C (167°F).

.2 Works as diagnostic tool that will give concise error code.

.12 Condensate Handling System:

.1 The system shall include a condensate neutralizing system that is gravity drain and self- actuating. The neutralizing system shall utilize calcium carbonate (limestone) as its neutralizing agent. The neutralizing system shall be sized to provide one heating seasons of neutralizing capacity.

.2 The system shall neutralize the acidic condensate to a pH level that is safe for copper piping, building concrete, and the city sewer system.

.3 The condensate system (tank/container) must be easily removable with the use of flexible couplings and unions. Do not bolt down condensate system.

.4 Acid neutralizer shall be 20 litres capacity or approved equal capable of handling 3,000 MBH input appliances.

PART 3 EXECUTION

3.1 Installation

.1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.

.2 Pipe relief valve to floor drain.

.3 Install unions to permit removal or replacement of equipment.

.4 Install tees in lieu of elbows at changes in direction of piping. Install plug in open ends of tees.

.5 Pipe vertical condensate drain from flue vent to floor drain. Drain pipe shall be silicone hose. Install condensate trap (loop) per installation instruction and prime trap.

.6 Provide vacuum breaker to CSA B64-01 as specified in Section 22 42 01 – Plumbing Specialties and Accessories.

3.2 Field Quality Control

.1 Commissioning:

.1 In accordance with Section 01 91 00 – Commissioning, and Section 23 08 00 – Commissioning of Mechanical Systems.

.2 Manufacturer to:

.1 Certify installation.

.2 Start up and commission installation.

.3 Carry out on-site performance verification tests.

.4 Demonstrate operation and maintenance.

.3 Provide Departmental Representative at least 48 hours' notice prior to inspections, tests, and demonstrations. Submit written report of inspections and test results.

3.3 Cleaning

.1 Proceed in accordance with Section 01 01 50 – General Instructions, and Section 23 08 02 – Cleaning & Startup of Mechanical Piping Systems.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Summary

.1 Section Includes:

.1 The supply and installation of Plumbing Fixtures and Trim.

.2 Products Installed but not Supplied Under this Section:

.1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.

.2 Equipment installed by others.

.1 Connect with unions.

.3 Equipment not installed.

.1 Capped for future connection by others.

1.2 Related Section

.1	Section 01 01 50	General Instructions
.2	Section 01 35 33	Health and Safety Requirements
.3	Section 23 05 00	Common Work Results for Mechanical

1.3 References

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA-B45 Series 02 (R2013) Plumbing Fixtures.

.2 CSA-B125.3-12, Plumbing Fittings.

.3 CSA-B651-12, Accessible Design for Built Environment.

.2 National Sanitation Foundation (NSF) / American National Standards Institute (ANSI).

.1 NSF/ANSI 61, Drinking Water System Components.

1.4 Submittals

.1 Submittals in accordance with Section 01 01 50 – General Instructions.

.2 Indicate, for all fixtures and trim:

.1 Dimensions, construction details, roughing-in dimensions.

1.5 Closeout Submittals:

.1 Submit maintenance data in accordance with Section 01 01 50 – General Instructions.

.2 Include:

.1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.

.2 Details of operation, servicing, maintenance.

.3 List of recommended spare parts.

1.6 Health and Safety

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.7 Delivery Storage and Disposal

.1 Waste Management and Disposal:

.1 Separate waste materials for recycling in accordance with Section 01 01 50 – General Instructions.

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan

.3 Fold up metal banding, flatten and place in designated area for recycling.

1.6 Quality Assurance

.1 All potable water system components shall conform to NSF/ANSI Standard 61.

PART 2 PRODUCTS

2.1 Manufactured Units

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.

.3 Exposed plumbing brass shall be chrome plated finish. Water supply piping exposed in finished areas shall be chrome plated brass pipe and fittings.

.4 Number, locations: architectural drawings to govern.

.5 Fixtures in any one location to be product of one manufacturer and of same type.

.6 Trim in any one location to be product of one manufacturer and of same type.

.7 Fixture Schedule:

WC-1 Water Closet

Toilet, 15" (381mm) high floor mounted, vitreous china with EverClean antimicrobial surface which inhibits the growth of stain and odor causing bacteria, mold and mildew, elongated syphon jet flush action bowl, 2-1/8" (54mm) fully glazed internal trapway, 10" x 12" (254mm x 305mm) large water surface, high efficiency 4.2 LPF (1.1 GPF) to low consumption 6 LPF (1.6 GPF), 1-1/2" (38mm) top spud with condensate channel and bolt caps, for use with exposed flush valve. (Minimum MaP Test Rating: 1000 grams.) Flush Valve, C.P. high efficiency, 4.8 LPF (1.28 GPF) factory set flow, dual filtered by-pass, quiet action 'PERMEX' diaphragm type with non-hold open feature, triple seal handle, high pressure vacuum breaker and seat bumper on back-check angle stop, V.P. smooth design stop cap. Toilet Seat, elongated heavy duty solid plastic open front less cover, with reinforced stainless steel check hinge, posts, washers and nuts. Provide Floor Flange, flange bolts and gasket.

WC-2 Water Closet

16-1/2" (420mm) HIGH' Toilet, floor mounted, vitreous china with EverClean antimicrobial surface which inhibits the growth of stain and odor causing bacteria, mold and mildew, elongated syphon jet flush action bowl, 2-1/8" (54mm) fully glazed internal trapway, 10" x 12" (254mm x 305mm) large water surface, high efficiency 4.2 LPF (1.1 GPF) to low consumption 6 LPF (1.6 GPF), 1-1/2" (38mm) top spud with condensate channel and bolt caps, for use with exposed flush valve. (Minimum MaP Test Rating: 1000 grams.) Flush Valve, C.P. high efficiency, 4.8 LPF (1.28 GPF) factory set flow, dual filtered by-pass, quiet action 'PERMEX' diaphragm type with non-hold open feature, triple seal handle, high pressure vacuum breaker and extended seat bumper on back-check angle stop, V.P. smooth design stop cap. Toilet Seat, elongated heavy duty solid plastic open front with cover, reinforced stainless steel check hinge, posts, washers and nuts. Provide Floor Flange, flange bolts and gasket.

L-1 Lavatory

Basin, 4" (102mm) centres, 20-1/2" x 18-1/4" x 8-1/8" (521mm x 464mm x 206mm) deep, wall hung, vitreous china, splash back, front overflow, self-draining deck, for concealed arm support. Metering Faucet, C.P. 4" (102mm) C.C., solid cast brass body, 'MVP' adjustable cartridge set to max. 0.95 Lpc (0.25 gpc) per push flow with vandal-resistant 1.9 LPM (0.5 GPM) flow P.C. spray outlet and temperature and time selection, temperature limit stop, user adjustable temperature control, check valves, screens and vandal-resistant metal lever handle. Mechanical Mixing Valve with Thermostatic Limit Stop, with temperature adj. dial and with integral back checks. Set valve temperature at 115° F (46° C), shut-off temp. at 120° F (48.8° C). Mixer installed in H & CW supplies to provide tempered water to hot side of faucet. Basin Drain, C.P., cast brass 1 pc. top, open grid with 17ga. (1.5mm), 1-1/4" (32mm) tailpiece. Supplies, C.P. Polished Brass Sink Supplies, rigid horizontal nipples 3/8" (10mm) x 5" (127mm) long, I.P.S. heavy all brass angle stops with V.P. loose key and escutcheons, less flexible risers. 'P' Trap, C.P., polished, cast brass adjustable body, 1-1/4" (32mm) with cleanout plug, seamless brass wall bend and escutcheon. Basin Carrier, with concealed arms and steel pipe legs, welded to block base feet support. (For narrow wall installation provide 'Z' type sleeve for arms).

L-2 Lavatory

BASIN, 4" (102mm) centres, 27" x 20" x 3 - 6-1/2" (686mm x 508mm x 76 - 165mm) deep, wall hung, vitreous china, flat slab, low front lip for wheelchair access, front overflow, for concealed arm support. Faucet, C.P. 4" (102mm) C.C., solid cast brass lead-free body, 1/4 turn ceramic disc valve cartridges, with aerator vandal-resistant, 1.9 LPM (0.5 GPM) flow aerator outlet and cast brass 4" (102mm) blade handles. McGuire #155WC Basin Drain, C.P., cast brass 1 pc. top, offset open grid with 17ga. (1.5mm), 1-1/4" (32mm) tailpiece. Supplies, C.P. Polished Brass Sink Supplies, rigid horizontal nipples 3/8" (10mm) x 5" (127mm) long, I.P.S. heavy all brass angle stops with V.P. loose key and escutcheons, less flexible risers. 'P' Trap, C.P., 17 gauge (1.5mm), brass adjustable body, 1-1/4" (32mm) and escutcheon.

Basin Carrier, with steel pipe legs, block base feet support and extended concealed arms. (For narrow wall installation provide 'Z' type sleeve for arms.) 'PROWRAP' Sanitary Covering, of PVC, vandal-resistant flexible seamless construction, anti-microbial, to exposed piping (to protect against heat/contusions) as per local codes.

SH-1 Shower

Shower Stall, 63-1/4" x 37-3/4" x 77-1/8" (1607mm x 959mm x 1959mm) high, inside dimension 60" x 36" (1524x927mm) right hand seat built-in as required, high gloss acrylic seamless one piece unit, cast acrylic, open top, full textured bottom pattern, fibreglass reinforced backing. Two 1-1/2" (38mm) dia. horizontal S.S. Grab Bar with white phenolic slotted bench lift-up Transfer Seat with S.S. supports. S.S. Curtain Rod 1" (25mm) diameter. These floors must be set on groutbed in order that floors be level. Comply to local codes for grab bar requirements, shower control location and to verify threshold size - before ordering shower stall. Shower stall shall be installed in a pit, 69-1/4" x 36-3/4" x 7/8" (1759 x 933 x 22mm) deep, finished floor shall be level with the top of the threshold - Unit also must be set in mortar leveled and made good- Comply to local codes for grab bar requirements and shower control location - before ordering shower stall. Floor Drain, cast brass body 2" (50mm) with C.P. strainer. Shower Valve, C.P. pressure balancing valve, solid brass body, adjustable temperature limit stop, integral check stops, c.p. escutcheon plate and single control metal lever handle. Provide all necessary piping, couplings and adaptors to connect shower valve, controls and showerhead. Provide adequate backing in wall for mounting head and valves Institutional Head, C.P. cast brass, one piece, with 7.6 LPM (2.0 GPM) flow restrictor, integral mounting bracket and V.P. screws. Provide backing in wall to suit. Hand Shower', C.P., spray head, 9.5 LPM (2.5 GPM) flow, slide bar, 24" (610mm) with 60" (1524mm) flexible metal hose, adjustable bracket for hand shower mounting. Wall supply elbow with flange, and C.P. in-line vacuum breaker. (Mounted in hose at wall supply fitting). Two Way in wall Diverter, C.P., cast brass body, metal lever handle.Inline Thermometer Snap On/Off Quick Disconnect, C.P. in-line. Provide 'p' Trap. Comply to local codes for Shower Control location and Trim Kit requirements.

S-1 Sink

S.S. Sink, 3 hole, 8" (203mm) centers, 20-1/2" x 20" x 8" (521mm x 508mm x 203mm) deep, counter mounted, back ledge, grade 18-8 type 302 stainless steel, single compartment, satin finished rim and bowl, self-rimming, sound deadening and mounting kit, Strainer, 3-1/2" (89mm) crumb cup. Faucet, C.P. 8" (203mm) C.C., deck mounted, solid cast brass lead-free body, 1/4 turn ceramic disc valve cartridges, 9 3/4" (248mm) high 5 1/4"(133mm) reach rigid/swing gooseneck spout with vandal-resistant, 5.7 LPM (1.5 GPM) flow aerator outlet and red and blue indexed cast brass 4" (102mm) blade handles. Mechanical Mixing Valve with Thermostatic Limit Stop, with temperature adj. dial and with integral back checks. Set valve temperature at 115° F (46° C), shut-off temp. at 120° F (48.8° C). Mixer installed in H & CW supplies to provide tempered water to hot side of faucet. ASSE 1016 approved. Supplies, C.P.

Polished Brass, rigid horizontal nipples 3/8" (10mm) x 5" (127mm) long, I.P.S. heavy all brass angle stops with wheel handle stops, escutcheons and with flexible copper risers. Sediment Interceptor, all duco coated steel, (located next to sink), 1-1/2" (38mm) drain and escutcheon. Provide 4-1/2" (114mm) clearance above interceptor for basket removal.

S-2 Sink

S.S. Sink, 3 hole, 8" (203mm) centers, 20-1/2" x 20" x 7" (521mm x 508mm x 178mm) deep, counter mounted, back ledge, grade 18-8 type 302 stainless steel, single compartment, satin finished rim and bowl, self-rimming, with 1 1/2" (38mm) tail piece, sound deadening and mounting kit, 3-1/2" (89mm) crumb cup strainer with 1-1/2" (38mm) tail piece. Faucet, C.P. 8" (203mm) C.C., deck mounted, solid cast brass lead-free body, 1/4 turn ceramic disc valve cartridges, 9" (229mm) long swing spout with vandal-resistant, 5.7 LPM (1.5 GPM) flow aerator outlet and red and blue indexed cast brass 4" (102mm) blade handles. Mechanical Mixing Valve with Thermostatic Limit Stop, with temperature adj. dial and with integral back checks. Set valve temperature at 115° F (46° C), shut-off temp. at 120° F (48.8° C). Mixer installed in H & CW supplies to provide tempered water to hot side of faucet. ASSE 1016 approved. Supplies, C.P. Polished Brass, rigid horizontal nipples 3/8" (10mm) x 5" (127mm) long, I.P.S. heavy all brass angle stops with wheel handle stops, escutcheons and with flexible copper risers. Provide 'p' Trap, cast brass 1-1/2" (38mm) with cleanout, union and escutcheon.

SS-1 Service Sink

Mop Sink, 24" x 24" x 10" (610mm x 610mm x 254mm) deep, floor mounted, molded-stone 'SMC' one piece homogeneous product, and Integral Drain with S.S. domed strainer and lint basket 3" (75mm) outlet. Faucet, C.P. 8" (203mm) C.C., wall mounted, solid cast brass leadfree body, 1/4 turn ceramic disc valve cartridges, cast brass lever handles, body mounted vacuum breaker, integral stops, 36" (915mm) hose and hanger. Bracket, S.S., 36" (915mm) hose with chrome coupling. Bumper Guards, Vinyl. Mop Hanger, triple. Mop Sink Drain Gasket, connection 3" (75mm) pipe. Wall Guards. S.S. for one, two, or three sides with corner bracket. Provide 'p' Trap.

EW- 1 Emergency Eye/Face Wash

Emergency Eye/face wash, polished CP brass, counter mounted next to sink, dual spray heads swivel 90 degrees from storage to operational position with flip-top dust covers in-line filter, volume regulator, water flow is activated by flag handle, identification sign All exposed piping to be chrome plated. Cold water 1/2" (12.7mm) connection and escutcheon.

Emergency Supply Fixture For Eyewash/ Facewash, thermostatic mixing valve, all brass and stainless steel design, with liquid-filled thermal motor, inlet check valves, safety shut-off should cold water supply fail, hot water failure will allow cold water flow through both the fixed and variable by-pass, outlet temperature gauge, 1/2" (12mm) NPT inlets and outlets. Tempered water factory set at 85 deg. F (29 deg.C). Surface mounted S.S. cabinet, type 304 with no. 4 finish, hinged door lockable to accept mixing valve.

FD- 1 Floor Drain

Floor Drain, all duco coated, 9" (220mm) dia. cast iron body, reversible flashing clamp with seepage openings, no-hub outlet round strainer, 6" (152mm) nickel bronze, trap primer connection 1/2" (13mm). Cast iron "P" trap.

FD- 2 Floor Drain

Floor Drain, all duco coated, 9" (220mm) dia. cast iron body, reversible flashing clamp with seepage openings, no-hub outlet oval Funnel 8-1/4" x 3-1/4" (210mm x 83mm) (Bolted-on to grate) nickel bronze, trap primer connection 1/2" (13mm). Cast iron 'P'trap.

FD- 3 Floor Drain

Floor Drain, all duco coated 12" (305mm) dia. cast iron body, flashing clamp with seepage openings, adjustable 8" (205mm) dia. grate, 6" (152mm) Outlet oval Funnel 8-1/4" x 3-1/4" (210mm x 83mm) (Bolted-on to grate) , trap primer connection 1/2" (13mm) , cast iron grate.

FD- 4 Floor Drain

Floor Drain, all duco coated, 9" (220mm) dia. cast iron body, reversible flashing clamp with seepage openings, no-hub outlet round strainer, 6" (152mm) nickel bronze, sediment bucket, hinged grate, heavy duty strainer, trap primer connection 1/2" (13mm). Cast iron "P" trap.

FD- 5 Floor Drain

Floor Drain, all duco coated, 9" (220mm) dia. cast iron body, reversible flashing clamp with seepage openings, no-hub outlet round strainer, 6" (152mm) nickel bronze, backwater valve.

RD- 1 Roof Drain

Roof Drain, all duco coated 12" (305mm) cast iron body, flashing clamp with seepage openings, sump receiver, underdeck clamp, extension solid (height to suit roof construction), aluminum dome, waterproofing flange to be provided by contractor.

RD- 2 Roof Drain

Gutter Drain, spun aluminum with aluminum strainer. Modify flange to suit gutter and seal water tight.

TP Trap Primer

Electronic trap primer with solenoid actuating device, vacuum breaker, water hammer arrestor and necessary electrical hardware; adjustable frequency and duration of priming and distribution splitter for multiple priming.

WH Wall Hydrant

Box Type non freeze Wall Hydrant, 1/4 turn non-drip, ceramic cartridge, 3/4" (19mm) wall type with bronze nickel face and stainless steel box with full 180 deg hinged locking cover opening box, self-draining integral vacuum breaker. Operating keys.

W Hose Bibb

Wall mounted hose valve, C.P. heavy duty rough cast brass body with integral cast flange, vandal-resistant lock shield bonnet with removable wheel handle, 3/4" (19mm) NPT female inlet and hose end vacuum breaker.

PART 3 EXECUTION

3.1 Installation

.1 Mounting heights:

.1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.

.2 Wall-hung fixtures: as indicated measured from finished floor.

.3 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA B651.

.2 For inmate areas, all gaps between fixtures, wall and floors are to be sealed with security caulking. Security caulking shall be two-part, non-sagging, chemically curing epoxy adhesive/sealant, specifically designed for use in interior security areas.

.3 For all other areas, all gaps between fixtures, wall and floors are to be sealed with silicone-based, mildew-resistant and low-VOC caulking compound, conforming to ASTM C920 Type S Grade NS Class 25.

.4 Caulking shall be made tight and beaded smooth in a neat and workmanlike manner

.5 Utilize security hardware and mounting plates provided with all security fixtures in areas accessible to inmates.

3.2 Supplies

.1 Provide isolation valves or stops for every fixture or appliance connection.

.2 Provide water hammer arrestors for flush valves and solenoid controlled appliances.

3.3 Adjusting

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:

.1 Adjust water flow rate to design flow rates.

.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

3.4 Performance Verification:

.1 PV procedures:

.1 Aerators: operation, cleanliness.

.2 Vacuum breakers, backflow preventers: operation under all conditions.

.3 Wash fountains: operation of flow-actuating devices.

.4 Thermostatic controls: Verify temperature settings, operation of control, limit and safety controls.

END OF SECTION

PART 1 GENERAL

1.1 Summary

.1 Section Includes:

.1 The supply and installation of Plumbing Specialties and Accessories.

.2 Products Installed but not Supplied Under this Section:

.1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.

.2 Equipment installed by others.

.1 Connect with unions.

.3 Equipment not installed.

.1 Capped for future connection by others.

1.2 Related Section

.1	Section 01 01 50	General Instructions
.2	Section 01 35 33	Health and Safety Requirements
.3	Section 23 05 00	Common Work Results for Mechanical
.4	Section 23 08 01	Performance Verification Mechanical Piping Systems

1.3 References

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A126-04(2009), Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.2 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.

.2 American Water Works Association (AWWA)

.3 Canadian Standards Association (CSA)

.1 CAN/CSA-B64 Series-01 (2007), Backflow Preventers and Vacuum Breakers.

.2 CAN/CSA-C22.2 No. 130-03 (R2013), Requirements for Electrical Resistance Heating Cables and Heating Device Sets.

.3 CAN/CSA-B356-10, Water Pressure Reducing Valves for Domestic Water Supply Systems.

.4 Plumbing and Drainage Institute (PDI)

.1 PDI-WH201-2010, Water Hammer Arresters Standard.

.5 National Sanitation Foundation (NSF) / American National Standards Institute (ANSI).

.1 NSF/ANSI 61, Drinking Water System Components.

1.4 Submittals

.1 Submittals in accordance with Section 01 01 50 – General Instructions.

.2 Indicate, for all plumbing specialties and accessories:

.1 Dimensions, construction details, roughing-in dimensions.

1.5 Closeout Submittals:

.1 Submit maintenance data in accordance with Section 01 01 50 – General Instructions.

.2 Include:

.1 Description of plumbing specialties and accessories, giving manufacturer's name, type, model, year, capacity.

.2 Details of operation, servicing, maintenance.

.3 List of recommended spare parts.

1.6 Health and Safety

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.7 Delivery Storage and Disposal

.1 Waste Management and Disposal:

.1 Separate waste materials for recycling in accordance with Section 01 01 50 – General Instructions.

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan

.3 Fold up metal banding, flatten and place in designated area for recycling.

1.8 Quality Assurance

.1 All potable water system components shall conform to NSF/ANSI Standard 61.

PART 2 PRODUCTS

2.1 Cleanouts

.1 Cleanout plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.

.2 Access covers:

.1 Wall access: face or wall type, polished nickel bronze or stainless steel round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.

.2 Floor access: round cast iron body and frame with adjustable secured nickel bronze top cast box with anchor lugs and:

.1 Plugs: bolted bronze with neoprene gasket.

.2 Cover for unfinished concrete floors: cast iron round gasket, vandal-proof screws.

.3 Cover for terrazzo finish: polished nickel bronze with recessed cover for filling with terrazzo, vandal-proof locking screws

.4 Cover for tile and linoleum floors: polished nickel bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.

.5 Cover for carpeted floors: polished nickel bronze with deep flange cover for carpet infill, complete with carpet retainer vandal-proof locking screws.

2.2 Water Hammer Arrestor

.1 Copper construction, bellows type: to PDI-WH201.

2.3 Back Flow Preventer

.1 To CSA-B64 Series. Approved for vertical-up installation.

.2 Application: as indicated.

2.4 Vacuum Breaker

.1 To CSA-B64 Series.

2.5 Pressure Regulator

.1 Capacity and performance:

.2 Up to NPS1-1/2 bronze bodies, screwed: to ASTM B62.

.3 NPS2 and over, semi-steel bodies, Class 125, flanged: to ASTM A126, Class B.

.4 Semi-steel spring chambers with bronze trim.

2.6 Trap Seals Primer

.1 Specified..

2.7 Strainers

.1 860 kPa, Y type with 20 mesh, monel, bronze or stainless steel removable screen.

.2 NPS2 and under, bronze body, screwed ends, with brass cap.

.3 NPS2 1/2 and over, cast iron body, flanged ends, with bolted cap.

2.8 Hose Bibbs and Sediment faucets

.1 Bronze construction complete with integral back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.

2.9 Circulation Pumps

.1 Provide circulating pumps where indicated, designed for quiet operation and guaranteed by the manufacturer for the intended operation.

.2 Hot water circulating pumps shall be suitable for pumping 100°C water.

.3 All pumps shall be fitted with mechanical shaft seals.

.4 Domestic water pumps shall be all bronze construction.

2.10 Balancing Fittings, for TAB:

.1 Sizes: Calibrated balancing valves, as specified this section.

.2 NPS 2 and under: Globe type, Y-pattern, bronze body, EPDM O-ring and NPT connections.

2.11 Sanitary Drainage - Pump Station

.1 Provide as indicated on drawings, sanitary duplex drainage – pump station as specified herein or approved equal.

.2 The assembly shall be underground, two pumps, automatic sewage pump station. Each pump station shall be furnished with piping, valves, and all necessary automatic controls, two submersible pumps, float type liquid level controls and a duplex pump control panel. Provide fiberglass basin 914mm [36 inches] diameter, depth as indicated on drawings, filament would FRP construction, manufactured in accordance with ASTM D883-69 standard for filament wound underground fiberglass tanks. The chamber shall be furnished in one (1) main section 0.914 meters (36") diameter, 3.04 meters (120") deep for sanitary pump station. The interior to be sanitary white with a dark green exterior, UV stabilized. The bottom shall have a reinforced anti-floatation flange. Provide a slide rail assembly with lifting chains, sealing flange, pump carrier and galvanized rails to suit sump depth. Provide 100mm inlet, 75mm discharge, 2-50mm electrical and 75mm vent coupling. All aluminum station cover shall be furnished with duplex pump hatch, non-slippery surface; hatch stay, recessed padlock and pad lock clip, lock hasp and upper rail support, BPS36 gastight.

.3 Pumps shall be heavy duty cast iron, non-clog type sewage, oil filled, submersible pumps. Each pump shall have a capacity of 3.8 L/s [60 gpm] against a total dynamic head of 32 kPa [25 ft] operating at a maximum speed of 3,450 RPM with a recessed non-clog type impeller which passes 50mm [2"] solids. Pump motors to be 1/2" HP, 208V, 3PH, 3450 RPM and 60 cycle. Pumps shall be furnished in standard construction c/w 20' of power cable and adaptors for pipe size indicated.

.4 Each pump shall be assembled complete with a lift-out slide rail system. Each rail shall include a 50mm (2") cast iron discharge assembly, upper and lower guide rail support, pump carrier and galvanized pump lifting chains.

.5 Provide 4 float type, non-mercury, liquid level controls for automatic pump control of the liquid level. A support bracket with strain relief connectors shall be supplied. A CEMA 4 junction box shall be provided for electrical connection.

FS#4 High water alarm

FS#3 Lag pump #2 on

FS#2 Lead pump #1 on

FS#1 Off-alternate pumps

.6 A duplex automatic 2 pump control panel shall be furnished in a CEMA 1 enclosure with the following equipment.

.1 Inner door mounted controls.

.2 Pump circuit breaker disconnects.

.3 Magnetic contactors with 3 leg overloads.

.4 H.O.A. selector switches for each pump.

.5 Run lights for each pump.

.6 Automatic alternator relay.

.7 Pump motor overload alarm and automatic interlock to lag pump.

.8 Lead-lag pump selector switch.

.9 High level alarm with buzzer, light and silencing switch, test switch and automatic reset.

.10 Provide also remote alarm panel to repeat light and buzzer signal, silencing switch and lamicoid label reading "High Water in Sewage Sump".

.11 Arrange with electrical contractor for wiring in accordance with manufacturer's installation instructions.

.7 Set inlet invert and supply cover plate frame for flush mounting in floor. Provide 50mm [2"] cast iron check valve and 50mm [2"] ball type isolation valve shall be factory installed on the discharge of each pump. Piping shall be schedule 40 PVC pipe fabricated to suit the installation. A 50mm [2"] discharge NPT coupling shall be furnished for connection to forcemain and field piping to complete the installation.

2.12 Oil Interceptor with Internal Storage Tank

.1 Epoxy coated inside and outside fabricated steel Oil Interceptor. Unit shall include sediment bucket, code approved deep seal trap, cover securing bolt(s), double vent connections, stainless steel calibrated orifice plate and epoxy coated, non-skid cover. Internal storage tank.

2.13 Domestic Hot Water Re-circulating Pumps

.1 Capacity: as indicated.

.2 Construction: closed-coupled, in-line centrifugal, all bronze or stainless steel construction conforming to NSF 61, stainless steel shaft, stainless steel or bronze shaft sleeve, two oil lubricated bronze sleeves or ball bearings. Design for 860 kPa (125 psi).

PART 3 EXECUTION

3.1 Installation

.1 Install in accordance with National Plumbing Code and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.2 Cleanouts

.1 In addition to those required by code, and as indicated, install at base of soil and waste stacks, and rainwater leaders.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS4.

3.3 Water Hammer Arrestor

.1 Install on branch supplies to each fixture or group of fixtures and where indicated.

3.4 Back Flow Preventers

.1 Install in accordance with CAN/CSA-B64 Series, where indicated and elsewhere as required by code.

.2 Pipe discharge to terminate over nearest drain and/ or service sink.

3.5 Hose Bibbs and Sediment Faucets

.1 Install at bottom of all risers, at low points to drain systems, and as indicated.

3.6 Trap Seal Primers

.1 Install for all floor drains and elsewhere, as indicated.

.2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Departmental Representative.

.3 Install soft copper or plastic tubing to floor drain.

.4 Provide isolation valve with union connection at trap primer inlet. Provide air gap fitting at trap primer outlet.

.5 Take off to trap primer shall be at the top of water line to prevent debris from entering trap primers.

3.7 Balancing of Domestic Hot Water Recirculation Systems

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

3.8 Performance Verification:

.1 General:

.1 In accordance with Section 23 08 01 – Performance Verification Mechanical Piping Systems.

.2 PV procedures:

.1 Vacuum breakers, circulating pumps: operation under all conditions.

.2 Thermostatic controls: Verify temperature settings, operation of control, limit and safety controls.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 35 33	Health Safety Requirements
.3	Section 23 05 05	Installation of Pipework
.4	Section 23 08 01	Performance Verification of Mechanical Piping Systems

1.2 References

.1 American Society of Mechanical Engineers (ASME)

- .1 ASME Boiler and Pressure Vessel Code Section VIII Pressure Vessels.
- .2 ASME B16.5-2013, Pipe Flanges and Flanged Fittings.
- .3 ASME B16.11-2011, Forged Fittings, Socket-Welding and Threaded.

.2 American Society for Testing and Materials (ASTM)

- .1 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
- .2 ASTM A181/181M-2013, Standard Specification for Carbon Steel Forgings for General Purpose Piping.

.3 Canadian Standards Association (CSA)

- .1 CSA B51-2014, Boiler, Pressure Vessel, and Pressure Piping Code.

1.3 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.

1.4 Quality Assurance

.1 Health and Safety:

- .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health Safety Requirements.

1.5 Closeout Submittals

.1 Provide maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.6 Delivery, Storage and Handling

.1 Packing, shipping, handling and unloading:

- .1 Deliver, store and handle in accordance with Section 01 01 50 – General Instructions.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

1.7 Waste Management Disposal

.1 Separate and recycle waste materials in accordance with Section 01 01 50 – General Instructions.

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan

.3 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 PRODUCTS

2.1 Piping

.1 Piping: to ASTM A 53/A53M, Schedule 80 seamless Hot-Dipped, Zinc-Coated steel.

.2 Fittings:

.1 NPS2 and smaller: to ASME B16.11, schedule 80 Hot-Dipped, Zinc-Coated steel, threaded.

.2 NPS2 1/2 and larger: to ASME B16.11, schedule 80 Hot-Dipped, Zinc-Coated steel, grooved coupling.

.3 Hot-Dipped, Zinc-Coated Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket.

.4 Hot-Dipped, Zinc-Coated Unions: 1000 kPa malleable iron with brass-to-iron ground seat.

.5 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.

.6 Joints:

.1 NPS2 and smaller: threaded joints with Teflon tape.

.2 NPS2 1/2 and larger: grooved coupling.

2.2 Valves

.1 Ball valves:

.1 NPS2 and under: Class 150 to MSS-SP-110. Cast bronze, 2-piece body, threaded, full port, anti-blowout stem, 316 stainless steel stem and ball (vented), TFE packing, RTFE thrust washers and seat rings, 50mm [2"] extended blowout stem for insulated piping, lever handle with position indicator.

2.3 Flexible Connectors

.1 Stainless steel flexible connector

.2 Type 304 stainless steel inner corrugated hose with Type 304 stainless steel outer braid.

.3 End fittings and length as noted on drawings to suit equipment.

2.4 Air Compressors

.1 Provide a horizontal tank mounted, automatic air compressor of size indicated on drawing for 1207 kPa (175 psi) max. service. Compressor shall be air cooled, 10 HP suitable for 600/3/60 power, 17.13 l/s (36.3 CFM) capacity @ 1034 kpa (150 psi).

.2 The air compressor shall have:

- Completely integrated and installed refrigerant air dryer in common enclosure with compressor, piped and wired in package with R404A refrigerant.
- ASME approved and certified 266 l (70 gal.) storage tank
- Air pressure gauge
- ASME approved safety valve
- Tank moisture drain
- Special design check valve
- Tank shut off valve
- Start-stop pressure control switch
- Copper cooling coils
- Cast Inter-cooler
- Intake filter/silencer
- Flexible connection on compressed air piping
- Pressure regulator
- Star-Delta reduced voltage starter
- Factory start-up and commissioning
- Premium sound attenuating canopy
- Microprocessor control panel.

3. Provide an electric high efficiency motor drive with guard over belts and pulleys. Power wiring to the motor and control switch with the required starters shall be provided under the Electrical specifications.

4. Provide vibration isolation and seismic restraints.

PART 3 EXECUTION

3.1 Piping Connections and Installations

.1 Install flexible connection to air compressor.

.2 Install shut-off valves at outlets, major branch lines and in locations as indicated.

.3 Install quick-coupler chucks and pressure gauges on drop pipes.

.4 Install unions to permit removal or replacement of equipment.

.5 Install tees in lieu of elbows at changes in direction of piping. Install plug in open ends of tees.

.6 Grade piping at 1% slope minimum.

.7 Make branch connections from top of main.

.8 Install compressed air trap at bottom of risers and at low points in mains, piped to nearest drain as indicated.

.9 Provide compressed air piping system as indicated on drawings and specified herein. The drawings are schematic and do not show all structural and equipment details. Where accurate measurements are required, they shall be taken on site and reference shall be made to the Owner's equipment and detail floor arrangements for exact location of outlets and connection requirements.

3.2 Field Quality Control

.1 In accordance with Section 23 08 01 – Performance Verification of Mechanical Piping Systems.

.2 Site Tests/Inspection:

.1 Testing: pressure test in accordance with requirements of Section 21 05 01 - Common Work Results for Mechanical, for 4h minimum, to 1100 kPa, with outlets closed and with compressor isolated from system. Pressure drop not to exceed 10 kPa.

3.3 Cleaning

.1 In accordance with Section 01 01 50 – General Instructions and as specified herein.

.2 Blow-out piping to clean interior thoroughly of oil and foreign matter.

.3 Check entire installation is approved by authority having jurisdiction.

.4 Perform cleaning operations in accordance with manufacturer's recommendations.

.5 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 This Section specifies the common work results for the Mechanical Divisions, including:

.1	Division 21	Fire Protection
.2	Division 22	Plumbing
.3	Division 23	Heating Ventilation & Air Conditioning
.4	Division 25	Integrated Automation (EMCS)

.2 Read Division 1 General Requirements in conjunction with the specifications for Mechanical Divisions. Division 1 and this Section shall form a part of and shall apply to all Mechanical Divisions. The most stringent requirements of this and other Mechanical Sections must be adhered to.

.3 The Mechanical work shall consist of the supply and installation of complete and operable mechanical systems and shall include all necessary labour, plant, materials, and incidentals for the work involved as listed in the Mechanical Divisions. All sections in the Mechanical Divisions specifications are related sections and shall be read in conjunction with each other, whether or not "Related Sections" are explicitly mentioned under each section.

1.2 Submittals

.1 Submittals: in accordance with Section 01 01 50 – General Instructions.

.2 Shop drawings to show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances.

.3 Shop drawings and product data accompanied by:

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

.4 In addition to transmittal letter referred to in Section 01 01 50 – General Instructions: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

.5 Closeout Submittals:

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.
- .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection. Also see "Mandatory Requirements for O&M Manuals" this in Section.

.3 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.4 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:

.1 Equipment performance verification test results.

.2 Special performance data as specified.

.3 For each fan and pump installed, provide performance data in "Curve" or multi rating table.

.4 For each plumbing fixture, floor and roof drain installed, provide manufacturer's "cut" of that item and "cuts" of associated brass goods.

.6 Approvals:

.1 Submit 1 copy of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless 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 additional data when need for it becomes apparent during specified demonstrations and instructions.

.2 Copies of extended guarantees and warranties for equipment items such as hot water tanks and heat exchangers shall be included in a separate section of the manual.

.8 Site records:

.1 Departmental Representative will provide 1 set of mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information weekly to site mechanical drawings. Update drawings to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.5 The drawings shall indicate the inverts and dimensioned locations of all services at the property line and where they penetrate the building perimeter.

.9 As-built drawings:

.1 Departmental Representative will provide CAD drawings to Contractor who will be responsible for producing the as-built drawings. Contractor shall update CAD drawings using CAD drafting procedures, to show all changes made.

.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 one (1) hard copy for check prints to Departmental Representative for approval, and make corrections as directed. Upon acceptance by Departmental Representative, Contractor shall make multiple copies of as-built drawings (electronic and hard copies), and submit completed as-built drawings with Operating and Maintenance Manuals in accordance with Division 1.

1.3 Regulations

.1 Comply with most stringent requirements of NBC, Provincial and Municipal regulations and by-laws, specified standards, codes and this specification. Practices contained in these standards or standards suggested or recommended by reference organizations, are to be taken as minimum requirements.

.2 Furnish certificates confirming work installed conforms to requirements of authorities having jurisdiction.

.3 Drawings and specifications should not conflict with these Regulations but where there are apparent discrepancies, notify the Departmental Representative in writing and obtain clarifications before proceeding with the work.

1.4 Quality Assurance

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.5 Guarantee Warranty

.1 Correct promptly at own expense, defects or deficiencies in the work in accordance with the Warranty requirements of the Contract.

.2 The Departmental Representative shall be the judge as to whether the failure is due to defective workmanship, improper usage or ordinary wear and tear.

.3 Make good any damage resulting from defective materials or workmanship.

.4 Rectify any deficiencies or omissions in respect to plans or Specifications which may appear during the guarantee period even though work has been accepted as complete.

1.6 Definitions

.1 Definitions used in this Division will have the following meaning:

.1 "Concealed": pipes, ducts, etc., in trenches, chases, furred spaces, pipe shafts, or hung ceilings.

.2 "Exposed": regarding insulation and painting of piping, ducts, etc., will mean that they are not "concealed", as defined herein.

.3 "Piping": includes, in addition to pipe, all fittings, valves, hangers, other accessories which comprise a system.

.4 "Provide": to supply and install, complete and ready for use.

1.7 Drawings

.1 Drawings:

.1 Are not intended to show structural details or architectural features.

.2 Are not to be scaled.

.3 Except where dimensioned, indicate general mechanical layouts only.

.4 The drawings are mainly schematic and do not attempt to show all offsets. Make such offsets at no additional cost to contract. Offset angles shall be as small as possible.

.5 All figured dimensions shall have precedence over scale. Detail drawings shall have precedence over small scale drawings; any difference between same shall be decided upon by the Departmental Representative.

.2 Provide field (shop) drawings to indicate relative position of various services when required by Departmental Representative and obtain approval before commencing work.

.3 Shop drawing review by Departmental Representative is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Departmental Representative approves the detail design inherent in the shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for quantities and dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all sub-trades.

1.8 Maintenance

.1 Furnish spare parts in accordance with Section 01 01 50 – General Instructions as indicated in the detailed product specification clauses.

.2 Provide access doors for concealed expansion joints, traps, strainers, cleanouts, balance dampers, fire dampers, other parts requiring accessibility for operating and maintenance.

.3 In suspended panel ceilings, use panel in place of access door; provide in such panel a button or other means of identification and easy removal when necessary.

1.9 Delivery, Storage and Handling

.1 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

1.10 Discrepancies and Omissions

.1 Bidders finding discrepancies in, or omissions from, Drawings, Specifications, or other documents, or having any doubt as to the meaning or intent of any part thereof, shall at once notify the Departmental Representative, who will send explanatory written instructions to all bidders. No verbal information will be considered valid.

.2 Should there be conflict(s) within or between the Specifications and/or Drawings, the most stringent or higher quality requirement shall apply.

1.11 Mandatory Requirements for O&M Manuals

.1 Employ an independent firm with minimum five (5) years' experience in preparing professional quality O&M manuals.

.2 Hard Copy Requirements:

.1 Hard copies shall be placed in D-ring binders with clear overlay on front and spine with labels inserted on front cover and spine. Labels shall include the following information: Front cover label shall include the project name, project location, owner, architect, mechanical consultant, general contractor, mechanical contractor, firm preparing the manuals, and the month and year that the manuals were prepared. It shall also bear the label "Operating & Maintenance Manual for Mechanical Systems".

.2 Spine label shall include the project name, project location, and the year that the manuals were prepared. It shall also bear the label "Operating & Maintenance Manual for Mechanical Systems".

.3 Indicate Volume X of Y if more than one volume is required.

.4 Insert a Title page and Table of Contents in clear plastic covers.

.5 Title page shall include the project name, project location, as well as the name, address, phone number of the owner, architect, mechanical consultant, general contractor, mechanical contractor, firm preparing the manuals, and the month and year that the manuals were prepared. It shall also bear the label "Operating & Maintenance Manual for Mechanical Systems".

.6 Index the binder according to the following system:

Tab 1.1 Mechanical Drawing Schedule

Tab 1.2 Description of Systems

- Provide a schematic drawing and component description for each major mechanical system including air handling systems, boiler and hot water heating piping distribution systems and (where applicable) water chillers and chilled water distribution systems. The schematic drawing shall identify each component with a letter designation corresponding to a description briefly explaining the purpose of each component and how it relates to the other components, and be presented in a current version of AutoCAD or similar computer aided drafting program.

- The component description shall be clearly written in a language that may be easily understood by the building operators and maintainers who will be using them.

Tab 1.3 Operating Division

Provide the following:

- Specific operating instructions for each major item of equipment, including air handling systems, pumps, boilers, chillers, etc.

  - Ventilation requirements, Energy considerations, Automatic temperature control settings, Information regarding air filters and pressure drops for clean and dirty conditions.

  - Trouble Shooting Procedure Guide in spreadsheet form with the most likely causes and recommended actions for all foreseeable problems. Trouble Shooting Procedure guides are required for all the major items of equipment including air handling systems, exhaust fans, circulating pumps, mechanical cooling equipment, etc.

  - Mechanical Equipment Starting Procedures.

Tab 1.4 Maintenance and Lubrication Division

Tab 1.5 Equipment Supplier and Contractor Schedule

- Provide a list of Equipment Suppliers and Contractors and include their address, telephone number.

- Provide the Equipment Make/Manufacturer

Tab 2.0 Guarantees, Certificates and Reports

- Including assurance letters, balancing and commissioning reports

Tab 2.1 Valve Tag Schedule

Tab 2.2 Labeling and Identification Schedule

- Piping colour code schedules
- Access panel identification schedules

Tab 2.3 Chemical Cleaning and Treatment

- Chemical cleaning shop drawings, water treatment data

Tab 3.0 Equipment Shop Drawings and Maintenance Data

- Organize this section into numbered tabs.
- Insert final shop drawings that have been reviewed and as-built control schematics.
- For each fan and pump installed, provide performance curves indicating the design point of intersection and the actual operating point.
- For each plumbing fixture, floor and roof drain installed, provide manufacturer's "cut" of that item and "cut" of associated brass goods.
- In addition to the shop drawings provided for the various items of mechanical equipment, this section shall also include the Manufacturers' Literature on:
  - o Operating and maintenance instructions
  - o Spare parts lists
  - o Trouble Shooting information

Tab 4.0 Balance Report

The divider tabs shall be custom laminated mylar plastic and shall be in accordance with the following colour scheme:

- Tabs 1.1 to 1.5 – Orange
- Tabs 2.0 to 2.3 – Green
- Tab 3.0 – Yellow

.7 Furnish sufficient copies of equipment manufacturer's literature, a set of drawings, approved shop drawings, and Mechanical Specification to the company preparing the O&M manuals to meet the above requirements.

.2 Digital Manual Requirements

.1 The digital version of the manuals and the hard cover version shall be prepared by the same company.

.2 In addition to the operating and maintenance manuals provided in hard covered binders, two copies of all information shall be provided in digital format as follows:

.3 The information shall be organized into sections in a user-friendly format to make it easy to search for specific information. An indexing system shall be included that remains on an expandable portion of the screen that allows the end user to scroll through the manual information that appears on the main portion of the screen. The digital version content and organization for each manual shall be arranged in a manner identical to the hard copy version. The specific requirements are listed below:

.1 Utilize Adobe Acrobat PDF format.

.2 If there is more than one volume of manual, indicate "Volume X of Y" for each volume.

.3 Include a copy of the latest Adobe Acrobat Reader.

.4 The final Digital copies are to be copied to CDR with a custom CDR label. The custom CDR label shall include: Project Name, Location of Project, Date of Assembly, name of Mechanical Consultant, and shall be titled "Operating & Maintenance Manual for Mechanical Systems".

.5 The Digital Manual shall be enhanced with the following features: Bookmarks, Thumbnails, Internet Links, Internal Document Links and Optical Character Recognition (OCR). Refer to Scanning Requirements and Organizational Requirements listed below.

.4 Scanning Requirements:

.1 All pages contained within the hard copy manual are to be scanned and/or digitized to Adobe Acrobat PDF format.

.2 Provide a minimum 300 DPI for all scanned pages.

.3 All scanned shop drawings may be searched for text with minimum 75% Optical Character Recognition (OCR).

.4 All shop drawings are to be scanned to a minimum 8.5"X11" size. If the original page size is 11"X17", the digital copy shall also be 11"X17". Page sizes exceeding 11"X17" may be shrunk down to 11"X17".

.5 Rotation of scanned page images/texts shall be displayed within +/- 20 degrees.

.5 Organizational Requirements:

.1 Digital Manual shall be organized in the same manner as the approved Hard Copy Manual. (e.g. Tabs 1.1, 1.2, 1.3, 1.4, 1.5, 2.0, 3.0, 4.0, etc).

.2 Bookmark all major tabs and subsections.

.3 Bookmark each set of shop drawings (Section 3.0).

.4 Link the Table of Contents page to the referenced sections.

.5 Insert an introduction/summary page for Sections 1.2, 1.3, 1.4, and 3.0 indicating major subsections. Link these pages to their referenced sections.

.6 Link the system descriptions to the referenced schematic drawings contained in Section 1.2.

.7 Insert Internet Links and Internal Document Links from Section 1.5 to Mechanical Equipment Manufacturers/Suppliers/Contractors official websites.

.8 Mechanical Equipment Shop Drawings located in Section 3.0.

.6 Use the following colour code for links contained in Sections 1.2, 1.3, 1.4, and 1.5.:

.1 Internet Links (light blue with underline).
.2 Internal Document Link (dark blue) (excludes AutoCAD schematic links).

.7 Insert a title page for each major piece of equipment located in Section 3.0. The title page shall include the Shop Drawing name, and a link (dark blue in colour) to Section 1.5.

.8 It is the responsibility of the Mechanical Trade to provide high quality documentation for scanning.

.9 Digital Manual shall be reviewed by the Departmental Representative for content and layout prior to final submission.

1.12 Security Fasteners

.1 Fasteners used in areas accessible by inmates shall be TORX with pin, stainless steel screws, which require a special tool to remove the fasteners.

.2 Use fasteners compatible with material through which they pass.

1.13 Firestopping

.1 Apply firestop sealant and systems around all penetrations through openings in fire rated wall, floor and ceiling assemblies.

.2 Seal around conduits penetrating fire separations.

.3 References:

.1 ULC-S115-05 – Standard Method of Fire Tests of Firestop Systems.

.4 Product Data

.1 Submit product data and layout plan in accordance with Section 01 01 50.

.2 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site. Include manufacturer's printed instructions for installation.

.3 Submit plan showing location of each penetration and product data to indicate type of firestopping being installed at each location.

PART 2 PRODUCTS

2.1 Access Doors

.1 Access door size shall be as indicated and where not indicated, make 305mm x 406mm [12" x 16"] minimum or 610mm x 457mm [24" x 18"] where persons have to enter. For acoustical ceilings, conform to architectural panel pattern.

.2 Unless otherwise indicated, access doors shall be hinged, flush type, steel framed panel, 14 gauge minimum, satin finished galvanized steel or type 304 stainless steel, with anchor straps for wet areas, washrooms, and all walls finished in ceramic tile.

.3 Hinges shall be concealed, spring hinge to allow door to open 175°. Locking devices shall be flush cam type, screwdriver operated, doors and frames shall ave prime coated rust inhibiting paint, unless made of stainless steel.

.4 Where doors are required in fire rated walls, access doors shall be uninsulated and for all fire rated ceilings and walls where maximum temperature rise limitation is applicable, shall be insulated. All fire rated access doors shall have Warnock Hersey or ULC listed 2 hour fire rating and shall be installed in accordance with NFPA 80 and manufacturer's installation instructions.

2.2 Firestopping

.1 Fire stopping and smoke seal systems: in accordance with ULC-S115.

.1 Systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of ULC-S115 and not to exceed opening sizes for which they are intended.

.2 Fire stop system rating: to match wall/floor/roof assembly of rating indicated.

.2 Service penetration assemblies: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No. 40 U19.

.3 Prefabricated flange units, with outer metal flange die-stamped from 0.3 mm thick 316 stainless steel, with inset of pre-molded silicone elastomeric ring, factory molded, U.L.C. or W.H. listed as a through penetration fire stop. Flange hinged for fixing over pipe and then secured tight with self-tapping screw.

.4 Fire-resistance rating of installed fire stopping assembly not less than the fire- resistance rating of surrounding wall assembly.

.5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables, elastomeric seal; do not use cementitious or rigid seal at such locations.

.6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: prefabricated silicone elastomeric seal; do not use a cementitious or rigid seal at such locations.

.7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

PART 3 EXECUTION

3.1 Installation

.1 Coordinate work with work of other sections to avoid conflict.

.2 Locate distribution systems, equipment, and materials to provide minimum interferences and maximum usable space.

.3 Where interference occurs, Departmental Representative shall approve relocation of equipment and materials, regardless of installation sequence.

.4 Provide tamperproof screws for new and relocated equipment located in inmate accessible areas.

3.2 Cleaning

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

3.3 Cutting and Patching

.1 Make arrangements with General Contractor for all cutting and patching in this work.

.2 Minimize cutting and patching. Set sleeves and mark openings in concrete or masonry.

.3 Conduct ground penetrating radar (GPR) scans prior to coring or cutting existing concrete structure.

3.4 Waterproofing

.1 Where any work pierces waterproofing including waterproofing concrete, the method of installation shall be as approved by the Departmental Representative before the work is done. Supply and install all necessary sleeves, caulking, roof curbs, and flashing required and make the openings watertight.

3.5 Protection of Work

.1 Protect equipment and material during construction from the weather, moisture, dust, painting, plastering and physical damage. Clean and return to "as new" condition.

.2 Mask or grease and cover machined surfaces. Firmly secure covers over equipment openings and open ends of piping, conduit and ductwork as work progresses. Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

.3 Any equipment that has operating parts, bearings or machined surfaces that show signs of rusting, pitting or physical damage will be rejected.

.4 Refinish damaged or marred factory finishes to the satisfaction of the Departmental Representative, using equal quality materials.

3.6 Field Quality Control

.1 Site Tests: conduct following tests in accordance with Section 01 01 50 – General Instructions and submit report as described in PART 1 - SUBMITTALS.

.2 Manufacturer's Field Services:

.1 Where specified, 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.

3.7 Demonstration and Operating Instructions

.1 Departmental Representative may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Provide training to Departmental Representative for the controls and operation of mechanical equipment and systems installed and/or modified as part of this project.

.3 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.

.4 Use operation and maintenance manual and as-built drawings as part of instruction materials.

.5 Instruction duration time requirements as specified in appropriate sections.

.6 During substantial performance review of the work the Mechanical Contractor, together with the Departmental Representative, Controls Contractor, and other Subcontractors designated by the Departmental Representative, shall instruct the Owner's operating personnel in the proper operation and maintenance of all systems and equipment installed under the contract.

.7 It shall be the Mechanical Contractor's responsibility to have the specified equipment manuals prepared, previously approved by the Departmental Representative, and ready for presentation to the Owner at this meeting.

.8 Convene the meeting with the aforementioned parties at the time called for in the substantial performance review. The arrangements shall include written notices to all the parties concerned. Should the equipment manuals, or system installation not be complete and operable at the proper time, he shall then convene the operating instruction meeting at a later date and pay any additional costs including time and travelling expenses for the personnel involved which are attributable to the delay.

.9 Keeping a sign-in sheet is mandatory for the demonstration and training session. Submit a copy of the sign-in sheet to Departmental Representative for record.

3.8 Access Doors

.1 Furnish access doors for concealed expansion joints, traps, strainers, cleanouts, balance dampers, fire dampers, other parts requiring accessibility for operating and maintenance. Access doors shall be provided to General Contractor for installation and shall be coordinated.

.2 In suspended panel ceilings, use panel in place of access door; provide in such panel a button or other means of identification and easy removal when necessary.

3.9 Firestopping

.1 Preparation:

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.2 Installation:

.1 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Tighten self-tapping screw on flange unit to ensure adequate tight and permanent seal.

.4 Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete. Responsible trade to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

.5 Avoid cutting or penetrating of existing firestop systems already installed by other trades. If unavoidable, especially in renovations, remove existing material and provide new fire stopping system to complete the installation in accordance with this specification.

.3 Inspection:

.1 Notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

.2 Final inspection of through-penetration firestopping shall be performed by the Manufacturer's Authorized Representative in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard. At project closeout, provide a letter to certification to the Departmental Representative indicating all fire stopping supplied and installed for the project meets Building Code requirements and has been installed in accordance with the Manufacturer's installation instructions. Include a copy of the letter in the O&M manual.

.4 Schedule:

.1 Fire stop and smoke seal at:

.1 Penetrations through fire-resistance rated walls, floors and ceilings.
.2 Around mechanical and electrical assemblies penetrating fire separations.

.2 Existing floor, wall and ceiling assemblies where there is fire stopping at existing penetration(s) shall be deemed to have fire resistive rating. New penetrations through such assemblies shall be fire stopped. Review existing condition on site and keep records.

END OF SECTION

PART 1 GENERAL

1.1 Use of Systems

.1 Use of new permanent heating and ventilating systems for supplying temporary heat or ventilation is permitted only under the following conditions:

- .1 Entire system is complete, pressure tested, cleaned, flushed out.
- .2 Specified water treatment system has been commissioned, water treatment is being continuously monitored.
- .3 Building has been closed in, areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.
- .4 There is no possibility of damage from any cause.
- .5 Supply ventilation systems are protected by filters, which shall be inspected daily, changed every week or more frequently as required.
- .6 Return systems have approved filters over all openings, inlets, outlets.
- .7 All systems will be:
  - .1 operated as per manufacturer's recommendations or instructions.
  - .2 operated by Contractor.
  - .3 monitored continuously by Contractor.
- .8 Warranties and guarantees are not thereby relaxed.
- .9 Regular preventive and all other manufacturers recommended maintenance routines are performed by Contractor at his own expense and under supervision of Departmental Representative.
- .10 Before static completion, entire system to be refurbished, cleaned internally and externally, restored to "as- new" condition, filters in air systems replaced.

.2 Filters referred to herein are over and above those specified elsewhere in this specification.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 01 01 50 — General Instructions

.2 Section 23 05 00 — Common Work Results – Mechanical

.3 Section 23 05 29 — Hangers & Support for Piping & Equipment

.4 Section 23 08 02 — Cleaning and Start-up of Mechanical Piping Systems

.5 This Section applies to all related work under Divisions 22 and 23.

1.2 References

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-1999, Ready-Mixed Organic Zinc-Rich Coating.

1.3 Waste Management and Disposal

.1 Separate and recycle waste materials in accordance with Section 01 01 50 – General Instructions.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used

PART 3 EXECUTION

3.1 Connections to Equipment

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

3.2 Clearances

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

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

3.3 Pipework Installation

.1 Protect openings against entry of foreign material.

.2 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.3 Assemble piping using fittings manufactured to ANSI standards.

.4 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.5 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.6 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.

.5 Install globe valves in bypass around control valves.

.6 Use chain operators on valves NPS 2-1/2 and larger where installed more than 2,400mm above floor in Mechanical Rooms.

.7 Install dielectric coupling between dissimilar metals.

.8 Install in accordance with Section 23 05 29 – Hanger & Support for Piping & Equipment.

3.4 Sleeves

.1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies (where steel sleeves are part of the listed assemblies), and elsewhere as indicated.

.2 Material: Schedule 40 black steel pipe.

.3 Construction: Foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.

.4 Sizes: 6 mm minimum clearance between sleeve and un-insulated pipe or between sleeve and insulation.

.5 Installation:

.1 Concrete, masonry walls, concrete floors on grade: Terminate flush with finished surface.

.2 Other floors: Terminate 25mm above finished floor.

.6 Sealing:

.1 Foundation walls and below grade floors: Fire retardant, waterproof non-hardening mastic.

.2 Elsewhere: Provide space for firestopping. Maintain fire rating integrity.

.3 Sleeves installed for future use: Fill with lime plaster or other easily removable filler.

.4 Ensure no contact between copper pipe or tube and sleeve.

3.5 Escutcheons

.1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.

.2 Construction: One piece type with set screws. Chrome or nickel plated brass or type 304 stainless steel.

.3 Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe.

3.6 Cleaning of Piping Systems

.1 Before start-up, clean interior of piping systems in accordance with requirements of Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

.2 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.7 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.

.3 Maintain specified test pressure without loss for 24 hours minimum unless specified for longer period of time.

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

.5 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.

.6 Conceal work only after approval and certification of tests by Departmental Representative.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 01 01 50 — General Instructions

.2 Section 23 05 00 — Common Work Results – Mechanical

.3 This Section applies to all related work under Divisions 22 and 23.

1.2 References

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 90.1-2013, Energy Code for Buildings Except Low-Rise Residential Buildings.

.2 Electrical Equipment Manufacturers' Advisory Council (EEMAC)

.3 Workplace Hazardous Material Information System (WHMIS)

.4 National Energy Code for Buildings (NECB) 2015.

1.3 Section Includes

.1 Electrical work to conform to Division 26 including the following:

.1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 23. Refer to Division 26 for quality of materials and workmanship.

1.4 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 01 50 – General Instructions.

1.5 Closeout Submittals

.1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.6 Waste Management and Disposal

.1 Separate and recycle waste materials in accordance with Section 01 01 50 – General Instructions.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.

.3 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.4 Dispose of packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

PART 2 PRODUCTS

2.1 General

.1 Motors to be high efficiency, in accordance with local Hydro company standards and the requirements of ASHRAE 90.1.

2.2 Motors

.1 Provide motors for mechanical equipment as specified.

.2 Motors under 373 W 1/2 HP : speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120V, unless otherwise specified or indicated.

.3 Motors 373 W 1/2 HP and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40°C, 3 phase, 208V, unless otherwise specified or indicated.

2.3 Belt Drives

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.

.3 For motors under 7.5 kW 10HP: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors 7.5 kW 10HP and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Correct size of sheave to be determined during commissioning.

.6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Motor slide rail adjustment plates to allow for centre line adjustment.

2.4 Drive Guards

.1 Provide guards for unprotected drives.

.2 Guards for belt drives:

- .1 Expanded metal screen welded to steel frame.
- .2 Minimum 1.2mm thick sheet metal tops and bottoms.
- .3 38mm dia. holes on both shaft centres for insertion of tachometer.
- .4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.5 Guard for flexible coupling:

- .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
- .2 Securely fasten in place.
- .3 Removable for servicing.

.6 Unprotected fan inlets or outlets:

.1 Wire or expanded metal screen, galvanized, 19 mm mesh.

.2 Net free area of guard: not less than 80% of fan openings.

.3 Securely fastened in place.

.4 Removable for servicing.

PART 3 EXECUTION

3.1 Installation

.1 Fasten securely in place.

.2 Make removable for servicing, easily returned into, and positively in position.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 91 00	Commissioning
.3	Section 23 05 00	Common Work Results – Mechanical
.4	Section 23 05 13	Common Motor Requirements for HVAC Equipment
.5	Section 23 08 00	Commissioning of Mechanical Systems

1.2 References

.1 ANSI/UL 508 Industrial Control Equipment

.2 Electrical Equipment Manufacturers' Advisory Council (EEMAC)

.3 Workplace Hazardous Material Information System (WHMIS)

1.3 Section Includes

.1 Electrical work to conform to Division 26 including the following:

.1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 23. Refer to Division 26 for quality of materials and workmanship.

1.4 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 01 50 – General Instructions.

1.5 Closeout Submittals

.1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.6 Waste Management and Disposal

.1 Separate and recycle waste materials in accordance with Section 01 01 50 – General Instructions.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.

.3 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.4 Dispose of packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.7 Warranty:

.1 The VFD shall be warranted by the manufacturer for a period of 36 months from date of shipment. The warranty shall include parts, labor, travel costs and living expenses incurred by the manufacturer to provide factory authorized on-site service. The warranty shall be provided by the VFD manufacturer.

PART 2 PRODUCTS

2.1 General

.1 Furnish complete Variable Frequency Drives (VFD's), as specified herein, for mechanical equipment where noted on drawings, equipment schedules, or specifications.

.2 All standard and optional features shall be included within the VFD enclosure, unless otherwise specified. VFD shall be housed in a metal NEMA 1 enclosure, or other NEMA type according to the installation and operating conditions at the job site. The VFD's UL listing shall allow mounting in plenum or other air handling compartments. If a NEMA 12 enclosure is required for the plenum rating, the manufacturer must supply a NEMA 12 rated VFD.

.3 The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control and to eliminate the need for motor de-rating.

.4 With the motor's rated voltage applied to the VFD input, the VFD shall allow the motor to produce full rated power at rated amps, RMS fundamental volts, and speed without using the motor's service factor. VFDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.

.5 The VFD shall include an input full-wave bridge rectifier and maintain a fundamental power factor near unity regardless of speed or load.

.6 The VFD and options shall be tested to ANSI/UL Standard 508. The complete VFD, including all specified options, shall be assembled by the manufacturer, which shall be UL-508 certified for the building and assembly of option panels. Assembly of the option panels by a third-party panel shop is not acceptable. The appropriate UL stickers shall be applied to both the VFD and option panel, in the case where these are not contained in one panel. When these VFDs are to be located in Canada, CSA or C-UL certifications shall apply. Both VFD and option panel shall be manufactured in ISO 9001 certified facilities.

.7 The VFD shall have DC link reactors on both the positive and negative rails of the DC bus to minimize power line harmonics. VFDs without DC link reactors shall provide a minimum 3% impedance line reactor.

.8 The VFD's full load amp rating shall meet or exceed NEC Table 430-150. The VFD will be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 160% of rated current for up to 0.5 second while starting.

.9 The VFD shall be able to provide full torque at any selected frequency from 28 Hz to base speed to allow driving direct drive fans without de-rating.

.10 An automatic energy optimization selection feature shall be provided standard in the VFD. This feature shall automatically and continually monitor the motor's speed and load and adjust the applied voltage to maximize energy savings and provide up to an additional 3% to 10% energy savings.

.11 Input and output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD. Switching rate may be up to 1 time per minute on the input and unlimited on the output.

.12 An automatic motor adaptation test algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to run the test.

.13 Galvanic and/or optical isolation shall be provided between the VFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs, not including either galvanic or optical isolation on both analog I/O and discrete I/O, shall include additional isolation modules.

.14 VFD shall minimize the audible motor noise through the use of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD efficiencies while reducing motor noise.

.15 Interface Features:

.1 Hand/Start, Off/Stop and Auto/Start selector switches shall be provided to start and stop the VFD and determine the speed reference.

.2 The VFD shall be able to be programmed to provide a 24 V DC output signal to indicate that the VFD is in Auto/Remote mode.

.3 The VFD shall provide digital manual speed control. Potentiometers are not acceptable.

.16 Bypass:

.1 Provide a manual 3 contactor bypass consisting of a door interlocked main fused disconnect padlockable in the off position, a built-in motor starter and a four position DRIVE/OFF/BYPASS/TEST switch controlling three contactors. In the DRIVE position, the motor is operated at an adjustable speed from the VFD. In the OFF position, the motor and VFD are disconnected. In the BYPASS position, the motor is operated at full speed from the AC power line and power is disconnected from the VFD so that service can be performed. In the TEST position, the motor is operated at full speed from the AC line power while power is applied to the input of the VFD. This allows the VFD to be given an operational test while continuing to run the motor at full speed in bypass. In case of an external safety fault, a customer supplied normally closed dry contact shall be able to stop the motor whether in DRIVE or BYPASS mode.

.2 Service personnel shall be able to defeat the main power disconnect and open the bypass enclosure without disconnecting power. This shall be accomplished through the use of a specially designed tool and mechanism while meeting all local and national code requirements for safety.

PART 3 EXECUTION

3.1 Installation

.1 Install per manufacturer's instructions.

.2 Install required safety labels.

3.2 Start-up Service

.1 The manufacturer shall provide start-up commissioning of the VFD and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. Sales personnel and other agents who are not factory certified shall not be acceptable as commissioning agents. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system.

.2 Commissioning:

.1 In accordance with Section 01 91 00 – Commissioning, and Section 23 08 00 – Commissioning of Mechanical Systems.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

.1 Materials and installation for thermometers and pressure gauges in piping systems.

.2 This Section applies to all related work under Divisions 22 and 23.

1.2 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 35 33	Health and Safety Requirements
.3	Section 23 05 00	Common Work Results – Mechanical
.4	Section 23 05 53	Mechanical Identification

1.3 References

.1 American Society of Mechanical Engineers (ASME).

.1 ASME B40.100-2013, Pressure Gauges and Gauge Attachments.

.2 ASME B40.200-2008, Thermometers, Direct Reading and Remote Reading.

.2 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-14.4-[M88], Thermometers, Liquid-in-Glass, Self-Indicating, Commercial/Industrial Type.

.2 CAN/CGSB-14.5-[M88], Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

1.4 Submittal

.1 Submittals in accordance with Section 01 01 50 – General Instructions.

.2 Submit shop drawings and product data.

1.5 Health and Safety

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.6 Waste Management and Disposal

.1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

.2 Collect, separate and place in designated containers for packaging in accordance with Waste Management Plan.

.3 Fold up metal banding, flatten and place in designated area for recycling.

.4 Place materials defined as hazardous or toxic waste in designated containers.

.5 Ensure emptied containers are sealed, labeled and stored safely for disposal away from children.

PART 2 PRODUCTS

2.1 General

.1 Design point to be at mid-point of scale or range.

.2 Ranges: as indicated.

2.2 Thermometers

.1 Industrial, adjustable angle, liquid-in-glass:

.1 Case: aluminum.

.2 Stem: Aluminum, 89mm [3-1/2"} length, adjustable angle.

.3 Window: acrylic or glass.

.4 Accuracy: 1%

.5 Scale length: 180mm [7"] minimum.

.6 Reading: dual Celsius and Fahrenheit.

.7 Socket: comply with industrial standard dimension.

2.3 Thermometer Wells

.1 Copper pipe: copper or bronze, 3/4 NPT.

.2 Steel pipe: brass or stainless steel, 3/4 NPT.

2.4 Pressure Gauges

.1 100 mm [4.0"] dial type: to ASME B40.100, Grade 1A, phosphor bronze bourdon tube having 1.0% accuracy full scale unless otherwise specified.

.1 Casing: Stainless Steel.

.2 Reading: S.I./Imperial.

.3 Range: indicate mid-scale under normal operating conditions.

.2 Provide:

.1 Siphon for steam service.

.2 Snubber for pulsating operation.

.3 Diaphragm assembly for corrosive service.

.4 Gasketted pressure relief back with solid front.

.5 Bronze stop cock.

PART 3 EXECUTION

3.1 General

.1 Install so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading units.

.2 Install between equipment and first fitting or valve.

3.2 Thermometers

.1 Install in wells on all piping. Provide heat conductive material inside well.

.2 Install on inlet and outlet of:

- .1 Hot water boilers.
- .2 Heat exchangers.
- .3 Chillers.
- .4 DHW tanks, heaters.

.3 Install wells as indicated for balancing purposes.

.4 Use extensions where thermometers are installed through insulation.

3.3 Pressure Gauges

.1 Install in the following locations:

- .1 Suction and discharge of pumps, and across pump strainers. Provide a single pressure gauge with point needle valves to isolate each point.
- .2 Upstream and downstream of PRV's.

.2 Use extensions where pressure gauges are installed through insulation.

END OF SECTION

PART 1 GENERAL

1.1 Related Section

.1 Section 01 01 50 General Instructions

.2 Section 01 35 33 Health and Safety Requirements

.3 Section 23 05 00 Common Work Results – Mechanical

.4 Section 23 05 48 Vibration & Seismic Control for Ductwork, Piping and Equipment

.5 All work installed under Divisions 22 and 23 shall conform to this Section.

1.2 References

.1 American National Standards Institute / Sheet Metal and Air Conditioning Contractors National Association (ANSI/SMACNA):

.1 ANSI/SMACNA 001-2008, Seismic Restraint Manual, Guidelines for Mechanical Systems, 3rd Edition.

.2 American Society of Mechanical Engineers (ASME):

.1 ASME B31.1-12, Power Piping.

.3 American Society for Testing and Materials (ASTM):

.1 ASTM A125-96(2013) e1, Standard Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM 307-12, 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.

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS):

.1 MSS SP58-2009, Pipe Hangers and Supports - Materials, Design and Manufacture.

.2 MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.

.3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.

.5 National Plumbing Code 2015.

1.3 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 SP58.

.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 all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP58.

.2 Performance Requirements:

.1 Design supports and hangers to withstand seismic events as specified Section 23 05 48 – Vibration & Seismic Control for Ductwork, Piping and Equipment.

1.4 Submittals

.1 Submittals: in accordance with Section 01 01 50 – General Instructions.

.2 Submit shop drawings and product data for following items:

.1 Bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

.3 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.

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

.2 Instructions: submit manufacturer's installation instructions.

.4 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.5 Quality Assurance

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.6 Delivery, Storage and Handling

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 01 50 – General Instructions.

.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 01 50 – General Instructions.

PART 2 PRODUCTS

2.1 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 SP58.

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

2.2 General

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.3 Upper Attachment

.1 Concrete:

.1 Inserts for cast-in-place concrete: galvanized steel wedge. ULC listed for pipe NPS 3/4 through NPS 8 - Grinnell/Anvil Fig. 281.

.2 Carbon steel plate with clevis for surface mount: malleable iron socket with expansion case and bolt. Minimum two expansion cases and bolts for each hanger – Grinnell/Anvil, plate fig. 49, socket fig. 290, expansion case fig. 117.

.2 Steel Beam (bottom flange):

.1 Cold piping NPS 2 and under: malleable iron C clamp - Grinnell/Anvil fig. 61.

.2 Cold piping NPS 2-1/2 and larger and all hot piping: malleable iron beam clamp - Grinnell/Anvil fig. 292.

.3 Steel Beam (top):

.1 Cold piping NPS 2 and under: malleable iron "top of beam" C clamp- Grinnell/Anvil Fig. 61.

.2 Cold piping NPS 2-1/2 and larger and all hot piping: steel jaw, hook rod with nut, spring washer and plain washer - Grinnell/Anvil fig. 227.

.4 Steel Joist:

.1 Cold piping NPS 2 and under: steel washer plate with double locking nuts.

.2 Cold piping NPS 2-1/2 and larger and all hot piping: steel washer plates with double locking nut, carbon steel clevis and malleable iron socket - Grinnell/Anvil: washer plate, fig. 60; clevis, fig. 66; socket, fig. 290.

.5 Steel Channel or Angle (bottom):

.1 Cold piping NPS 2 and under; malleable iron C clamp - Grinnell/Anvil fig. 86.

.2 Cold piping NPS 2-1/2 and larger and all hot piping; universal channel clamp - Grinnell/Anvil fig. 226.

.6 Steel Channel or Angle (top):

.1 Cold piping NPS 2 and under: malleable iron "top of beam" C clamp - Grinnell/Anvil fig. 61.

.2 Cold piping NPS 2-1/2 and larger and all hot piping: steel jaw, hook rod with nut, spring washer and plain washer - Grinnell/Anvil fig. 227.

.7 Wood beam or ceiling:

.1 Ceiling plate and flanges: malleable iron – Grinnell/Anvil Fig. 128R.

.2 Eye socket: galvanized steel – Grinnell/Anvil fig. 189 or 190.

2.4 Middle Attachments (Rod)

.1 Carbon steel black (electro-galvanized/cadmium plated for mechanical rooms) continuous threaded rod - Grinnell/Anvil fig. 146.

.2 Ensure that hanger rods are subject to tensile loading only.

2.5 Pipe Attachments

.1 Piping with less than 25 mm [1"] horizontal movement, NPS 2 and under: adjustable swivel ring hanger - Grinnell/Anvil fig. 69.

.2 Piping with less than 25 mm [1"] horizontal movement, NPS 2-1/2 and over: adjustable clevis hanger - Grinnell/Anvil fig. 260.

.3 Suspended hot piping with horizontal movement more than 25 mm [1"], all steam piping: pipe roller - Grinnell/Anvil fig. 174 or Grinnell/Anvil fig. 181 up to NPS 6 and Grinnell/Anvil fig. 171 NPS 8 and larger.

.4 Bottom-supported hot piping: pipe roller stand - Grinnell/Anvil fig. 271.

.5 Spring hangers; where required to offset expansion on horizontal runs which follow long vertical risers - Grinnell/Anvil fig. 171 single pipe roll hanger with Grinnell/Anvil fig. 178.

.6 Use oversize pipe hangers for cold piping all sizes, hot piping NPS 2-1/2 and over, and steam piping all sizes.

.7 Perforated band iron, wire or chain hangers will not be approved.

.8 All hangers for copper pipe shall be copper, copper clad, felt lined or use plastic tape wrapped pipe at hanger.

2.6 Riser Clamps

.1 Steel or cast iron pipe: galvanized carbon steel - Grinnell/Anvil fig. 261.

.2 Copper pipe: carbon steel copper finished - Grinnell/Anvil fig. CT-121.

2.7 Protection Shields

.1 Cold piping, all sizes: protection shield with calcium silicate pipe insulation under shield with uninterrupted vapour barrier.

.2 Hot piping with less than 25 mm [1"] horizontal movement, NPS 2 and under: insulation over pipe hanger.

.3 Hot piping with less than 25 mm [1"] horizontal movement, NPS 2-1/2 and over: protective shield with calcium silicate insulation under shield.

.4 Hot piping with horizontal movement more than 25 mm [1"], all sizes: protective shield with calcium silicate insulation under shield.

.5 Steam piping, all sizes: protective shield with calcium silicate insulation under shield.

2.8 Wall Supports

.1 Horizontal pipe adjacent to wall:

.1 Angle iron wall brackets with specified hangers.

.2 Vertical pipe adjacent to wall.

.1 Exposed pipe wall support for lateral movement restraint - Grinnell/Anvil fig. 262 or 263.

.2 Channel type support.

2.9 Floor Support

.1 Horizontal pipe.

.1 Do not support piping from the floor unless specifically indicated.

.2 Vertical pipe.

.1 Mid-point of risers between floor slabs - adjustable fabricated steel supports.

PART 3 EXECUTION

3.1 Installation

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems per Section 23 05 48 – Vibration and Seismic Controls for Ductwork, Piping and Equipment.

.3 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.4 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations. Supporting piping from underside of light weight roof deck (without concrete) is not permitted.

.5 Use expansion anchor on existing concrete structure.

3.2 Hanger Spacing

.1 HVAC piping: in accordance with table below.

.2 Plumbing piping: in accordance with the most stringent requirements of the table below as well as the following:

.1 National. Plumbing Code.

.2 Authority Having Jurisdiction.

.3 Pipe hanger rods shall be sized in accordance to SMACNA Seismic Restraint Manual based on Seismic Hazard Level (SHL). For SHL, see Section 23 05 48 – Vibration and Seismic Controls for Ductwork, Piping and Equipment.

MAXIMUM HANGER SPACING						
PIPE DIA. NPS	STEEL SCH.40	COPPER L,K Hard Drawn	CAST.I STD.	GLASS	ABS/PVC	PEX
1/2	1.8 m [6'-0"]	1.8 m [6'-0"]			1.2 m [4'-0"]	0.8 m [2'-6"]
3/4 & 1	2.4 m [8'-0"]	2.4 m [8'-0"]			1.2 m [4'-0"]	0.8 m [2'-6"]
1-1/4	2.4 m [8'-0"]	3.0 m [10'-0"]			1.2 m [4'-0"]	0.8 m [2'-6"]
1-1/2 & 2	2.4 m [8'-0"]	3.0 m [10'-0"]	3.0 m [10'-0"]		1.2 m [4'-0"]	0.8 m [2'-6"]
2-1/2, 3, 4 & 5	2.4 m [8'-0"]	3.0 m [10'-0"]	3.0 m [10'-0"]	2.4 m [8'-0"]	1.2 m [4'-0"]	0.8 m [2'-6"]
6 & 8	3.0 m [10'-0"]	3.0 m [10'-0"]	3.0 m [10'-0"]	2.4 m [8'-0"]	1.2 m [4'-0"]	0.8 m [2'-6"]

3.3 Hanger Installation

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.4 Horizontal Movement

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.5 Final Adjustment

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 01 01 50 — General Instructions

.2 Section 23 05 00 — Common Work Results – Mechanical

.3 This Section applies to all related work under Divisions 22 and 23.

1.2 References

.1 National Building Code of Canada (NBC)

.2 American National Standards Institute/Sheet Metal and Air Conditioning Contractors National Association (ANSI/SMACNA):

.1 ANSI/SMACNA 001-2008, Seismic Restraint Manual, Guidelines for Mechanical Systems, 3rd Edition.

1.3 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 01 50 – General Instructions.

.2 Provide vibration isolation systems shop drawings complete with performance and product data. Shop drawings shall demonstrate compliance with the National Building Code and shall bear the seal of a Professional Engineer.

.3 Provide detailed drawings of all seismic restraint systems for piping and equipment.

1.4 Waste Management and Disposal

.1 Separate and recycle waste materials in accordance with Section 01 01 50 – General Instructions.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.

.3 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.4 Dispose of packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

PART 2 PRODUCTS

2.1 Vibration Isolation System – General

.1 Performance of vibration isolation systems shall be designed by manufacturer specializing in vibration isolation materials and devices.

.2 Size and shape of bases type shall be coordinated with submitted equipment.

.3 Products shall of the same manufacturer unless otherwise noted.

2.2 Elastomeric Pads

.1 Type EP1 - neoprene waffle or ribbed; 9 mm [3/8"] minimum thick; 50 durometer; maximum loading 350 kPa [50 psi].

.2 Type EP2 - rubber waffle or ribbed; 9 mm [3/8"] minimum thick; 30 durometer natural rubber; maximum loading 415 kPa [60 psi].

.3 Type EP3 - neoprene-steel-neoprene; 9 mm [3/8"] minimum thick neoprene bonded to 1.71 mm [16 gauge] steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa [50 psi].

.4 Type EP4 - rubber-steel-rubber; 9 mm [3/8"] minimum thick rubber bonded to 1.71 mm [16 gauge] steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa [60 psi].

2.3 Hangers

.1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30° arc without metal to metal contact.

.2 Type H1 - neoprene - in-shear, molded with rod isolation bushing which passes through hanger box.

.3 Type H2 - stable spring, elastomeric washer, cup with molded isolation bushing which passes through hanger box.

.4 Type H3 - stable spring, elastomeric element, cup with molded isolation bushing which passes through hanger box.

.5 Type H4 - stable spring, elastomeric element with pre-compression washer and nut with deflection indicator.

2.4 Acoustic Barriers for Anchors and Guides

.1 Acoustic barriers: between pipe and support, consisting of 25 mm [1"] minimum thick heavy duty duck and neoprene isolation material.

2.5 Flexible Pipe Connectors

.1 Inner corrugated hose: stainless steel.

.2 Outer braid: Braided wire mesh stainless steel outer jacket.

.3 Type of end connection: threaded for 50mm [2"] or smaller; flange for 65mm [2-1/2"] or larger.

.4 Operating conditions:

.1 Working pressure: 1379 kPa [200 psi].

.2 Working temperature: 4540 °C [850 °F].

2.6 Seismic Control Measures

.1 General:

.1 Design anchorage and attachment methods for all systems and/or equipment as specified herein.

.2 Seismic control systems to work in all directions.

.3 Fasteners and attachment points to resist same maximum load as seismic restraint.

.4 Drilled or power driven anchors and fasteners not permitted.

.5 No equipment, equipment supports or mounts to fail before failure of structure.

.6 Supports of cast iron or threaded pipe not permitted.

.7 Seismic control measures not to interfere with integrity of firestopping.

.8 For equipment mounted on housekeeping pad, specify the minimum distance between anchor bolt and edge of housekeeping pad.

.2 Static equipment:

.1 Anchor equipment to equipment supports. Anchor equipment supports to structure.

.2 Seismic restraints:

.1 Cushioning action to be gentle and steady.

.2 Shall never reach metal-like stiffness.

.3 Vibration isolated equipment:

.1 Seismic control measures not to jeopardize noise and vibration isolation systems. Provide 6 to 9mm clearance during normal operation of equipment and systems between seismic restraint and equipment.

.2 Provide seismic restraints in addition to vibration isolation system to resist complete isolator unloading.

.4 Piping systems:

.1 Provide seismic restraints for all piping in accordance to the latest edition of SMACNA Seismic Restraint Manual.

.2 Seismic restraints may be omitted for the following conditions:

.1 Fuel and compressed air, less than 25mm [1"] diameter.

.2 All other piping less than 32mm [1-1/4"] diameter located inside boiler rooms and mechanical rooms

.3 All other piping less than 65mm [2-1/2"] diameter located outside boiler rooms and mechanical rooms.

.4 All piping suspended by individual hangers 305mm [12"] or less in length, as measured from the top of the pipe to the bottom of the structural support for the hanger.

.3 To be compatible with requirements for anchoring and guiding of piping systems.

.4 Wet weight of piping shall be to be used for designing seismic restraint systems.

.5 Small pipes may be rigidly secured to larger pipes for restraint purposes, but not reverse.

.6 Where cable is used for restraining vibration isolated piping systems, install cable with sufficient slack to avoid short-circuiting of vibration isolators.

.5 Ductwork systems:

.1 Provide seismic restraints for all ductwork in accordance to the latest edition of SMACNA Seismic Restraint Manual as described below:

.1 All rectangular ducts with cross sectional areas $0.56m^2$ [6 ft^2] and larger.

.2 All round ducts with diameters 711 mm [28"] and larger.

.2 Seismic restraints may be omitted for the following conditions:

.1 All ductwork suspended by hangers 305mm [12"] or less in length, as measured from the top of the duct to the bottom of the structural support for the hanger.

.3 Diffusers, Grilles, and Registers:

.1 Diffusers, grilles and registers installed in a suspended grid ceiling shall be provided with wire retainers or duct straps connecting the fixture at diagonally opposite corners to the building structure.

.6 Bracing methods:

.1 Approved by Departmental Representative.

.2 Structural angles or channels.

.3 Cable restraint system incorporating grommets, shackles and other hardware to ensure alignment of restraints and to avoid bending of cables at connection points. Incorporate neoprene into cable connections to reduce shock loads.

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 Seismic control measures to meet requirements of NBC.

.2 Install vibration isolation equipment in accordance with manufacturer's instructions and adjust mountings to level equipment.

.3 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.

.4 Where isolation is bolted to floor use vibration isolation rubber washers.

.5 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.3 Field Quality Control

.1 Provide the services of the Professional Engineer(s) who designed the restraint systems for "Field Review" of the installed components, and submit the following to the Departmental Representative:

.1 Schedule B, signed and sealed; provided at the commencement of the project.

.2 Signed and sealed shop drawings of seismic restraints for equipment, piping and ductwork; provided prior to installation.

.3 Typewritten inspection reports; provided during the construction period.

.4 Schedule C-B, signed and sealed; provided after performing "Field Review".

END OF SECTION

PART 1 - GENERAL

1.1 Related Sections

.1 Section 01 01 50 — General Instructions

.2 Section 01 35 33 — Health and Safety Requirements

.3 Section 23 05 00 — Common Work Results – Mechanical

.4 This Section applies to all related work under Divisions 21, 22 and 23.

1.2 References

.1 Canadian Standards Association (CSA International):

.1 CAN/CSA B149.1, Natural Gas and Propane Installation Code.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3, Identification of Piping Systems.

.3 National Fire Protection Association (NFPA)

.1 NFPA 13, Standard for the Installation of Sprinkler Systems.

.2 NFPA 14, Standard for the Installation of Standpipe and Hose Systems.

1.3 Quality Assurance

.1 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 5 33 - Health and Safety Requirements.

1.4 Delivery, Storage, and Handling

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 01 50 – General Instructions.

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

.2 Waste Management and Disposal:

.1 Construction Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

.2 Dispose of unused paint and coating material at official hazardous material collections site approved by Departmental Representative.

.3 Do not dispose of unused paint and coating material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

PART 2 - PRODUCTS

2.1 Manufacturer's Equipment Nameplates

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 System Nameplates

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	11 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 Piping Systems Governed by Codes

.1 Identification:

.1 Natural gas and propane: to CSA/CGA B149.1.

.2 Sprinklers: to NFPA 13.

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.

.3 Legend:

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

.4 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 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:

Background colour:	**Legend, arrows:**
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background Colour Marking	Legend
Compressed Air (to Code)		
Domestic hot water supply	Green	DOM.HW SUPPLY
Domestic HW recirculation	Green	DOM.HW CIRC
Domestic cold water supply	Green	DOM.CW S
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN.VENT
Natural gas and propane	to Codes	
Fire protection water	Red	FIREPROT.WTR
Sprinklers	Red	SPRINKLERS

2.5 Identification Ductwork Systems

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

2.6 Valves, Controllers

.1 Plastic tags with 12 mm stamped identification data.

.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 Timing

.1 Provide identification only after painting specified has been completed.

3.3 Installation

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide CSA registration plates as required by respective agency.

.3 Identify systems, equipment to conform to PWGSC PMSS.

3.4 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.

3.5 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.

3.6 Cleaning

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

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 Company

.1 Testing and balancing shall be performed by an agency that specializes in this type of work. Provide proof that the agency has successfully completed five projects of similar size and scope

.2 All work shall be performed by persons with proven ability and thoroughly versed in the type of testing and balancing. Submit names, complete with experience, record and references for review by the Consultant prior to work being carried out.

.3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:

.1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.

.2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.

.4 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

.1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.

.2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 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 installed 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.

.3 Balance systems and installed equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 Exceptions

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

.2 TAB of existing equipment already in operation but not affected by the renovation.

1.5 Coordination

.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. Confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Departmental Representative in writing all proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

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 23.

1.8 Operation of Systems During TAB

.1 Operate systems for length of time required for 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:

- .1 Installation of ceilings, doors, windows, other construction affecting TAB.
- .2 Application of weather-stripping, sealing, caulking.
- .3 All pressure, leakage, other tests specified elsewhere Division 23.
- .4 All provisions for TAB installed and operational.

.3 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

- .1 Proper thermal overload protection in place for electrical equipment.
- .2 Air systems:
  - .1 Filters in place, clean.
  - .2 Duct systems clean.
  - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
  - .4 Correct fan rotation.
  - .5 Fire, smoke, volume control dampers installed and open.

.6 Coil fins combed, clean.
.7 Access doors, installed, closed.
.8 Outlets installed, volume control dampers open.

.3 Liquid systems:
.1 Flushed, filled, vented.
.2 Correct pump rotation.
.3 Strainers in place, baskets clean.
.4 Isolating and balancing valves installed open.
.5 Calibrated balancing valves installed, at factory settings.
.6 Chemical treatment systems complete, operational.

1.10 Application Tolerances

.1 Do TAB to following tolerances of design values:
.1 HVAC systems: plus 5%, minus 5%.
.2 Hydronic systems: plus or minus 10%.

1.11 Accuracy Tolerances

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

1.12 Instruments

.1 Prior to TAB, submit to Departmental Representative list of instruments to be used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to 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 Prior to calling Substantial Completion, submit for checking and approval of Departmental Representative 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 Associated Air Balance Council Manual.

.2 TAB report to show results in SI units and to include:

.1 Project record drawings.

.2 System schematics.

.3 Include final TAB report in O&M manual. Provide one (1) copy of final TAB Report to Departmental Representative.

1.16 Verification

.1 Reported results subject to verification by Departmental Representative.

.2 Provide manpower and instrumentation to verify up to 30% of reported results.

.3 Number and location of verified results to be at discretion of Departmental Representative.

.4 Pay 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 and ASHRAE.

.2 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop, temperatures (dry bulb, wet bulb, dew point, duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.3 Locations of equipment measurements: To include, but not be limited to, following as appropriate:

.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.

.2 At controllers, controlled device.

.4 Locations of systems measurements to include, but not be limited to, following as appropriate: Main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 Domestic Hot Water Systems

.1 Meet requirements as specified for liquid systems.

.2 Locations of equipment measurements: To include, but not be limited to, following as appropriate: Inlet and outlet of heaters, tank, pump, circulator, at controllers, controlled device.

.3 Locations of systems measurements to include, but not be limited to, following as appropriate: main, main branch, branch, sub-branch.

.4 Domestic hot water recirculation system shall be balanced by proportioning the water flow at balancing fittings and ensuring adequate flow through each circuit.

1.22 Other TAB Requirements

.1 Testing of Fire Dampers & Fire Stop Flaps:

.1 Conduct a "trip" test on all fire dampers and fire stop flaps to ensure that fire mechanisms function correctly and that dampers attain a fully closed position when tripped.

.2 Send a copy of test results tabulating the fire damper location, size, and date of trip test, to the Departmental Representative for record purposes. Copies shall also be inserted in Equipment Maintenance Manuals.

.3 Damper and Flaps which fail to function correctly shall be re-tested after corrective action has been completed. Any fusible links damaged when conducting tests shall be replaced by the Contractor. A signed and dated test label shall be attached to each fire damper upon completion of test and resetting of fire damper.

PART 2 - PRODUCTS

2.1 Not Used

.1 Not used.

PART 3 - EXECUTION

3.1 General

.1 Test and balance new/existing relocated equipment and systems serving the new areas and buildings.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 35 33	Health and Safety Requirements
.3	Section 23 05 00	Common Work Results - Mechanical
.4	Section 23 05 29	Hangers and Supports for HVAC Piping and Equipment

1.2 References

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

- .1 ANSI/ASHRAE/IESNA 90.1-2013; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 American Society for Testing and Materials International, (ASTM)

- .1 ASTM B209M-10, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
- .2 ASTM C335/C335M-10e1, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
- .3 ASTM C411-11, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
- .4 ASTM C449-07(2013), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
- .5 ASTM C547-12, Standard Specification for Mineral Fiber Pipe Insulation.
- .6 ASTM C553-13, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- .7 ASTM C612-14, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- .8 ASTM C795-08(2013), Standard Specification for Thermal Insulation for Use with Austenitic Stainless Steel.
- .9 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-1989, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 South Coast Air Quality Management District (SCAQMD), California State

- .1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

.5 Thermal Insulation Association of Canada (TIAC):

- .1 Mechanical Insulation Best Practice Guide, 2013.

.6 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-07, Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701-11, Standard for Thermal Insulation Polyotrene, Boards and Pipe Covering.

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

.1 Material Safety Data Sheets (MSDS).

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 defined herein.

.2 TIAC Codes:

.1 CRD: Code Round Ductwork,

.2 CRF: Code Rectangular Finish.

1.4 Submittals

.1 Submittals: in accordance with Section 01 01 50 – General Instructions.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 01 50 – General Instructions.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 01 50 – General Instructions.

.4 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.

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

.2 Instructions: submit manufacturer's installation instructions.

1.5 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 of TIAC.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.6 Delivery, Storage and Handling

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 01 50 – General Instructions.

.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 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

.2 Place excess or unused insulation and insulation accessory materials in designated containers.

.3 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

.4 Dispose of unused adhesive material at official hazardous material collections site approved by Departmental Representative.

PART 2 PRODUCTS

2.1 Fire and Smoke Rating

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 Insulation

.1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C 335.

.3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612. Provide 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. Provide 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.

.5 Evidence shall be provided to the Departmental Representative on the site of ULC listings of all products being used. Duct insulation adhesives and coatings shall be non-toxic as defined by WCB Regulations.

2.3 Jackets

.1 Canvas:

.1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: Compatible with insulation.

.1 Maximum VOC limit 250 g/L to SCAQMD Rule 1168.

.2 Aluminum:

.1 To ASTM B 209 with and without moisture barrier as scheduled in PART 3 of this section.

.2 Thickness: 0.50 mm sheet.

.3 Finish: Stucco embossed.

.4 Jacket banding and mechanical seals: 19 mm wide, 0.5 mm thick stainless steel.

2.4 Accessories

.1 Vapour retarder lap adhesive:

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

.2 Indoor Vapour Retarder Finish:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.

.4 Outdoor Vapour Retarder Mastic:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m².

.5 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.

.6 Contact adhesive: quick-setting

.1 Maximum VOC limit 80 g/L to SCAQMD Rule 1168.

.7 Canvas adhesive: washable.

.1 Maximum VOC limit 250 g/L to SCAQMD Rule 1168.

.8 Tie wire: 1.5 mm stainless steel.

.9 Banding: 19 mm wide, 0.5 mm thick stainless steel.

.10 Facing: 25 mm stainless steel hexagonal wire mesh stitched on one face of insulation.

.11 Fasteners: 2 mm diameter pins with 35 mm square clips, length to suit thickness of insulation.

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 ductwork systems 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 manufacturer's instructions and as indicated.

.3 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.

.3 Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.5 Seal vapor barrier penetrations with vapor barrier adhesive.

.6 Supports, Hangers in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.7 Fasteners: At 300 mm oc in horizontal and vertical directions, minimum two rows each side.

.8 All ductwork exposed to weather shall have waterproof seams for weathertight construction. Ductwork exposed to weather which are not insulated or finish painted, shall be coated with two applications of bitumastic waterproofing compound to prevent corrosion. Exposed ducts, which are insulated, shall have aluminum jacket.

3.4 Duct Insulation Schedules

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

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular, cold, dual temperature supply air ducts	C-1	Yes	50
Round, cold, dual temperature supply air ducts	C-2	Yes	50
Rectangular, warm air ducts	C-1	No	25
Round, warm air ducts	C-2	No	25
Supply, return and exhaust ducts exposed in space being served			None
Outside air ducts to mixing plenum	C-1	Yes	25
Exhaust ducts between dampers and louvers	C-1	No	25
Rectangular ducts outside	C-1	Special	50
Round ducts outside	C-2	Special	50
Acoustically lined ducts			None
Outdoor supply duct, exposed to weather	C-2	Yes	50
Outdoor exhaust duct, exposed to weather	C-2	No	50

.2 Finish: Conform to following table:

	TIAC Code	
	Rectangular	Round
Indoor, concealed	None	None
Indoor, exposed within Service Rooms, including but not limited to mechanical equipment rooms, electrical equipment rooms, telecom/LAN rooms, janitor rooms	CRF/1	CRD/1
Indoor, exposed elsewhere	CRF/2	CRD/2
Outdoor, exposed to weather	CRF/3	CRD/3

3.5 Cleaning

.1 Proceed in accordance with Section 01 01 50 – General Instructions.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 35 33	Health and Safety Requirements
.3	Section 23 05 00	Common Work Results - Mechanical
.4	Section 23 05 29	Hangers and Supports for HVAC Piping and Equipment

1.2 References

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

- .1 ANSI/ASHRAE/IESNA 90.1-2013; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 American Society for Testing and Materials International, (ASTM)

- .1 ASTM B209M-10, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
- .2 ASTM C335/C335M-10e1, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
- .3 ASTM C411-11, Test Method for Hot-Surface Performance of High- Temperature Thermal Insulation.
- .4 ASTM C449-07(2013), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
- .5 ASTM C547-12, Standard Specification for Mineral Fiber Pipe Insulation.
- .6 ASTM C553-13, Standard Specification or Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- .7 ASTM C612-14, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- .8 ASTM C795-08(2013), Standard Specification for Thermal Insulation for Use with Austenitic Stainless Steel.
- .9 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-1989, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 Thermal Insulation Association of Canada (TIAC):

- .1 Mechanical Insulation Best Practice Guide, 2013.

.5 Underwriters Laboratories of Canada (ULC)

- .1 CAN/ULC-S102-07, Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701-11, Standard for Thermal Insulation Polyotrene, Boards and Pipe Covering.

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

.1 Material Safety Data Sheets (MSDS).

1.3 Submittals

.1 Submittals: in accordance with Section 01 01 50 – General Instructions.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 01 50 – General Instructions.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 01 50 – General Instructions.

.4 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.

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

.2 Instructions: submit manufacturer's installation instructions.

1.5 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 of TIAC.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.6 Delivery, Storage and Handling

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 01 50 – General Instructions.

.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 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

.2 Place excess or unused insulation and insulation accessory materials in designated containers.

.3 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

.4 Dispose of unused adhesive material at official hazardous material collections site approved by Departmental Representative.

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: 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 C 335.

.3 TIAC Code A-1: Rigid molded mineral fibre without factory applied vapour retarder jacket.

.1 Mineral fibre: ASTM C547.

.2 Maximum "k" factor: ASTM C547.

.4 TIAC Code A-3: Rigid molded mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: ASTM C547.

.2 Jacket: to CGSB 1-GP-52Ma.

.3 Maximum "k" factor: ASTM C547.

.5 TIAC Code C-1: Rigid mineral fibre board, unfaced.

.1 Mineral fibre: ASTM C612.

.2 Maximum "k" factor: ASTM C612.

.6 TIAC Code C-4: Rigid mineral fibre board faced with factory applied vapour retarder jacket.

.1 Mineral fibre: ASTM C612.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: ASTM C612.

.7 TIAC Code C-2: Mineral fibre blanket unfaced or faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: ASTM C553.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: ASTM C553.

.8 TIAC Code A.6: Flexible unicellular tubular elastomer.

.1 Insulation: with vapour retarder jacket.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor.

.4 Certified by manufacturer free of potential stress corrosion cracking corrodants.

.9 TIAC Code A-2: Rigid molded calcium silicate in sections and blocks, and with special shapes to suit project requirements.

.1 Insulation: ASTM C533.

.2 Maximum "k" factor: ASTM C533.

.3 Design to permit periodic removal and re-installation.

2.3 Cement

.1 Thermal insulating and finish

.1 To: ASTM C 449/C449M.

.2 Air drying on mineral wool, to ASTM C449.

2.4 Jackets

.1 Polyvinyl Chloride (PVC):

.1 One-piece molded type and sheet to CGSB 51-GP-53M with pre-formed shapes as required.

.2 Colours: white.

.3 Minimum service temperatures: -20° C.

.4 Maximum service temperature: 65° C.

.5 Moisture vapour transmission: 0.02 perm.

.6 Thickness:

.1 Indoor: 0.5 mm [0.020"].

.2 Outdoor: UV rated material at least 0.7 mm [0.030"].

.7 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.8 Covering adhesive: Compatible with insulation.

.2 Canvas:

.1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.

.2 Lagging adhesive: Compatible with insulation.

.3 Aluminum:

.1 To ASTM B 209.

.2 Thickness: 0.50mm [0.02"].

.3 Finish: Stucco embossed or corrugated.

.4 Joining: Longitudinal and circumferential slip joints with 50mm [2"] laps.

.5 Fittings: 0.50mm [0.02"] thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 19mm [1-1/2"] wide, 0.50mm [0.02"] thick at 300mm [12"] spacing.

2.5 Insulation Securements

.1 Tape: Self-adhesive, aluminum, [plain] [reinforced], [50] mm wide minimum.

.2 Contact adhesive: Quick setting.

.3 Canvas adhesive: Washable.

.4 Tie wire: [1.5] mm diameter stainless steel.

.5 Bands: Stainless steel, [19] mm wide, [0.5] mm thick.

.6 Facing: 25 mm steel hexagonal wire mesh on [[one face] [both faces] of insulation] [on one face of insulation with expanded metal lath on other face].

.7 Fasteners: 2 mm diameter pins with 35 mm square clips. Length of pin to suit thickness of insulation.

2.6 Vapour Retarder Lap Ahesive

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

2.7 Indoor Vapour Retarder Finish

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.8 Outdoor Vapour Retarder Finish

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing

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 ductwork systems complete, witnessed and certified.

.2 Surfaces clean, dry and free from foreign material.

3.3 Installation

.1 Install in accordance with TIAC National Standards.

.1 Hot equipment: To TIAC code 1503-H.

.2 Cold equipment: to TIAC code 1503-C.

.2 Provide vapour retarder as recommended by manufacturer.

.3 Apply materials in accordance with manufacturer's instructions and as indicated.

.4 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.

.5 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.6 Supports, Hangers in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

3.4 Removable, Pre-fabricated Insulation and Enclosures

.1 Application: At expansion joints, valves, primary flow measuring elements, flanges and unions at equipment.

.2 Installation to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

3.5 Equipment Insulation Schedules

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 Hot Equipment:

.1 TIAC code A-1 or C-1 with mechanical fastenings, wire or bands and 13 mm cement reinforced with one layer of reinforcing mesh.

.2 Thicknesses per table below:

	Thickness (mm)
Heat exchangers (for domestic hot water tank)	40 (1-1/2")

3.5 Cleaning

.1 Proceed in accordance with Section 01 01 50 – General Instructions.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 35 33	Health and Safety Requirements
.3	Section 23 05 00	Common Work Results - Mechanical
.4	Section 23 05 05	Installation of Pipe Work.
.5	Section 23 05 29	Hangers and Supports for Piping and Equipment

1.2 References

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

- .1 ANSI/ASHRAE/IESNA 90.1-2013; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 American Society for Testing and Materials International, (ASTM)

- .1 ASTM B209M-10, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
- .2 ASTM C335/C335M-10e1, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
- .3 ASTM C411-11, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
- .4 ASTM C449-07(2013), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
- .5 ASTM C547-12, Standard Specification for Mineral Fiber Pipe Insulation.
- .6 ASTM C553-13, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- .7 ASTM C612-14, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- .8 ASTM C795-08(2013), Standard Specification for Thermal Insulation for Use with Austenitic Stainless Steel.
- .9 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-1989, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 Thermal Insulation Association of Canada (TIAC):

- .1 Mechanical Insulation Best Practice Guide, 2013.

.5 South Coast Air Quality Management District (SCAQMD), California State

- .1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

.6 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-07, Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701-11, Standard for Thermal Insulation Polyotrene, Boards and Pipe Covering.

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

.1 Material Safety Data Sheets (MSDS).

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 defined herein.

.2 TIAC Codes:

.1 CRF: Code Rectangular Finish.

.2 CPF: Code Piping Finish.

1.4 Submittals

.1 Submittals: in accordance with Section 01 01 50 – General Instructions.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 01 50 – General Instructions.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 01 50 – General Instructions.

.4 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.

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

.2 Instructions: submit manufacturer's installation instructions.

1.5 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 of TIAC.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.6 Delivery, Storage and Handling

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 01 50 – General Instructions.

.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 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

.2 Place excess or unused insulation and insulation accessory materials in designated containers.

.3 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

.4 Dispose of unused adhesive material at official hazardous material collections site approved by Departmental Representative.

PART 2 - PRODUCTS

2.1 Fire and Smoke Rating

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 Insulation

.1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code A-1: Rigid molded mineral fibre without factory applied vapour retarder jacket.

.1 Mineral fibre: to CAN/CGSB-51.9 / ASTM C547.

.2 Maximum "k" factor: to CAN/CGSB-51.9.

.4 TIAC Code A-3: Rigid molded mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to CAN/CGSB-51.9 / ASTM C547.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/CGSB-51.9 / ASTM C547.

.5 TIAC Code C-2: Mineral fibre blanket faced [with] [without] factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: to CAN/ULC-S702 / ASTM C553.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/ULC-S702 / ASTM C553.

.6 TIAC Code A-6: Flexible unicellular tubular elastomer.

.1 Insulation: flexible closed-cell elastomer to ASTM C534.

.2 Jacket: to CGSB 51-GP-52Ma. Required for outdoor application.

.3 Maximum "k" factor: 0.27.

.4 Vapour transmission: 0.08 perm-inch.

.5 To be certified by manufacturer to be free of potential stress corrosion cracking corrodants.

.7 To be formaldehyde free, low VOC; resists mold and mildew.

.8 Evidence shall be provided to the Engineer on the site of ULC listings of all products being used. Duct insulation adhesives and coatings shall be non-toxic as defined by WCB Regulations.

2.3 Insulation Securement

.1 Tape: Self-adhesive, aluminum, reinforced, 50mm wide minimum.

.2 Contact adhesive: Quick setting.

.1 Maximum VOC limit 80 g/L to SCAQMD Rule 1168.

.3 Canvas adhesive: Washable.

.1 Maximum VOC limit 250 g/L to SCAQMD Rule 1168.

.4 Tie wire: 1.5mm diameter stainless steel.

.5 Bands: Stainless steel, 19mm wide, 0.5mm thick.

2.4 Cement

.1 Thermal insulating and finishing cement:

.1 To CAN/CGSB-51.12.

.2 Hydraulic setting or Air drying on mineral wool, to ASTM C 449.

2.5 Vapour Retarder Lap Adhesive

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

2.6 Indoor Vapour Retarder Finish

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 Outdoor Vapour Retarder Finish

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m.

2.8 Jackets

.1 Polyvinyl Chloride (PVC):

.1 One-piece molded type and sheet to CGSB 51-GP-53M with pre-formed shapes as required.

.2 Colours: White.

.3 Minimum service temperatures: 20°C [68°F].

.4 Maximum service temperature: 65°C [150°F].

.5 Moisture vapour transmission: 0.02 perm.

.6 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.2 Canvas:

.1 220 and 120 gm/m cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.

.2 Lagging adhesive: Compatible with insulation.

.1 Maximum VOC limit 250 g/L to SCAQMD Rule 1168.

.3 Aluminum:

.1 To ASTM B 209 with and without moisture barrier as scheduled in PART 3 of this section.

.2 Thickness: 0.50 mm sheet.

.3 Finish: Stucco embossed.

.4 Jacket banding and mechanical seals: 19 mm wide, 0.5 mm thick stainless steel.

PART 3 - EXECUTION

3.1 Pre-Installation Requirement

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces to be clean, dry and free from foreign material.

3.2 Installation

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer's instructions and this specification.

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.5 Supports, hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized pipe supports, saddles and shoes. See Section 23 05 29 – Hangers and Supports for Piping and Equipment.

.6 Seal vapor barrier penetrations with vapor barrier adhesive.

3.3 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: high temperature fabric for indoor applications and aluminum for outdoor applications.

3.4 Installation of Elastomeric Insulation

.1 Insulation to remain dry at all times. Overlaps to manufacturer's instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.5 Piping Insulation Schedules

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 TIAC Code: A-1.

.1 Securements: SS Bands at 300mm on centre.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code 1501-H.

.3 TIAC Code: A-3.

.1 Securements: SS Bands at 300mm on centre.

.2 Seals: VR lap seal adhesive, VR lagging adhesive.

.3 Installation: TIAC Code: 1501-C.

.4 TIAC Code: A-6.

.1 Seals: lap seal adhesive, lagging adhesive.

.2 Installation: TIAC Code: 1501-CA; per manufacturer's recommendation.

.5 TIAC Code: C-2 with vapour retarder jacket.

.1 Insulation securements: SS Bands at 300mm on centre.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code: 1501-C.

.6 Thickness of insulation to be as listed in following table.

.1 Run-outs to individual units and equipment not exceeding 4000mm long.

.2 Do not insulate exposed run-outs to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp °C	TIAC Cod	Run	To NPS1	1 ¼-2	2 ½-4	5-6	8 & over
Water Heating	60-94	A-1	25	38	38	38	38	38
Water Heating	< 59	A-1	25	25	25	25	38	38
Domestic HW		A-1	25	25	25	38	38	38
Domestic CW		A-3	25	25	25	25	25	25
Condensation		A-3	25	25	25	25	25	25
Storm drain RWL		A-3	25	25	25	25	25	25

.7 Finishes:

.1 Exposed indoors: Canvas or PVC jacket.

.2 Exposed indoor in Service Rooms: Canvas or PVC jacket.

.1 Service Rooms include but are not limited to mechanical equipment rooms, electrical equipment rooms, telecom/LAN rooms, janitor rooms.

.3 Concealed, indoors: ASJ, no further finish.

.4 Exposed outdoors: Aluminum jacket.

3.6 Cleaning

.1 Proceed in accordance with Section 01 01 50 – General Instructions.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 Related Sections

.1 Section 01 91 00 — Commissioning

.2 Section 23 05 93 — Testing, Adjusting and Balancing

1.2 Quality Assurance

.1 The commissioning of mechanical systems shall be executed in accordance with the intent of:

.1 ASHRAE Guideline 1.1-2007, HVAC&R Technical Requirements for the Commissioning Process.

.2 ANSI/ASHRAE/IES Standard 202-2013, Commissioning Process for Buildings and Systems.

1.3 General

.1 Commissioning of the mechanical systems, including the HVAC, and Plumbing and Drainage Systems, shall be carried out by an independent Commissioning Agent acceptable to the Departmental Representative with technicians specifically trained in commissioning procedures.

.2 The Mechanical Subcontractor shall retain a Commissioning Agent, who shall be active in the commissioning process and actively encourage his own forces and sub-trades to work together to achieve optimum system performance for the mechanical systems in a timely manner. Refer to Section 01 91 00 – Commissioning for additional requirements.

.3 It is not intended that this work shall, in any way, replace normal factory start-up service for equipment or relieve the Contractor or his sub-trades of their responsibility for providing first-class installation in satisfactory working order.

.4 As part of the final commissioning report, submit a Certificate stating that the commissioning procedures have been completed, that complete factual reports have been distributed and that directions have been given to the Contractor to correct faults and omissions and finally, that follow-up testing, after the correction of faults and omissions has been completed and recorded.

.5 Be responsible for the performance and commissioning of all equipment supplied under the Sections of Division 21, 22, 23. Commissioning is the process of advancing the installation from the stage of static completion to full working order in accordance with the contract documents and design intent. It is the activation of the completed installation.

.6 In consultation with the General Contractor, ensure that sufficient time is allowed and fully identified on the construction schedule for the proper commissioning of all mechanical systems.

1.4 Commissioning and Demonstration

.1 Submit a schedule for the commissioning phase of the work. This schedule shall show:

.1 Equipment start-up schedule.

.2 Submission dates for the various documents required prior to substantial completion.

.3 Timing of the commissioning, testing, balancing, and demonstration process.

.2 Commissioning is concluded when the air and water system is balanced and the installation is in full working order and acceptable for use. The work shall include the following:

.1 Balancing of the air systems as specified in this section.

.2 Set up air diffusers, registers and grilles for optimum distribution/comfort.

.3 Plug all air pressure and flow measuring holes.

.4 Adjust vibration isolators and earthquake restraints for optimum performance.

.5 Verification and certification of the sealing of all HVAC penetrations through fire separations (rated & non-rated) and sound separations. Forms in Section 23
08 02 shall be used for this purpose.

.6 Verification of water tightness of all roof and exterior wall penetrations.

.7 Verification that coil drain pan operates.

.8 Set up all automatic control valves/dampers and automatic temperature control devices.

.9 Set up and test all alarm and protective devices.

.10 EMCS:

.1 Commissioning of EMCS is primarily responsible by Controls Contractor. Refer to Section 25 05 01 EMCS General Requirements.

.2 The Commissioning Agent shall assign one person experienced and qualified in commissioning control systems through practical experience and a comprehensive knowledge of the interactive nature of HVAC systems and DDC controls **to verify** the performance of the control systems by conducting random tests of the control sequences until the Commissioning Agent is satisfied that the controls are performing according to the intended control sequences.

.3 The Controls Contractor shall loan a current copy of all control software/devices needed for full access to the control system, at no charge to the Commissioning Agent. The software/devices shall be returned to the Controls Contractor in good working order at the completion of the commissioning process, or the Commissioning Agent must reimburse the Controls Contractor for the purchase price of the material.

.3 In addition to the piping, equipment and systems listed above provide commissioning of all plumbing piping, equipment and systems including the following:

.1 Domestic cold water including PRV setpoint.

.2 Domestic hot water and recirculation including temperature set points.

.3 Domestic tempered water including setpoints.

.4 Sanitary waste and venting.

.5 Plumbing fixtures including adjustments of all flush valves, and setting temperature limit stops on shower valves.

.4 At the conclusion of commissioning, demonstrate the operation of the systems to the Departmental Representative. For demonstration and instruction to Operating staff requirements, refer to this section of the specification and also to section 25 05 01 EMCS: General Requirements.

.5 The verification process shall include the demonstration of the following:

.1 The ease of access that has been provided throughout for servicing coils, motors, drives, control dampers and damper operators.

.2 Location of and opening and closing of all access panels.

.3 Operation of all automatic control dampers and automatic temperature control devices.

.4 Operation of all alarm and protective devices.

.5 Operation of all equipment and systems under each mode of operation, and failure.

.6 At the completion of commissioning, testing, balancing and demonstration submit the following to the Departmental Representative:

.1 A letter certifying that all work specified under this contract is complete, clean and operational in accordance with the specification and drawings.

.2 Completed copies of all commissioning check lists plus copies of start-up reports from specialty contractors and vendors.

.3 "As-Built" record drawings, as specified.

.4 A list of all alarm and protective devices tested, with the final operating settings.

.7 Training

.1 During "Substantial Performance" review, the Mechanical Contractor, Control Sub-contractor, and other Sub-contractors designated by the Departmental Representative shall provide training to the operating personnel in the proper operation and maintenance of all systems and equipment installed under the contract.

.2 It shall be the Mechanical Contractor's responsibility to have the specified equipment manuals prepared, previously approved by the Departmental Representative, and ready for presentation to the Departmental Representative at this meeting.

.3 Convene the meeting with the aforementioned parties at the time called for in the substantial performance review. The arrangements shall include written notices to all the parties concerned. Should the equipment manuals, or system installation not be complete and operable at the proper time, he shall then convene the operating instruction meeting at a later date and pay any additional costs including time and travelling expenses for the personnel involved which are attributable to the delay.

END OF SECTION

PART 1 - GENERAL

1.1 Related Sections

.1 Section 01 91 00 — Commissioning

.2 Section 22 42 01 — Plumbing Specialties and Accessories

.3 Section 23 05 93 — Testing, Adjusting and Balancing

.4 Section 23 08 00 — Commissioning of Mechanical Systems

.5 Section 23 08 02 — Cleaning and Start-up of Mechanical Piping Systems

.6 This Section applies to all related work under Divisions 22 and 23.

1.2 References

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM E202-12, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

1.3 Cleaning and Start-up of Mechanical Piping Systems

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.4 Gaseous Fuel Systems

.1 Operation tests:

.1 Measure gas pressure at gas meter outlet and at burner manifold.

.2 Verify details of temperature and pressure compensation at meter.

.3 Verify settings, operation, venting of high and low pressure cut-outs, alarms.

.4 Check terminals of vents for gas pressure regulators.

1.5 Potable Water Systems

.1 When cleaning is completed and system filled:

.1 Verify performance of equipment and systems as specified elsewhere in Division 22.

.2 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or recharge air chambers. Repeat for each outlet and flush valve.

.3 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.

1.6 Industrial Quality Compressed Air Systems

.1 Air compressor, compatible air dryer and compressed air piping.

.2 Commissioning Agency: installing Contractor.

.3 Design Criteria, Design Intents: refer to Performance Verification (PV) Report Forms.

.4 Application Tolerances:

.5 Timing:

.6 Commissioning Procedures:

.1 Air Compressor: refer to Section 22 67 15 and plumbing drawings.

.2 Check operation of automatic drain valves.

.3 Bleed off measured flow rate of compressed air from receiver.

.4 Measure cumulative length of time that air compressor operates to recover pressure. Carry out test over extended period of time.

.5 Test compressor unloading systems at stages of operation. This may be performed by repeating above test at several bleed-off rates.

.6 Refrigerated air drier: perform similar checks and tests as specified for air compressor. Measure cooling air flow rate, pressure, entering and leaving ambient and compressed air temperatures.

.7 Water-cooled after-coolers: measure water flow rate, EWT, LWT, compressed air temperature, pressure drops.

1.7 Wet and Dry Pipe Sprinkler System

.1 Cleaning, testing, start-up, performance verification of equipment, systems, components, and devices is specified elsewhere in Division 21.

.2 Verification of controls, detection devices, alarm devices is specified Division 28.

.3 Demonstrate that fire hose will reach to most remote location regardless of partitions, and obstructions.

.4 Verify operation of interlocks between HVAC systems and fire alarm systems.

1.8 Sanitary and Storm Drainage Systems

.1 Buried systems: Perform tests prior to back-filling. Perform hydraulic tests to verify grades and freedom from obstructions.

.2 Ensure that traps are fully and permanently primed.

.3 Ensure that fixtures are properly anchored, connected to system.

.4 Operate flush valves, tank and operate each fixture to verify drainage and no leakage.

.5 Cleanouts: Refer to Section 22 42 01 - Plumbing Specialties and Accessories.

.6 Roof drains:

.1 Refer to Section 22 42 01 - Plumbing Specialties and Accessories.

.2 Remove caps as required.

1.9 Reports

.1 In accordance with Section 01 91 00 – Commissioning and Section 23 08 00 – Commissioning of Mechanical Systems

PART 2 - PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 - EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 35 33	Health and Safety Requirements
.3	Section 23 05 00	Common Work Results-Mechanical
.4	Section 23 05 93	Testing Adjusting and Balancing
.5	Section 23 25 00	HVAC Water Treatment Systems

1.2 References

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

.1 Material Safety Data Sheets (MSDS).

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM E 202-12, Standard Test Methods for Analysis of Ethylene Glycols and

1.3 Submittals

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions. Include product characteristics, performance criteria, and limitations.

.2 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.

.1 Instructions: submit manufacturer's installation instructions.

1.4 Quality Assurance

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.5 Delivery, Storage, and Handling

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse recycling in accordance with Section 01 01 50 – General Instructions.

PART 2 PRODUCTS

2.1 Cleaning Solutions and Chemicals

.1 Tri-sodium phosphate: 0.40 kg per 100 L water in system.

.2 Sodium carbonate: 0.40 kg per 100 L water in system.

.3 Low-foaming detergent: 0.01 kg per 100 L water in system.

.4 Cleaning solutions shall be provided by the supplier of chemicals for water treatment under Section 23 25 00 – HVAC Water Treatment Systems.

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 Cleaning of Hydronic Systems

.1 Timing:

.1 Systems to be operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.

.2 Cleaning Agency:

.1 Retain qualified water treatment specialist to perform system cleaning.

.3 Install instrumentation such as flow meters, orifice plates, pitot tubes and flow metering valves only after cleaning is certified as complete by water treatment specialist. Install cross upstream per manufacturer's recommendation. Install plugs in unused connections.

.4 Cleaning procedures:

.1 Provide detailed report outlining proposed cleaning procedures at least 4 weeks prior to proposed starting date. Report to include:

.1 Cleaning procedures, flow rates, elapsed time.

.2 Chemicals and concentrations to be used. Include Material Safety Data Sheets (MSDS).

.3 Inhibitors and concentrations.

.4 Specific requirements for completion of work.

.5 Special precautions for protecting piping system materials and components.

.6 Complete analysis of water to be used to ensure water will not damage systems or equipment.

.5 Conditions at time of cleaning of systems:

.1 Systems to be free from construction debris, dirt and other foreign material.

.2 Control valves to be operational, fully open to ensure that terminal units can be cleaned properly.

.3 Strainers to be clean prior to initial fill.

.6 Report on Completion of Cleaning:

.1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.

.7 Hydronic System:

.1 Fill system with water, ensure air is vented from system.

.2 Provide drain connections to drain system in one hour. All drains for chemical treatment shall be piped to the nearest floor drain. After initial flushing has been completed, clean all strainer screens.

.3 System pumps may be used for circulating cleaning solution provided that pumps are dismantled and inspected, worn parts repaired with new gaskets and seals install. Submit used seals.

.4 Add cleaners and chemicals to closed systems at concentration levels recommended by the Chemical Specialist.

.5 For heating hot water systems, apply heat while circulating, raise temperature slowly to 70°C [158°F] and maintain at 70°C [158°F] for a minimum of 12 hours. Remove heat and continue to circulate until temperature is below 38°C [100°F].

3.3 Start-up of Hydronic Systems

.1 After cleaning is completed and system is filled:

.1 Establish circulation and expansion tank level, set pressure controls.

.2 Ensure air is removed.

.3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.

.4 Dismantle system pumps used for cleaning, inspect, replace worn parts; install new gaskets and new set of seals.

.5 Clean out strainers repeatedly until system is clean.

.6 Commission water treatment systems as specified in Section 23 25 00 - HVAC Water Treatment Systems.

.7 Check water level in expansion tank with cold water with circulating pumps OFF and ON.

.8 Repeat with water at design temperature.

.9 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.

.10 Bring system up to design temperature and pressure slowly over a 48 hour period.

.11 Perform TAB as specified in Section 23 05 93 - Testing, Adjusting and Balancing.

.12 Adjust pipe supports, hangers, springs as necessary.

.13 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.

.14 Re-tighten bolts, etc. using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.

.15 Check operation of drain valves.

.16 Adjust valve stem packings as systems settle down.

.17 Fully open all balancing valves (except those that are factory-set).

.18 Check operation of over-temperature protection devices on circulating pumps.

.19 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

3.4 Cleaning

.1 Proceed in accordance with Section 01 01 50 – General Instructions.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 91 00	Commissioning
.3	Section 23 05 05	Installation of Pipe Work
.4	Section 23 05 29	Hangers & Supports for Piping & Equipment
.5	Section 23 05 48	Vibration & Seismic Controls for Ductwork, Piping & Equipment
.6	Section 23 08 00	Commissioning of Mechanical Systems

1.2 References

.1 American Society of Mechanical Engineers (ASME)

- .1 ASME B16.5-13, Pipe Flanges and Flanged Fittings.
- .2 ASME B18.2.1-96, Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws.

.2 American Society for Testing and Materials (ASTM)

- .1 ASTM A47/A47M-09, Standard Specification for Ferritic Malleable Iron Castings.
- .2 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

.3 Canadian Standards Association (CSA)

- .1 CSA W47.1-09, Certification of companies for Fusion Welding of Steel Structures.
- .2 CAN/CSA-B137 Series, 2013, Thermoplastic Pressure Piping Compendium.
- .3 CSA Z662-11, Oil and Gas Piping Systems

.4 Canadian Standards Association (CSA)/Canadian Gas Association (CGA)

- .1 CAN/CGA B149.1-10, Natural Gas and Propane Installation Code.
- .2 CAN/CGA B149.2-10, Propane Storage and Handling Code.

1.3 Submittals

.1 Submit product data in accordance with Section 01 01 50 – General Instructions.

.2 Indicate on manufacturer's catalogue literature following: valves.

1.4 Closeout Submittals

.1 Provide maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.5 Waste Management and Disposal

.1 Separate and recycle waste materials in accordance with Section 01 01 50 – General Instructions.

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.3 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 PRODUCTS

2.1 Pipe

.1 Steel pipe: to ASTM A53/A53M, Schedule 40, seamless as follows:

.1 NPS 1/2 to 2, screwed.

.2 NPS2 1/2 and over, plain end.

.2 Underground gas piping: High Density polyethylene pipe meeting the requirements of CSA-B137.4.

.3 Epoxy coated steel pipe risers designed for connection to plastic service piping for NPS 2 (50mm) size and smaller.

2.2 Jointing

.1 Screwed fittings: pulverized lead paste.

.2 Welded fittings: to CSA W47.1.

.3 Flange gaskets: nonmetallic flat.

.4 Underground Piping shall be joined by heat fusion, electrofusion, or mechanical methods in accordance with CSA Z662 and the manufacturer's instructions.

2.3 Fittings

.1 Steel pipe fittings, screwed, flanged or welded:

.1 Malleable iron: screwed, banded, Class 150.

.2 Steel pipe flanges and flanged fittings: to ASME B16.5.

.3 Welding: butt-welding fittings.

.4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.

.5 Bolts and nuts: to ASME B18.2.1.

.6 Nipples: schedule 40, to ASTM A53/A53M.

2.4 Valves

.1 Provincial Code and CSA B137.1 approved, lubricated type.

.2 All valves used shall match existing and labeled to match existing nomenclature.

.3 Provide seismic actuated shut off valve at building wall.

PART 3 EXECUTION

3.1 Installation

.1 Install in accordance with Section 23 05 05 - Installation of Pipework, Section 23 05 29 – Hangers & Supports for Piping & Equipment, and Section 23 05 48 – Vibration & Seismic Controls for Ductwork Piping & Equipment.

.2 Install in accordance with CAN/CGA B149.1 and local authority having jurisdiction.

.3 Install underground gas piping strictly in accordance with manufacturer's instructions. Provide warning tape (plain tape only) buried directly above gas pipe, 300mm below finished grade. The installation of plastic pipe underground shall include installation of a tracer wire and tracer wire shall terminate above ground at riser locations. At the service meter and at indicated building locations, provide epoxy coated steel pipe risers designed for connection to plastic service piping. Provide dielectric fittings and a lubricated plug valve where the underground pipe is connected to the pipe entering the building.

.4 Project new gas piping to new and relocated equipment to meet codes.

3.2 Valves

.1 Install valves with stems upright or horizontal unless otherwise approved by Departmental Representative.

.2 Install valves at branch take-offs to isolate pieces of equipment, and as indicated.

.3 Provide shutoff valve and insulated union for di-electric isolation of building gas piping.

3.2 Field Quality Control

.1 Test system in accordance with CAN/CGA B149.1, CAN/CGA B149.2 and requirements of authorities having jurisdiction.

3.3 Purging

.1 Purge after pressure test in accordance with CAN/CGA B149.1, CAN/CGA B149.2.

3.4 Pre-Start-Up Inspections

.1 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.

.2 Check gas trains, entire installation is approved by authority having jurisdiction.

3.5 Reports

.1 In accordance with Section 01 91 00 – Commissioning and Section 23 08 00 – Commissioning of Mechanical Systems.

3.6 Related Work

.1 Provide underground gas piping from connector to existing underground gas piping to gas meter at the building. Refer to Civil Site Services drawings for location and routing of gas piping.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 23 05 00	Common Work Results-Mechanical
.3	Section 23 05 93	Testing Adjusting and Balancing

1.2 Waste Management and Disposal

.1 Separate and recycle waste materials in accordance with Section 01 01 50 – General Instructions.

.2 Dispose of unused cleaning solutions at official hazardous material collections site approved by the Departmental Representative.

.3 Do not dispose of unused cleaning solutions into sewer system, into streams, lakes, onto ground or in other locations where it will pose health or environmental hazard.

.4 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.5 Dispose of packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.3 Scope

.1 All air systems installed by this contract shall be cleaned by a Cleaning Contractor.

.2 The Cleaning Contractor shall visit the site in the case of existing systems or shall review the drawings and specifications of new systems, in order to be fully acquainted with the scope of work and requirements before tendering. No consideration will be granted for any misunderstanding of work to be done resulting from failure to visit the site or inspect the contract documents.

.3 The following air systems shall be cleaned, as applicable:

- .1 Relief
- .2 Supply
- .3 Return
- .4 Exhaust
- .5 Air Conditioning

.4 All components within each system shall be thoroughly cleaned to the Departmental Representative's satisfaction and shall include but not be limited to the following:

- .1 Intake exhaust and relief louvres
- .2 Bird screens
- .3 Auto dampers
- .4 Filter frames
- .5 Coils
- .6 Fans & motors - complete assembly
- .7 All plenum surfaces
- .8 Terminal heating/cooling coils

.9 Supply air grilles, registers and diffusers

.10 Ductwork

.11 Mixing boxes, air terminal units

.12 Return, exhaust and relief air grilles and diffusers.

1.4 Qualifications

.1 Cleaning shall be performed by a cleaning service company with high capacity cleaning equipment designed specifically for the work involved, executed by personnel specifically trained for the application.

PART 2 PRODUCTS

2.1 Cleaning Equipment

.1 Cleaning shall generally by high capacity power vacuum.

.2 High pressure compressed air, wire brushing and/or non-toxic solvent cleaning shall be used where dirt or scale cannot be removed otherwise.

PART 3 EXECUTION

3.1 Cleaning HVAC Systems

.1 The Cleaning Contractor shall provide access as required for the work and shall reseal and make good any duct or insulation damaged in the process of this work.

.2 Remove cheesecloth from grilles, etc., let over from the temporary use of the air systems.

.3 Air systems must not be shut down without prior approval from the owner

.4 The Cleaning Contractor shall be responsible for removing and replacing filter media. In new buildings this Contractor will remove the temporary filters and replace with new after cleaning the systems. In existing buildings this Contractor may re-use existing filter media (cleaned if possible) or new media will be provided by the Owner as established by the Departmental Representative.

.5 The Cleaning Contractor shall mark balancing damper positions before cleaning and return them to their original position when cleaning is completed unless the system is to be balanced.

.6 Re-install any grilles, registers and diffusers which may have been removed for cleaning purposes.

3.2 Report

.1 After completion of the work, the Contractor shall provide four copies of a certificate stating that all systems have been cleaned as specified and that all access panels for all cleaning openings are in place. This certificate shall be placed in the Operating and
Maintenance Manuals.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 35 33	Health and Safety Requirements
.3	Section 23 05 00	Common Work Results - Mechanical
.4	Section 23 05 48	Vibration and Seismic Controls for Ductwork, Piping and Equipment
.5	Section 23 05 94	Pressure Testing of Ducted Air Systems
.6	Section 23 07 13	Thermal Insulation for Ducting
.7	Section 23 31 10	Cleaning of Mechanical Duct Systems

1.2 References

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.2 American Society for Testing and Materials (ASTM)

.1 ASTM A312/A312M-2014, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

.2 ASTM A480/A480M-2013, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.3 ASTM A635/A635M-2013, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.

.4 ASTM A653/A653M-2013, 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 Agency (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 91-2010, Standard for Exhaust System for Air Conveying of Vapours, Gases, Mists, and Non-combustible Particle Solids.

.6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 ANSI/SMACNA 006-2006, HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition.

.2 SMACNA HVAC Air Duct Leakage Test Manual, 2nd Edition, 2012.

.3 IAQ Guideline for Occupied Buildings Under Construction 1995, 1st Edition.

.7 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

.8 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-07, Surface Burning Characteristics of Building Materials and Assemblies.

.9 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

1.3 Submittals

.1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets for the following:

.1 Sealants.

.2 Adhesive

.3 Duct tape.

.4 Duct liners.

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 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.5 Delivery Storage and Handling

.1 Protect on site stored or installed absorptive material from moisture damage.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and recycling and place in designated containers in accordance with Waste Management Plan.

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.7 Fold-up metal and plastic banding, flatten and place in designated area for recycling.

PART 2 PRODUCTS

2.1 Seal Classification

.1 Classification as follows:

Pressure Class	Maximum Pressure (Pa)	SMACNA Seal Class
Medium Pressure	750	[B]
Low Pressure	500	[B]

.2 Seal classification:

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant.

.2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.

2.2 Ductwork - General

.1 Duct dimension noted on drawings are clear inside dimensions. Insulation thickness shall be as noted on the drawings.

.2 All seams, joints and raw edges shall be sealed and covered with glassfab.

.3 Insulation shall be applied with mechanical fasteners and suitable adhesives. Duct insulation adhesive and coatings shall be non-toxic as defined by WCB Regulations.

.4 Round duct: with spiral seams. Sections shall be joined with a RT1 slip joint, screw fastened and sealed with no visible duct sealant to interfere with finish painting.

.5 Exposed round duct shall be installed in a neat workmanlike manner parallel to building walls and roof with no sags or misalignment, and shall be true and round.

.6 Ductwork downstream of low-pressure single duct air terminal units shall be constructed to 500 Pa low pressure duct.

.7 Ductwork upstream of single duct air terminal units shall be constructed to 1,000 Pa medium pressure duct.

2.3 Fittings

.1 Fabrication: to SMACNA. Fittings shall be 2 gauges heavier than connecting ductwork.

.2 Radius elbows:

.1 Rectangular: Centre-line radius equal to 1.5 times width of duct, with single thickness turning vanes.

.2 Round: Centre-line radius equal to 1.5 times diameter. 5-gore for 300mm [12"] and larger; die-stamped for 254mm [10"] and smaller.

3 Mitered elbows, rectangular:

.1 To 400mm [16"]: with single thickness turning vanes.

.2 Over 400mm [16"]: with double thickness turning vanes.

.4 Branches:

.1 Rectangular main and branch: 45° entry on branch.

2 Round main and branch: enter main duct at 45° or with conical connection. The use of spin-in collars is not acceptable.

.5 Transitions:

.1 Diverging: 20° maximum angle.

.2 Converging: 30° maximum angle.

.6 Offsets: full radius elbows.

.7 Obstruction deflectors: maintain full cross-sectional area.

.8 Elbows in autoclave exhaust shall be unvaned, smooth radius construction with centre- line equal to 1.5 times width of duct.

2.4 Galvanized Steel

.1 Lock forming quality: to ASTM A653, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA.

.4 Applications:

.1 All supply and exhaust ductwork unless otherwise noted.

2.5 Aluminum

.1 To SMACNA. Aluminum type: 3003-H-14.

.2 Thickness: 2 gauges heavier than gauges required for galvanized duct.

.3 Joints: to SMACNA.

.4 Applications:

.1 Rooms with high humidity, such as autoclave room: first 3,000mm [10'-0"] of exhaust duct.

.2 As noted on drawings.

.5 Provide neoprene gaskets between dissimilar metals.

.6 Do not use of sheet metal screws or other fasteners which will obstruct air flow in clothes dryer exhaust duct.

2.6 Stainless Steel

.1 Material: 316 stainless steel to ASTM A312.

.2 Thickness: minimum 1.2mm [18 gauge], built for structural strength.

.3 Joints: continuously welded.

.4 Duct system shall be fitted with copper-grounding straps, connected to the duct and to an effective grounding system.

.5 Applications:

.1 Fume exhaust duct.

.2 Canopy exhaust duct.

.3 Kitchen exhaust duct.

.3 As noted on drawings.

2.7 Hangers and Supports

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger: 500mm [20"].

.2 Hangers, hanger configuration and attachment to structure: to SMACNA.

2.8 Duct Liner

.1 Fibrous glass duct liner: air stream side faced with FSK facing.

.2 Rigid:

.1 Use on flat surfaces.

.2 25mm [1"] or 50mm [2"] thick fibrous glass rigid board duct liner.

.3 Density: 36 kg/m^3 [2.2 lb/ft^3].

.4 Thermal resistance: RSI-0.76 [R-4.3] for 25mm [1"], RSI-1.53 [R-8.7] 50mm [2"].

.3 Flexible:

.1 Use on round or oval surfaces.

.2 25mm [1"] or 50mm [2"] thick fibrous glass blanket duct liner as indicated.

.3 Density: 24 kg/m^3 [1.5 lb/ft^3].

.4 Thermal resistance: RSI-0.74 [R-4.2] for 25mm [1"], RSI-1.47 [R-8.3] 50mm [2"].

.4 Fasteners shall be weld pins with metal retaining clips and square head.

.5 Flame and smoke ratings:

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.9 Sealant

.1 For indoor and outdoor applications:

.1 Water based, fiber reinforced, non-toxic, elastomeric duct sealant. Suitable for indoor and outdoor use, non-sagging, non-cracking, UV resistant, freeze/thaw stable, paintable. Temperature range of -32°C to 99°C [-26°F to 210°F]. ULC listed and comply with NFPA 90A and NFPA 90B.

.2 Flame and smoke ratings:

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

.2 For outdoor applications only:

.1 Solvent based, fiber reinforced, elastomeric duct sealant. Suitable for outdoor unit, non-sagging, non-cracking, UV-proof, freeze/thaw stable, paintable. Temperature range of -45°C to 120°C [-50°F to 250°F].

.3 Maximum VOC limit 420 g/L to SCAQMD Rule 1168 and SMACNA Technical Resource Bulletin (TRB) #9-09.

2.10 Adhesive

.1 Water-based vinyl copolymer adhesive. Temperature range of -23°C to 71°C [-10°F to 160°F]. ULC listed and comply with NFPA 90A and NFPA 90B. Adhesive shall be non-toxic as defined by Worksafe BC Regulations.

.2 Flame and smoke ratings:

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

.3 Maximum VOC limit 80 g/L to SCAQMD Rule 1168.

2.11 Duct Tape System

.1 Two part system combined of treated woven fibreglass tape and liquid sealant/adhesive. ULC listed and comply with NFPA 90A and NFPA 90B.

.2 Flame and smoke ratings:

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

PART 3 EXECUTION

3.1 General

.1 Do work in accordance with NFPA 90A, NFPA 90B, ASHRAE, SMACNA, and as indicated.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.3 Support risers in accordance with SMACNA.

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

.7 All openings in ductwork shall be sealed with temporary duct cover during construction. Failure to maintain duct cleanliness will require the inside of all air ducts, plenums and equipment in the air stream to be cleaned with an industrial vacuum cleaner before system balancing is started.

.8 Apply protective galvanize coating to galvanized ductwork and accessories which have been welded.

.9 Apply duct sealer to all joints of metal ducts, connections to diffusers, plenums and flexible duct.

.10 Provide medium pressure duct for the following:

.1 Ductwork serving systems with air terminal units, extending from the air handling unit discharge to the inlet of air terminal units.

.2 As indicated.

.11 The use of plastic duct tape is not permitted.

.12 Thermal insulation to Section 23 07 13 – Thermal Insulation for Ducting.

3.2 Hangers

.1 Strap hangers: Install in accordance with SMACNA.

.2 Rectangular duct: Extend strap hanger down on both sides of duct, turn under bottom 25mm [1"] minimum. On each strap provide two sheet metal screws on the side and one in the bottom.

.3 Angle hangers: complete with locking nuts and washers.

.4 Hanger spacing: to SMACNA.

.5 Seismic restraint to Section 23 05 48 – Vibration and Seismic Controls for Ductwork, Piping and Equipment.

3.3 Ductwork Exposed to Weather

.1 All ductwork exposed to weather shall have watertight seams.

.2 Exposed ducts which are not insulated or finished with paint shall be coated with two applications of bitumastic waterproofing compound to prevent corrosion.

3.4 Duct Liner

.1 Install in accordance with manufacturer's recommendations, and as follows:

.1 Fasten to interior sheet metal surface with 100% coverage of adhesive.

.2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 425mm on centres.

.3 Acoustically lined round ducts shall have perforated inner metal liner.

.2 Line inside of ducts where indicated.

.3 Duct dimensions, as indicated, are clear inside duct lining.

.4 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's written recommendations, and as follows:

.1 Bed tape in sealer.

.2 Apply two coats of sealer over tape.

.5 Replace damaged areas of liner.

.6 Protect leading and trailing edges of duct sections with sheet metal nosing having 15mm [1/2"] overlap and fastened to duct.

.7 Provide 50mm [2"] liner for ductwork exposed to weather which is not insulated.

3.5 Watertight Duct

.1 Provide watertight duct for:

.1 Dishwasher exhaust.

.2 Fresh air intake.

.3 Minimum 3,000 mm from duct mounted humidifier in all directions.

.2 Form bottom of horizontal duct without longitudinal seams.

.1 Solder or weld joints of bottom and side sheets.

.2 Seal other joints with duct sealer.

.3 Slope horizontal branch ductwork down towards fume hoods served.

.1 Slope header ducts down toward risers.

.4 Fit base of riser with 150 mm deep drain sump and 32 mm drain connected, with deep seal trap and trap primer and discharging to open funnel drain.

3.6 Kitchen Exhaust Systems

.1 Install to NFPA 96.

3.7 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.

3.8 Leakage Tests

.1 Refer to Section 23 05 94 - Pressure Testing of Ducted Air Systems.

.2 In accordance with SMACNA HVAC Duct Leakage Test Manual.

.3 Perform leakage tests in sections.

.4 Perform trial leakage tests, as instructed to demonstrate workmanship.

.5 Install no additional ductwork until trial tests have been achieved.

.6 Test section minimum of 30m [100 ft] long with not less than three branch takeoffs and Two 90□ elbows.

.7 Complete tests before insulation or concealment.

3.7 Cleaning

.1 Perform cleaning operations as specified in Section 23 31 10 – Cleaning of Mechanical Duct Systems and in accordance with manufacturer's recommendations.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 35 33	Health and Safety Requirements
.3	Section 23 05 00	Common Work Results - Mechanical

1.2 References

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 ANSI/SMACNA 006-2006, HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition.

.2 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 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S110-07, Standard Method of Tests for Air Ducts.

.2 UL 181-2013, Standard for Factory-Made Air Ducts and Air Connectors.

1.3 Submittals

.1 Submittals in accordance with Section 01 01 50 – General Instructions.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.

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

.1 Certification of ratings: catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

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

.5 Instructions: submit manufacturer's installation instructions.

.6 Manufacturer's Field Reports: manufacturer's field reports specified.

.7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.4 Quality Assurance

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.5 Delivery, Storage and Handling

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan (WMP).

.4 Separate for reuse and recycling and place in designated containers in accordance with Waste Management Plan (WMP).

.5 Divert unused materials from landfill to recycling facility as approved by Departmental Representative.

PART 2 PRODUCTS

2.1 General

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

2.2 Flexible Duct

.1 General:

.1 UL-181 listed and labeled as Class I air duct, and complies with NFPA 90A and 90B.

.2 Non-metallic, Insulated:

.1 Constructed of CPE liner duct permanently bonded to a spring steel wire helix and with factory applied fibreglass insulation, lower permeability vapour barrier and laminate jacket for low and medium pressure systems.

.2 Maximum rated pressure: 1,000Pa [4" w.g.] positive, 250Pa [1" w.g.] negative.

.3 Operating temperature: -29 to 121 °C [-20 to 250 °F].

.4 Thermal resistance: RSI-0.74 [R-4.2].

.5 Application: cold air supply duct.

.3 Non-metallic, un-insulated:

.1 Constructed of supporting helix of coated spring steel wire permanently bonded to a coated woven fiberglass.

.2 Maximum rated pressure: 2,500Pa [10" w.g.] positive, 250Pa [1" w.g.] negative.

.3 Operating temperature: -18 to 121 °C [-0 to 250 °F].

.4 Application: warm air supply duct.

2.3 Flexible Duct Connectors

.1 Frame: galvanized sheet metal frame 0.66mm [24 gauge] thick with fabric clenched by means of double locked seams.

.2 Fabric:

.1 Indoor: Fire resistant, self-extinguishing, neoprene coated fibreglass fabric, temperature rated at -40°C to 90°C [-40°F to 200°F], thickness of 0.63mm [0.025"].

.2 Outdoor: Fire resistant, self-extinguishing, DuPont Hypalon coated fibreglass fabric, temperature rated at -40°C to 120°C [-40°F to 250°F], thickness of 0.61mm [0.024"].

2.4 Access Doors in Ducts

.1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6mm [24 gauge] thick complete with sheet metal angle frame.

.2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6mm [24 gauge] thick complete with sheet metal angle frame and 25mm [1"] thick rigid fibreglass insulation.

.3 Gaskets: neoprene.

.4 Hardware:

.1 Up to 300 x 300 mm: two sash locks complete with safety chain.

.2 301 to 450 mm: four sash locks complete with safety chain.

.3 451 to 1000 mm: piano hinge and minimum two sash locks.

.4 Doors over 1000 mm: piano hinge and two handles operable from both sides.

2.5 Turning Vanes

.1 Factory-made, single or double thickness as specified elsewhere, with trailing edge. Vanes shall be constructed of same material as duct, 0.55mm [26 gauge].

.2 Rails shall be fabricated of same material as duct, 0.66m [24 gauge]. Vanes shall be attached to rails using fasteners.

2.6 Instrument Test Ports

.1 Alloy casting with screw-in cap, neoprene gasket, 18 mm [3/4"] inside diameter opening for pitot tube or velometer.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 Installation

.1 Flexible Duct

.1 Provide flexible duct connecting air outlets as indicated. Flexible duct with integral volume damper is not acceptable.

.2 Install flexible duct fully extended, without tight bends and kinks. The radius at the centre-line shall not be less than one duct diameter. Do not install in compressed state.

.3 Length of flexible duct shall within 1,500mm to 2,100mm (5'-0" to 7'-0").

.4 Provide support for flexible duct at 1,200mm (4'-0") on centre. Maximum permissible sag is 42 mm/m (1/2 inch per foot) of spacing between support. A connection to a rigid duct or equipment shall be considered a support joint.

.5 Sheet metal strap for flexible duct support shall be minimum 38mm (1-1/2") wide.

.6 Sheet metal collars to which the flexible ducts are attached shall be minimum 50mm (2") in length.

.7 Repair torn or damaged vapour barrier jackets approved duct tape. If the internal core is penetrated, replace the flexible duct.

.8 Do not use flexible duct for connecting mixing box and air terminal unit inlets.

.9 Do not use flexible duct on return and exhaust ductwork.

.2 Flexible Duct Connectors

.1 Install in following locations:

.1 Inlets and outlets to supply air units and fans.

.2 Inlets and outlets of exhaust and return air fans.

.3 As indicated.

.2 Length of connection: 100mm [4"].

.3 Minimum distance between metal parts when system in operation: 75mm [3"].

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:

.1 Ducting on sides of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

.6 Flexible duct connector exposed to weather shall have a sheet metal shield for additional UV protection.

.3 Access Doors in Ducts

.1 Size:

.1 610mm x 1520 mm [24"x60"] for person size entry.

.2 460mm x 460 mm [18"x18"] for service.

.3 300mm x 200mm [12"x8"] for cleaning.

.4 As indicated.

.2 Locations:

.1 Fire dampers and smoke dampers.

.2 Control dampers.

.3 Devices requiring maintenance.

.4 Required by code.

.5 Reheat coils.

.6 On both sides of turning vanes.

.7 At the base of all duct risers.

.8 At 12,000m [40'-0"] intervals in all duct systems, and 6,000mm [20'-0"] intervals in horizontal exhaust ducts for cleaning purposes.

.4 Instrument Test Ports

.1 Install in accordance with manufacturer's instructions.

.2 Locate to permit easy manipulation of instruments.

.3 Locations:

.1 For traverse readings:

.1 Ducted inlets to roof and wall exhausters.

.2 Inlets and outlets of other fan systems.

.3 Main and sub-main ducts.

.4 And as indicated.

.2 For temperature readings:

.1 At outside air intakes.

.2 In mixed air applications in locations.

.3 At inlet and outlet of coils.

.4 Downstream of junctions of two converging air streams of different temperatures.

.5 And as indicated.

.5 Turning Vanes

.1 Install in accordance with manufacturer's recommendations.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 35 33	Health and Safety Requirements
.3	Section 23 05 00	Common Work Results – Mechanical
.4	Section 23 33 00	Air Duct Accessories

1.2 References

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 ANSI/SMACNA 006-2006, HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition.

.2 SMACNA – Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems, 2002.

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S112-10, Standard Method of Fire Test of Fire Damper Assemblies.

.2 CAN/ULC-S112.2-07, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.

.3 ULC-S505-1974, Standard for Fusible Links for Fire Protection Service.

.3 National Fire Protection Agency (NFPA)

.1 NFPA 90A-2012, Standard for the 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 01 50 – General Instructions. Include product characteristics, performance criteria, and limitations.

.1 Indicate the following:

.1 Volume dampers.

.2 Remote control damper regulators.

.3 Fire dampers.

.4 Fire stop flaps.

.5 Smoke dampers.

.6 Backdraft dampers.

.7 Relief dampers.

.2 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.

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

.2 Instructions: submit manufacturer's installation instructions.

1.4 Quality Assurance

.1 Health and Safety Requirements:

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.5 Delivery, Storage and Handling

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 01 50 – General 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 01 50 – General Instructions.

1.6 Extra Materials

.1 Provide maintenance materials in accordance with Section 01 01 50 – General Instructions.

.2 Provide following:

.1 Six (6) fusible links for each type of fire damper.

PART 2 PRODUCTS

2.1 General

.1 Manufacture to SMACNA standards.

2.2 Single Blade Volume Dampers

.1 Blade: Of same material as duct. Two gauges heavier than duct but not less than 0.6mm [24 gauge], stiffened.

.2 Maximum dimension: 305mm [12"] height for rectangular ducts.

.3 Axles: 9.5mm [3/8"] continuous square rod up to 457mm [18"] wide duct, and 13mm [1/2"] continuous square rod up to 1,219mm [48"] wide duct.

.4 Linkage: shaft extension with locking quadrant and position indicator.

.5 Bearings: bronze oilite.

.6 Frame: of the same material as duct. Complete with angle stop for rectangular duct.

2.3 Multi-Bladed Volume Dampers

.1 Opposed blades: 1.2mm [18 gauge] of same material as adjacent duct, stiffened.

.2 Maximum blade width: 150mm [6"].

.3 Axles: 9.5mm [3/8"] or 13mm [1/2"] continuous square rod.

.4 Bearings: bronze oilite.

.5 Linkage: shaft extension with locking quadrant and position indicator.

.6 Frame: 51mm [2"] or 40 x 13 x 3 mm [1-1/2"x1/2"x1/8"] structural or roll-formed channel, complete with angle stop.

2.4 Remote Control Damper Regulators

.1 Cable controlled damper regulator for concealed ceiling applications.

.2 Cable: 1.4mm 0.054] stainless steel Bowden cable encapsulated in 1.6mm [1/16"] flexible galvanized spiral wire sheath.

.3 Control kit: die-cast aluminum housing with 76mm [3"] diameter chrome-plated cover, with steel rack and pinion gear drive converting rotary motion to push-pull motion.

.4 Provide hardware kit for damper by others.

2.5 Fire Dampers

.1 Dynamic type, Arrangement B, ULC listed and labelled, meeting requirements of provincial fire authority and NFPA 90A. Fire damper assemblies to be fire tested in accordance with CAN/ULC-S112. Factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

.2 Frame and integral sleeve shall be of same material as duct with mounting angles furnished by the damper manufacturer. Sleeve thickness to SMACNA and NFPA-90A.

.3 Top hinged: offset, round or square, interlocking blade type and sized to maintain full duct cross section.

.4 Fusible link: 74°C [165°F], replaceable.

.5 40 x 40 x 3 mm [1-1/2" x 1-1/2" x 1/8"] retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

2.6 Fire Stop Flaps

.1 To be ULC listed and labelled and fire tested in accordance with CAN4-S112.2.

.2 Construct of same material as duct, minimum 1.5 mm thick with 1.6 mm thick non-asbestos ULC listed insulation and corrosion-resistant pins and hinges.

.3 Flaps to be held open with fusible link conforming to ULC-S505 and close at 74°C [or as indicated].

2.7 Smoke Dampers

.1 Class I leakage rate, with airfoil blades, pressure sensitive blade edge and jamb seals for low leakage, concealed linkage. Both damper and actuator shall be ULC listed and labelled.

.2 Constructed frame and blades of same material as duct.

.3 Operation: Normally open position. Damper shall close upon detection of smoke or from remote alarm signalling device.

2.8 Backdraft Dampers

.1 Multi-blade, gravity-operated, centre pivoted, constructed of same material as duct with nylon bearings.

2.9 Relief Dampers

.1 Multi-blade, insulated, counter-weight, centre pivoted, constructed of same material as duct with brass bearings, set to open at 12.4 Pa [0.05 in. w.g.] static pressure unless otherwise noted.

PART 3 EXECUTION

3.1 General

.1 Install where indicated.

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

.3 Seal multiple damper modules with silicon sealant.

3.2 Volume Damper

.1 For supply, return and exhaust systems, locate balancing dampers in each branch duct.

.2 Run-outs to registers and diffusers: install single blade damper located as close as possible to main ducts.

.3 All dampers to be vibration free.

.4 Attach fluorescent tape to regulator handle for concealed volume dampers.

.5 Provide remote control damper regulator for volume dampers above inaccessible ceiling where ceiling access panel is not provided, and as indicated.

3.3 Fire Dampers

.1 Install in accordance to Part 3, Sub-section 3.1.8 of the National Building Code.

.2 Provide fire damper where duct penetrates through fire-rated floor, wall, or fire separation.

.3 Provide fire stop flap at fire-rated ceiling assembly.

.4 Provide access door per Section 23 33 00 – Air Duct Accessories.

3.4 Smoke Dampers

.1 Provide smoke dampers in the supply and return air streams if the air handling system:

.1 serves more than one storey.

.2 serves more than one suite in a storey.

.2 Coordinate with Division 26 for power and Division 28 for interlock/interfacing.

.3 Provide access door per Section 23 33 00 – Air Duct Accessories.

3.4 Field Quality Control

.1 Tests:

.1 Tests to cover period of not less than 2 days and demonstrate that system is functioning as specified.

3.5 Cleaning

.1 Proceed in accordance with Section 01 01 50 – General Instructions.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 35 33	Health and Safety Requirements
.3	Section 01 91 00	Commissioning
.4	Section 23 05 13	Common Motor Requirements for HVAC Equipment
.5	Section 23 05 48	Vibration & Seismic Controls for HVAC Piping & Equipment
.6	Section 23 08 00	Commissioning of Mechanical Systems
.7	Section 23 33 00	Air Duct Accessories

1.2 References

.1 Air Movement and Control Association (AMCA)

- .1 ANSI/AMCA 99-10, Standards Handbook.
- .2 ANSI/AMCA 210-07, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .3 ANSI/AMCA 300-08, Reverberant Room Method for Sound Testing of Fans.
- .4 AMCA 301-90, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB 1.181-1999, Ready-Mixed Organic Zinc-Rich Coating.

1.3 System Description

.1 Performance Requirements:

- .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.
- .2 Capacity: flow rate, static pressure, BHP, HP, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
- .3 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.
- .4 Sound ratings: comply with AMCA 301, tested to AMCA 300.
- .5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210.

1.4 Submittals

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

.1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.

.3 Provide:

.1 Fan performance curves showing point of operation, BHP and efficiency.

.2 Sound rating data at point of operation.

.4 Indicate:

.1 Motors and sheaves details.

.5 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.

.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.

.6 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.5 Quality Assurance

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.6 Delivery, Storage and Handling

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 01 50 – General Instructions.

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

.3 Waste Management and Disposal:

.2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

PART 2 PRODUCTS

2.1 Fans General

.1 Motors:

.1 In accordance with Section 23 05 13 - Common Motors Requirements for HVAC Equipment supplemented as specified herein.

.2 For use with variable speed controllers where specified.

.3 Sizes as specified.

.2 Accessories and hardware: as specified.

.3 Scroll casing drains: as indicated.

.4 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.

.5 Vibration isolation: to Section 23 05 48 - Vibration and Seismic Controls for Ductwork Piping and Equipment.

.6 Flexible connections: to Section 23 33 00 - Air Duct Accessories.

2.2 Cabinet Fans – General Purpose

.1 Fan characteristics and construction: as centrifugal fans.

.2 Cabinet hung single wheel with centrifugal fan in factory fabricated, acoustically insulated casing complete with vibration isolators and seismic control measures, motor and other accessories as noted.

.3 Fabricate casing of zinc coated or phosphate treated steel of 18 gauge reinforced and braced for rigidity. Provide removable panels for access to interior. Paint uncoated, steel parts with corrosion resistant paint to CAN/CGSB 1.181.

2.4 In-Line Centrifugal Fans

.1 Characteristics and construction: as for centrifugal fan wheels.

.2 Provide AMCA arrangements 1 or 9 as indicated with stiffened flanges, smooth rounded inlets, and stationary guide vanes.

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 Fan Installation

.1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 – Vibration and Seismic Controls for Ductwork, Piping and Equipment, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.

.2 Provide sheaves and belts required for final air balance.

.3 Bearings and extension tubes to be easily accessible.

.4 Access doors and access panels to be easily accessible.

3.3 Anchor Bolts and Templates

.1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified in Section 23 05 48 – Vibration and Seismic Controls for Ductwork, Piping and Equipment.

3.4 Field Quality Control

.1 Commissioning:

.1 In accordance with Section 01 91 00 – Commissioning, and Section 23 08 00 – Commissioning of Mechanical Systems.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 35 33	Health and Safety Requirements
.3	Section 23 05 00	Common Work Results - Mechanical
.4	Section 23 05 48	Vibration and Seismic Controls for Ductwork, Piping and Equipment
.5	Section 23 31 14	Metal Ducts

1.2 References

.1 American Conference of Governmental Industrial Hygienists (ACGIH)

.1 ACGIH Industrial Ventilation Manual of Recommended Practices, 24 th Edition.

.2 National Fire Protection Association (NFPA)

.1 NFPA 91-2010, Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids.

.2 NFPA 664-2012, Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities.

.3 American Society for Testing and Materials (ASTM)

.1 ASTM A480/A480M-2013, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A635/A635M-2013, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.

.3 ASTM A653/A653M-2013, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

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

.1 Material Safety Data Sheets (MSDS).

.5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 ANSI/SMACNA 006-2006, HVAC Duct Construction Standards, Metal ad Flexible, 3rd Edition.

.2 SMACNA HVAC Air Duct Leakage Test Manual, 2nd Edition, 2012.

.3 IAQ Guideline for Occupied Buildings Under Construction 1995, 1st Edition.

1.3 Submittals

.1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.

.2 Product Data: Submit WHMIS MSDS - Material Safety Data Sheets for the following:

.1 Sealants.

.2 Adhesive

.3 Duct tape.

.4 Duct liners.

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 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.5 Delivery Storage and Handling

.1 Protect on site stored or installed absorptive material from moisture damage.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and recycling and place in designated containers in accordance with Waste Management Plan.

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.7 Fold up metal and plastic banding, flatten and place in designated area for recycling.

PART 2 PRODUCTS

2.1 General

.1 Provide a complete dust collection system as indicated on drawings and as specified herein. Provide hoods in accordance with SMACNA Standards and make connections to indicated machines. Provide flexible non-collapsible neoprene hose connections where required for hoods. Adjacent to each machine provide blast gate (butterfly dampers will not be permitted) which shall be lockable after adjustments have been made.

2.2 Ducts

.1 Ducts shall be constructed of 20 U.S.S. gauge galvanized iron; hoods, elbows and fittings shall be 18 U.S.S. gauge. Duct seams shall be double lock. Girth seams shall be lapped 25 mm in direction of air flow. All ductwork shall be sealed to maintain 10" w.g. vacuum.

2.3 Fittings

.1 Fabrication: to SMACNA. Fittings shall be 2 gauges heavier than connecting ductwork.

.2 Radius elbows:

.1 Rectangular: Centre-line radius equal to 1.5 times width of duct, with single thickness turning vanes.

.2 Round: Centre-line radius equal to 1.5 times diameter. 5-gore for 300mm [12"] and larger; die-stamped for 254mm [10"] and smaller.

.3 Branches:

.1 Rectangular main and branch: 45° entry on branch, 30° preferred.

.2 Round main and branch: enter main duct at 45° or with conical connection. The use of spin-in collars is not acceptable.

.4 Transitions:

.1 Diverging: 20° maximum angle.

.2 Converging: 30° maximum angle.

.5 Offsets: full radius elbows.

.6 Obstruction deflectors: maintain full cross-sectional area.

.7 Provide dead end caps within 150 mm of last branch of all mains and sub mains and cleanout every 3 m and near elbow. Support ducts at least every 4 m for 200 mm diameter and smaller and every 6 m for larger ducts so as to prevent placing of any load on connected equipment and to carry weight of system of plugged.

2.4 Galvanized Steel

.1 Lock forming quality: to ASTM A 653, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA.

2.5 Hangers and Supports

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger: 500mm [20"].

.2 Hangers, hanger configuration and attachment to structure: to SMACNA.

2.6 Sealant

.1 Water based, fiber reinforced, non-toxic, elastomeric duct sealant. Temperature range of -32°C to 99°C [-26°F to 210°F]. ULC listed and comply with NFPA 90A and NFPA 90B.

.2 Flame and smoke ratings:

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

.3 Maximum VOC limit 420 g/L to SCAQMD Rule 1168 and SMACNA Technical Resource Bulletin (TRB) #9-09.

2.7 Sawdust Collection Unit

.1 Dust collector shall be a self-contained weatherproof, intermittent shaker style unit suitable for inside or outside installation. Housing shall be minimum 14 gauge all welded construction with factory standard finish. Unit shall have a support stand of welded construction and designed to the seismic rating of the site. The stand shall be bolted in place by the installing contractor.

.2 Collector will provide primary separation of heavier particles in the inlet section and secondary filtration of fine particles in the filter section. Filters to be tube-type minimum 5" (127 mm) diameter and provide 275 sq. ft. (25.5m²) or more of filtration area. Filters will be terylene unless otherwise specified. A filter access door is included. Waste storage will be in 45-gallon (170 litre) drums with castors, and supply will include drums, lids, connector sleeves, and clamps. Unit shall have a minimum of 12 cubic feet or 340 litres of storage capacity.

.3 Unit shall be c/w fully automatic electric motor driven shaker mechanism and remote pre-wired control panel for the fan and shaker supplied by the dust collector manufacturer. The shaker mechanism shall include the 0.5 HP TEFC shaker motor, 575V/60/3, three phase shaker motor starter and solid state single cycle timer 115/60/1. The prewired control panel requires a single power feed, is a NEMA 12 enclosure and houses the three phase shaker and fan motor starters, 115V/60/1 control transformer, 115V/60/1 timer, fused door disconnect switch, push button on/off switch and fan "on" pilot light. The panel is to bear CSA approval. Wiring to and from the panel and supply (as required) of motor disconnects (other than at the panel) are by the electrical trade.

.4 Collector shall be supplied with a minimum Class II, backward inclined radial tipped belt driven fan integrally top mounted on the cleanside of the filter, complete with 1800 RPM, high TEFC motor and belt guard. Fan performance: 3350 CFM (1581 L/S), 10" (2.5 Kpa) T.S.P, driven by 10 HP. 600/3/75 motor.

.5 Location/orientation/rotation of the collector inlet, discharge, shaker, filter door, fan, and drum access to be as per the drawings. Provide inlet blowback prevention damper and explosion relief responsive to equipment location. Provide sprinkler rack and flame arrestor and dust collector.

.6 An inline discharge silencer with elbow shall be supplied by the dust collector supplier installed by the contractor. The pressure drop shall not exceed 100 Pa and the minimum insertion losses in the third fourth and fifth octave bands shall be as scheduled. Inline silencer minimum insertion losses in bands 3, 4, and 5 shall be 12, 19, and 22.

PART 3 EXECUTION

3.1 General

.1 Do work in accordance with NFPA 90A, NFPA 90B, ASHRAE, SMACNA, and as indicated.

.2 Support risers in accordance with SMACNA.

.3 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.4 Apply protective galvanize coating to galvanized ductwork and accessories which have been welded.

.5 Apply duct sealer to all joints of metal ducts, connections to equipment.

3.2 Hangers

.1 Strap hangers: Install in accordance with SMACNA.

.2 Rectangular duct: Extend strap hanger down on both sides of duct, turn under bottom 25mm [1"] minimum. On each strap provide two sheet metal screws on the side and one in the bottom.

.3 Angle hangers: complete with locking nuts and washers.

.4 Hanger spacing: to SMACNA.

.5 Seismic restraint to Section 23 05 48 – Vibration and Seismic Controls for Ductwork, Piping and Equipment.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 35 33	Health and Safety Requirements
.3	Section 23 05 00	Common Work Results – Mechanical

1.2 System Description

.1 Performance Requirements:

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

1.3 Submittals

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions. Include product characteristics, performance criteria, and limitations.

.2 Indicate following:

.1 Capacity.

.2 Throw and terminal velocity.

.3 Noise criteria.

.4 Pressure drop.

.5 Neck velocity.

.2 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.

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

.2 Instructions: submit manufacturer's installation instructions.

1.4 Quality Assurance

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.5 Delivery, Storage and Handling

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 01 50 – General Instructions.

.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 01 50 – General Instructions.

1.6 Maintenance

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 01 50 – General Instructions.

.2 Include:

.1 Keys for volume control adjustment.

.2 Keys for air flow pattern adjustment.

PART 2 PRODUCTS

2.1 General

.1 Size as indicated.

.2 Capacity, pressure drop, terminal velocity, throw, noise level, neck velocity shall conform to intended performances of specified materials.

.3 Frames:

.1 Full perimeter gaskets.

.2 Plaster frames where set into plaster or gypsum board and as specified on architectural reflected ceiling plans.

.3 Concealed fasteners.

.4 Where balancing damper is scheduled, damper shall be of opposed blade type.

.5 Diffusers, grilles and registers in areas with high humidity shall be of aluminum construction.

.6 Provide neck transition as required.

2.2 Manufactured Units

.1 Grilles, registers and diffusers of same generic type, product of one manufacturer.

2.3 Supply Grilles and Registers

.1 Supply grille, Type SG-1: fixed louvre, steel, 32 mm border, 19 mm o.c. blade spacing, double deflection, front blades parallel to long dimension. Finish: silver baked enamel.

.2 Supply register, Type SR-1: fixed louvre, steel, 32 mm border, 19 mm o.c. blade spacing, double deflection, front blades parallel to long dimension, coated steel opposed blade damper. Finish: silver baked enamel.

2.4 Return, Exhaust, and Transfer Grilles and Registers

.1 Exhaust grille, Type EG-1: fixed louvre, aluminum, 32 mm border, 45 degree deflection, 19mm blade pacing, front blades parallel to long dimension. Finish: white baked enamel.

.2 Return air grille, Type RG-1; and transfer air grille, Type TG-1: egg crate, steel, 13 mm x 13 mm x 13 mm aluminum grid core, lay-in. Finish: white baked enamel.

.3 Transfer air grille, Type TG-2: egg crate, steel, 13 mm x 13 mm x 13 mm aluminum grid core, surface mounted. Finish: baked enamel, color as selected by architect from manufacturer's standard color choices.

.4 Exhaust register, Type ER-1: fixed louvre, aluminum, 32 mm border, 45 degree deflection, 19mm blade pacing, front blades parallel to long dimension, coated steel opposed blade damper. Finish: white baked enamel.

.5 Exhaust register, Type ER-2: fixed louvre, aluminum, 32 mm border, 45 degree deflection, 19mm blade pacing, front blades parallel to long dimension, coated steel opposed blade damper. Finish: baked enamel, color as selected by architect from manufacturer's standard color choices.

2.5 Diffusers

.1 Supply diffuser, Type SD-1: square cone diffuser, 3-cones, four-way throw, steel, having fixed pattern, round inlet collar, lay-in or with dry-wall ceiling frame. Finish: white baked enamel.

.2 Supply diffuser, Type SD-2: round cone diffuser, 4-cones, air pattern adjustable from full horizontal to full vertical, heavy gauge spun steel, volume control damper and custom baked enamel finish to be selected by Architect.

2.6 Undercut and Door Grilles

.1 Type A: 20 mm undercut.

.2 Type B: door grille, 508 mm x 305 mm, aluminum, 32 mm border, both sides, countersunk screw hole fastening, sight proof. Finish: silver baked enamel.

.3 Type C: door grille, 508 mm x 406 mm, aluminum, 32 mm border, both sides, countersunk screw hole fastening, sight proof. Finish: silver baked enamel.

.4 Type D: door grille with fire damper, 457 mm x 356 mm. Finish: silver baked enamel.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 Installation

.1 Install in accordance with manufacturer's instructions.

.2 Install with flat head screws in countersunk holes where fastenings are visible.

.3 Bolt grilles, registers and diffusers, in place, in gymnasium and similar game rooms.

.4 Paint matte black behind all diffusers, grilles and registers so that no metallic part will be visible from the exposed side.

.5 Provide tamperproof screws for security grilles/diffusers located in inmate accessible areas. For grilles/diffusers supplied with sleeve and angle frame, stitch weld to metal duct. The use of flexible duct connection to security grilles/diffusers is not acceptable.

.6 Stitch weld steel angles shipped loose with security grilles/diffusers.

.7 Provide security joint sealant on all medium and maximum security grilles/diffusers.

.8 Provide security bars at transfer air openings above ceiling in inmate accessible areas.

.9 Provide concealed safety chain on each grille, register and diffuser in gymnasium and similar game rooms.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 01 01 50 — General Instructions

.2 Section 01 35 33 — Health and Safety Requirements

.3 Section 23 05 00 — Common Work Results – Mechanical

.4 Section 23 05 48 — Vibration and Seismic Controls for Ductwork, Piping and Equipment

1.2 References

.1 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.

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.3 Air Movement and Control Association (AMCA)

1.3 System Description

.1 Performance Requirements:

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

1.4 Submittals

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions. Include product characteristics, performance criteria, and limitations.

.1 Indicate following:

.1 Pressure drop.

.2 Face area

.3 Free area.

.4 Beginning point of water penetration.

.2 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.

.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 Test Reports:

.1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

1.5 Quality Assurance

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.6 Delivery, Storage and Handling

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 01 50 – General Instructions.

.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 01 50 – General Instructions.

PART 2 PRODUCTS

2.1 Gravity Roof Outside Air Intake and Relief Vents –Hood Type

.1 Factory manufactured aluminum hooded, roof mounted gravity ventilator.

.1 Bolted and welded construction utilizing corrosion resistant fastener. Minimum 18 gauge aluminum, bolted to minimum 8 gauge aluminum support structure. Complete with lifting lugs, rain gutter, anti-condensate coating.

.2 The base shall have continuously welded curb cap corners.

.3 Birdscreen: 12mm [1/2"] galvanized mesh screen.

.4 Roof curb: galvanized steel construction, minimum 18 gauge. Complete with damper tray,

.5 Accessories: as scheduled or indicated.

2.2 Louvres

.1 Louvres shall have free areas as scheduled, be of extruded aluminum sections and have all welded assemblies. Fitted with removable aluminum 12mm (1/2") mesh, 16 gauge bird-screen on interior. Louvre flanges shall be suitable for type of construction encountered, caulked and weather-tight.

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 In accordance with manufacturer's and SMACNA recommendations.

.2 Reinforce and brace as indicated.

.3 Anchor securely into opening. Seal with caulking around to ensure weather tightness.

3.3 Anchor Bolts and Templates

.1 Gravity Ventilator: Size anchor bolts to withstand seismic acceleration and velocity forces as specified in Section 23 05 48 – Vibration and Seismic Controls for Ductwork, Piping and Equipment.

3.4 Cleaning

.1 Proceed in accordance with Section 01 01 50 – General Instructions.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 01 01 50 — General Instructions

.2 Section 01 35 33 — Health and Safety Requirements

.3 Section 01 91 00 — Commissioning (Cx) Plan

.4 Section 23 08 00 — Commissioning of Mechanical Systems

1.2 References

.1 National Electrical Manufacturer's Association (NEMA)

.2 Canadian Standards Association (CSA)

.1 CSA C22.2 No.46-2013, Electric Air-Heaters.

1.3 Submittals

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

.1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.

.3 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.4 Quality Assurance

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.5 Delivery, Storage and Handling

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 01 50 – General Instructions.

.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 01 50 – General Instructions.

PART 2 PRODUCTS

2.1 Electric Duct Heater

.1 Heater: open coil duct heater.

.2 Capacity: as scheduled.

.3 Clearance to combustible: CSA approved for zero clearance from combustible materials.

.4 Duct connection: flanged casing or invert type as scheduled.

.5 Frame: constructed of corrosion protected galvanized heavy gauge steel.

.6 Provide automatic and manual reset thermal cut outs as required by CSA and pressure differential air flow proving device. Heaters shall have factory wired SCR controls for modulating control, "silent" contactors, disconnect switch, and 24 volt control transformer, modulating duct thermostat with remote adjuster. All factory wiring shall be brought to clearly identified terminals.

.7 Division 26 (electrical) shall provide power to the coil disconnect switch. Control wiring between the room thermostat and the duct heater will be provided by Division 25.

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 Field Quality Control

.1 Commissioning:

.1 In accordance with Section 01 91 00 – Commissioning, and Section 23 08 00 – Commissioning of Mechanical Systems.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 35 33	Health and Safety Requirements
.3	Section 01 91 00	Commissioning
.4	Section 23 05 00	Common Work Results – Mechanical
.5	Section 23 05 48	Vibration & Seismic Controls for HVAC Piping & Equipment
.6	Section 23 08 00	Commissioning of Mechanical Systems

1.2 References

.1 American National Standards Institute (ANSI) / Canadian Standards Association (CSA International)

- .1 ANSI Z83.8-2013/CSA 2.6-2013, Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters and Gas-Fired Duct Furnaces.

.2 Canadian Standards Association (CSA International)

- .1 CAN/CSA-B149.1-10, Natural Gas and Propane Installation Code.
- .2 CAN/CSA-B149.2-10, Propane Storage and Handling Code.

.3 Canadian Electrical Code

1.3 Submittals

.1 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

- .1 Submit shop drawings in accordance with Section 01 01 50 – General Instructions.
- .2 Indicate the following:
  - .1 Equipment, piping and connections, together with valves, control assemblies, thermostatic controls, auxiliaries and hardware and recommended ancillaries which are mounted, wired and piped ready for final connection to building system, its size and recommended bypass connections.
  - .2 Piping, valves and fittings shipped loose showing final location in assembly.
  - .3 Control equipment shipped loose, showing final location in assembly.
  - .4 Field wiring diagrams.
  - .5 Dimensions, internal and external construction details, installation clearances recommended method of installation, sizes and location of mounting bolt holes.

.6 Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories, controllers.

.3 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.

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

.2 Instructions: submit manufacturer's installation instructions.

.4 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.4 Quality Assurance

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.5 Delivery, Storage and Handling

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 01 50 – General 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 01 50 – General Instructions.

1.6 Warranty

.1 Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

.2 Manufacturer's Warranty: Submit, for Departmental Representative's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Departmental Representative may have under Contract Documents.

.3 Warranty: Commencing on Date of Installation.

.1 Sheet metal parts: 1 year (limited).

.2 Other Covered Components: 2 years (limited).

.3 Stainless Steel Heat Exchangers: 10 years (limited).

PART 2 PRODUCTS

2.1 General

.1 Provide CSA approved, packaged factory assembled unit consisting of cabinet, fan, induced fan, fan motor, intake/exhaust assembly, heat exchanger, separated combustion chamber, burner, controls.

.2 Thermal efficiency level range: 80%.

.3 Certification of components and construction of factory assembled gas-fired unit: to ANSI Z83.8/CGA 2.6 for gas fired unit heaters.

.4 Capacity: as scheduled.

.5 Air flow rate: as scheduled.

.6 Input: natural gas (propane gas) as scheduled.

.7 Electrical characteristics: as scheduled.

2.2 Cabinet

.1 Minimum 20 gauge aluminized steel with baked-on polyester powder paint 7-mil thickness finish.

.2 Easily removed and secured access doors for components requiring service.

2.3 Heat Exchanger

.1 Type 409 stainless steel tubes, header tubes and headers.

2.4 Combustion Chamber

.1 Power vent, induced draft: to manufacturer's standard.

.2 Sealed type: 100% outside air, to ANSI Z21.64.

2.5 Circulation Blower Motor Assembly

.1 Blower: propeller type:

.1 Statically and dynamically balanced.

.2 Motor: overload protection.

2.6 Heater Burner

.1 General: to bear CSA and ULC labels.

.2 Gas burner:

.1 In-shot type, directly firing each heat exchanger tube individually.

.2 Electronic ignition system with direct spark igniter.

.3 Manual main shut-off valve, automatic safety pilot, automatic electric valve and gas pressure regulator.

.4 Fan operating control switch with adjustable set points and continuous operating switch.

.3 Safety controls:

.1 Electronic combustion control relay with flame rectification sensor to detect and supervise flame by shutting off fuel upon flame failure or safety interlock signal within seconds, in sequence pre-purge-pilot ignition, supervision-main valve opening-pilot cut-off-burner operation and roll out switch.

.2 Blocked vent shut-off switch or control system.

.3 Limit control to shut down furnace if heat exchanger temperature exceeds limit setting. Combination fan and limit control to be spiral wound.

.4 Electronic board built-in diagnostics.

2.8 Intake and Vent Assembly

.1 Provide manufacturer's standard wall combined concentric vent and intake complete with termination assembly.

.2 Galvanized steel or other suitable corrosion resistant material. Not PVC or other forms of plastic venting material.

2.9 Controls

.1 General: conform to CSA C22.2 No.24.

.2 Operating controls:

.1 Programmable wall mount temperature sensor.

.2 Control transformer and 24 Volt controls.

.3 Motor starters or contactors.

.4 Fan operating control switch with adjustable set points and continuous operating switch.

PART 3 EXECUTION

3.1 Installation

.1 Install in accordance with manufacturer's instructions, regulations of authorities having jurisdiction and to CSA-B149.1 and Canadian Electric Code.

.2 Provide support and seismic restraints to withstand seismic acceleration and velocity forces as specified in Section 23 05 48 – Vibration and Seismic Controls for Ductwork, Piping and Equipment.

3.2 Start-up and Commissioning

.1 Start-up and submit written report to Engineer.

.2 Commissioning:

.1 In accordance with Section 01 91 00 – Commissioning and Section 23 08 00 – Commissioning of Mechanical Systems.

3.3 Cleaning

.1 Proceed in accordance with Section 01 01 50 – General Instructions.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Halocarbons

.1 Comply with all of:

.1 Federal Halocarbon Regulations, 2003;

.2 *Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems* (the Environment Canada "Refrigeration Code of Practice") Cat. No.: En14-207/2015E-PDF. . April, 2015.

.2 Work on Halocarbon Systems includes installation, servicing, leak testing or charging of a refrigeration system or an air-conditioning system or doing any other work on the system that may result in the release of a halocarbon.

.3 All work on Halocarbon Systems shall be carried out only by a "Certified Person" as defined by the Federal Halocarbon Regulations 2003.

.1 Provide copies of all technicians' certificates to the Departmental Representative.

.4 Halocarbons listed under Item 1 through 10 of Schedule 1 of Federal Halocarbon Regulations, 2003 (SOR/2003-289) are not acceptable refrigerants.

.5 Document **all** work on Halocarbon Systems using CSCs halocarbon form "**Information Required for Refrigeration Systems at Federal Correctional Facilities**". Obtain the latest form from Departmental Representative. Affix the completed form to equipment, and submit a copy of the form to Departmental Representative.

.6 Comply with the following timelines:

.1 Upon delivery of halocarbon-containing equipment to site, submit the following information to Departmental Representative within 24 hours of service;

.1 Make

.2 Model

.3 Serial number

.4 Type of halocarbon

.5 Halocarbon charging capacity of system (kg or lbs)

.6 Factory Halocarbon Charge (kg or lbs)

.7 Cooling capacity (kW, Btuh, or Tons)

.2 Leak-test factory-charged halocarbon-containing equipment containing over 10kg of refrigerant in accordance with the Refrigeration Code of Practice within one week of equipment delivery to site.

.3 Leak-test field-charged halocarbon-containing equipment in accordance with Section 4.4 of the Refrigeration Code of Practice at the time of field charging of system.

.4 For all work on Halocarbon Systems, submit forms to Departmental Representative within 48 hours of work.

.5 For release of halocarbons >10 kg and <100 kg, submit forms to Departmental Representative within 24 hours of discovery of release.

.6 For release or potential release of halocarbons > 100 kg, submit forms to Departmental Representative **immediately**.

.7 Conduct annual leak tests of halocarbon-containing equipment with 19kW (5.4 tons) or greater cooling capacity in accordance with the Federal Halocarbon Regulations, 2003 until such time as Interim Certificate of Completion is issued.

END of SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 91 00	Commissioning
.3	Section 23 05 13	Common Motor Requirements for Mechanical Equipment
.4	Section 23 05 48	Vibration & Seismic Controls for Ductwork, Piping & Equipment
.5	Section 23 08 00	Commissioning of Mechanical Systems
.6	Section 23 73 12	Halocarbon Management

1.2 References

.1 Air Conditioning and Mechanical Contractors (AMCA)

- .1 ANSI/AMCA 99-10, Standards Handbook.
- .2 ANSI/AMCA 210-07, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .3 ANSI/AMCA 300-08, Reverberant Room Method for Sound Testing of Fans.
- .4 AMCA 301-90, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.2 American National Standards Institute/Air-Conditioning and Refrigeration Institute (ANSI/ARI)

- .1 ANSI/ARI 430-2009, Central Station Air Handling Units.

.3 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.4 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

- .1 ANSI/ASHRAE/IESNA 90.1-2013; Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 ANSI/ASHRAE 15-2013, Safety Code for Mechanical Refrigeration.

.5 Federal Halocarbon Regulations, 2003.

1.3 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.

.2 Indicate the following:

- .1 Unit configuration including plan and elevations drawn to scale.
- .2 Fan curve showing point of operation
- .3 Fan sound power information.
- .4 Fan vibration isolation detail.
- .5 Motor data.

.6 Shipping detail and operating weight.

.7 Detailed total static pressure calculations

.8 Coil selections.

.9 VFD

.10 Unit sound data.

1.4 Closeout Submittals

.1 Provide maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

.2 Include the "CSC Commissioning Form – Refrigeration or Air-Conditioning System" in the O&M manual and provide a copy to the Departmental Representative.

1.5 Waste Management and Disposal

.1 Separate and recycle waste materials in accordance with Section 01 01 50 – General Instructions.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

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

.5 Divert unused paint material from landfill to official hazardous material collections site.

.6 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.

1.6 Extra Materials

.1 Provide maintenance materials in accordance with Section 01 01 50 – General Instructions.

.2 Furnish following spare parts:

.1 One set of spare filters.

PART 2 PRODUCTS

2.1 Outdoor Packaged DX Air Handling Units

.1 General:

.1 Manufacturer shall provide installing contractor all required details of fan installation within plenum chambers and with technical start up assistance including check lists of field tests for inclusion in equipment manuals.

.2 Roof Curb:

.1 Factory fabricated 12 gauge, galvanized steel mounting curb designed for seismic conditions. Manufactured by air handling unit manufacturer with full support for unit base frame.

.2 Roof curb shall be field insulated with 50mm [2"] acoustic insulation.

.3 Provide gaskets for field mounting between unit base and roof curb.

.4 Method of installation and flashing shall be coordinated with project construction details.

.5 Minimum 305mm [12"] unless otherwise noted.

.6 Roof curb shall accommodate piping vestibule.

.3 Base:

.1 Unit base shall be constructed of structural perimeter channel iron frame with intermediate channel and angle iron supports.

.2 Provide 16 gauge steel floor with all seams continuously welded.

.3 For units 60 inches and higher, the floor shall have epoxy non-slip impregnated painted finish. Floors to be watertight with drains on both sides of coils.

.4 Provide lifting brackets on the unit section bases to accept cable or chain hooks.

.4 Casing:

.1 Walls and roof shall be constructed of double break design 16 gauge galvanized and painted steel panels with overlapped seams gasketed and caulked, not exceeding 610mm [24"].

.2 All required holes in casing for controls, electrical, etc. shall have grommets. Seal all openings neatly and airtight. Site sealed openings shall be to a standard set by manufacturer.

.3 Floor duct openings shall be supplied with safety grates.

.4 Unit shall be manufactured for outdoor application including sloped roofs, door rain gutters and weather shields.

.5 Access Doors:

.1 Provide double neoprene gasketed doors in each equipment section to provide servicing access to all components and to allow for removal of motors and components as required.

.2 Doors shall be of insulated double wall construction with continuous closed cell automotive door gasket, heavy duty "Leverlock" door securing handles.

.3 All doors shall open against pressure, or shall be fitted with a fail-safe stop and manual latch release to permit the door to open partially to relieve fan pressure before manually releasing latch.

.4 All access panels to have pad lock and hasp or be key lockable in a manner acceptable to the owner to prevent unauthorized access to unit components and controls.

.6 Acoustic Liner:

.1 All walls, partitions and roof shall be insulated with 50mm [2"], 48 kg/m3 [3 lbs/cubic foot] neoprene coated fibre glass insulation secured with fire retardant adhesive.

.2 Underside of base shall have 50mm [2"], 48 kg/m3 [3 lbs/cubic foot] rigid foam.

.3 All edges of insulation shall be covered with metal Z-bar.

.4 Provide 24 gauge galvanized steel perforated in all sections to protect insulation.

.7 Finish:

.1 All metal surfaces shall be pre-painted with vinyl wash primer to ensure paint bond to metal.

.2 All uncoated steel shall be painted with red oxide primer.

.3 Unit casing shall be undercoated with two component zinc chromate primer and finish painted with electrostatically applied enamel paint.

.8 Mixing dampers:

.1 Return air: multi-opposed blade, low leakage type.

.2 Outdoor and relief air: insulated, multi-opposed blade, low leakage type.

.3 Dampers shall be sized to a minimum velocity of 7.62m/sec [1500 fpm] and a maximum velocity of 10.1m/sec [2000 fpm] and located to provide efficient air mixing and easy access to linkages and damper operators.

.4 Dampers blades shall parallel where needed to eliminate stratification.

.5 Damper blades shall be extruded aluminum air foil shaped with synthetic rubber blade and frame seals mechanically fastened.

.6 Damper locations shall permit easy access to linkages and damper operators.

.9 Fans

.1 All fans shall be belt driven c/w fan base, motor, belts, sheaves, inlet bell, inlet and discharge screens (where applicable) and extended grease nipples.

.2 Provide neoprene coated flexible connector on fan inlet/outlet.

.3 All fans shall be statically and dynamically balanced for quiet operation.

.4 Units shall have solid steel fan shafts mounted in heavy duty, self-aligning, L10-80K relubricative ball bearings. Fans with hollow shafts are not acceptable.

.5 Plenum fans shall be completely enclosed by expanded metal mesh including fan inlet and outlet, door latches or door screens shall not be considered a suitable substitute.

.10 Motors

.1 Type: heavy duty, high efficiency, 1800 RPM, T.E.F.C. motors with 1.15 service factor.

.2 Motors shall have heavy gauge structural steel base adjustable for motor alignment and belt tensioning by threaded bolt positioners. Extra set of sheaves shall be supplied, if required, when final air balance made. All motors shall be aligned and belts properly tensioned prior to turnover and acceptance by owner. V-belt drive shall be suitable for 150% of motor rating. Fan shall be guarded to WCB regulations, and be provided with openings suitable for instrument.

.11 Fan Base

.1 Fan base shall be formed with structural channel.

.2 Fan base shall have housed spring vibration isolators with seismic restraints selected to meet performance as specified in Section 23 05 48 – Vibration & Seismic Controls for HVAC Piping & Equipment, for the required load.

.12 Coils

.1 Heating and DX cooling coils shall be constructed of seamless copper tubing

.2 Coils shall be fully enclosed within the casing and mounted on primed and painted angle iron racks manufactured to facilitate easy removal of coils.

.3 Removable coil access panel shall be provided to remove coil through casing wall. Coils shall be sealed to casing to allow no air by-pass.

.4 If not scheduled, coils selected by manufacturer shall not exceed 2.5m/sec. [500 fpm].

.5 Coils shall be ARI rated, pressure tested to 2.4 MPa [350 psi] air under water.

.6 Heating coil piping from building to coil shall be enclosed in a piping vestibule. Piping vestibule shall accommodate piping appurtenance including control valve and isolation valves.

.7 For DX coils, evacuate and charge coil with nitrogen and seal before sending to site

.13 Drain pans

.1 Drain pans shall be provided for coils.

.2 Constructed to SMACNA standards, continuously welded 304 stainless steel pans extending to outside of unit at header and return bends.

.3 Intermediate drain pans shall be interconnected with 304 stainless steel 32mm drain lines. Provide a 32mm drain pipe from lowest drain pan to exterior of unit through channel with stub suitable for connection.

.4 Drain pans must extend upstream and downstream as required to ensure no carry-over and provide access for cleaning.

.5 Drain pans shall have sloped bottom for positive drainage.

.14 Filters

.1 Provide 50mm thick MERV 8 pleated filter.

.2 Filter sections shall have filter racks, and access doors for filter removal and block-offs as required to prevent air bypass around filters.

.3 Filter area shall be as scheduled. Where not scheduled, they shall be designed and selected for a face velocity of less than 2.5m/sec. [500fpm].

.4 Provide 0-250 Pa. [0-1"wg.] magnehelic gauge for each filter bank, complete with static pressure tappings and tubing. Mount in accordance with manufacturer's instructions.

.5 All filter media shall be replaced with new filter media upon turn over and acceptance of job. Provide 1 spare set of filters to Owner upon turn over.

.15 Air-Cooled Condensing Section

.1 Provide air-cooled condensing section to form an integral part of the air handling unit and shall be engineered by air handling unit manufacturer. Air-cooled condensing unit shall include compressors, condenser coils and fans, refrigerant piping, full charge of refrigerant, and refrigeration controls.

.2 Compressors

.1 Compressors shall be hermetic type, 3600 RPM, set on resilient neoprene mounts and complete with line voltage break internal overload protection, internal pressure relief valve and crankcase heater.

.2 Make-up air and VAV units shall have minimum 3 compressors.

.3 Condenser Coils

.1 Condenser coils shall be copper tube type, mechanically expanded into aluminum fins. Coils shall be factory tested with air at 300 psig (2070 kPa) while immersed in an illuminated water tank.

.4 Condenser Fans

.1 Condenser fans shall be ultra-quiet type, direct driven propeller type, arranged for vertical draw through air flow. Motors shall be weather resistant type, with integral overload protection and designed for vertical shaft condenser fan applications. Fan and motor assemblies shall be mounted on a formed orifice plate for optimum efficiency with minimum noise level.

.5 Refrigeration

.1 Units shall be pre-charged with R-410A refrigerant and shall operate down to 50°F (10°C) as standard. Where applicable, multiple refrigeration circuits shall be separate from each other. Refrigeration circuits shall be complete with liquid line filter-driers, and service ports fitted with Schraeder fittings. Units shall also incorporate load compensated thermal expansion valves with external equalizers and combination sight glass moisture indicators. The complete piping system shall be purged and pressure tested with dry nitrogen, then tested again under vacuum. Each system shall be factory run and adjusted prior to shipment.

.1 Controls for hermetic compressor units shall include compressor and condenser fan motor contactors, supply fan contactors and overload protection control circuit transformer, cooling relays, ambient compressor lockout, automatic reset low pressure controls, and high pressure controls on compressors over 5 tons. Head pressure actuated fan cycling control shall be provided on all multiple condenser fan units.

.2 Provide five minute anti-cycle timers.

.3 Provide interstage time delay timers.

.4 Provide hot gas bypass on the lead compressor to maintain adequate suction pressure in the event of low loads. This feature shall be provided on all VAV and Make-Up Air applications with less than four stages of cooling control.

.6 Controls:

.1 Provide factory electronic control system to stage the compressors based on discharge air control with set point from the BMS. Incorporate PI control scheme that reduces temperature droop by resetting the set point after each stage is cycled on.

.2 Provide an adjustable deadband range between heating and cooling from 2° F to 11° F. While in the range, the outside air dampers shall be in minimum position.

.3 Provide BM override on minimum position.

.16 Electrical

.1 Units equipped with adjustable speed drives shall be factory wired for single point power connection. For units not equipped with adjustable speed drives, the starters and disconnect switches shall be supplied by Division 26.

.2 Units shall be furnished with dead-front disconnect, adjustable speed drives (where scheduled), transformers for 24 volt control circuit with fuse protection.

.3 Control enclosure will be NEMA 3R rated for outdoor applications.

.4 All wiring shall be run in EMT conduit.

.5 Provide maximum 3 feet of flexible Liquid-tite between EMT and motor.

.6 The manufacturer shall label and number code all wiring and electrical devices in accordance with the unit electrical diagram. The unit shall be labeled and certified to CSA, UL, ETL, or NRTL. The manufacturer is to provide proof of this certification at time of submittal.

.7 Units 1500mm [60"] and higher shall also have switched marine lights in each fan section as well as the filter section where walk in access is provided for servicing. Marine lights shall be glass globe style with a zinc plated steel wire guard. Provide with 100 watt service duty light bulbs. Wiring from switches to lights and junction box to service outlets to be factory installed. All wiring shall be installed in EMT conduit complete with necessary couplings and connectors. The 120V power supply will be provided separately by electrical trade to allow power to lights and receptacles when the main unit disconnect is off.

.8 Provide mounting bracket and factory pre-wire disconnect switch to terminal blocks and motors to terminal blocks.

.9 Provide 120 volt service receptacle. Power will be provided separately by electrical trade.

.17 Adjustable Speed Drives

.1 Variable volume units shall incorporate Adjustable Speed Drive controllers in place of magnetic starters.

.2 ASD's shall be factory installed and wired.

.3 The drive shall be accessed through a hinged access door complete with a 5/16" (8mm) hex key latch. The door shall be hinged.

.4 Variable frequency drives are still to be wired to a single point power connection as noted above.

PART 3 EXECUTION

3.1 Installation

.1 Provide appropriate protection apparatus.

.2 Install units in accordance with manufacturer's instructions and as indicated.

.3 Ensure adequate clearance for servicing and maintenance.

.4 Size anchor bolts to withstand seismic acceleration and velocity forces as specified in Section 23 05 48 – Vibration and Seismic Controls for Ductwork, Piping and Equipment.

.5 Make piping connections.

.6 Nothing to obstruct ready access to components or to prevent removal of components for servicing.

.7 The installation shall be completed in compliance with Federal Halocarbon Regulations, 2003.

3.2 Fans

.1 Install fan sheaves required for final air balance.

.2 Install flexible connections at fan inlet and fan outlets.

3.3 Condensate drain.

.1 Install deep seal P-traps on drip lines.

3.4 Start-up and Commissioning

.1 Charge refrigerant, start-up and submit written report to Departmental Representative.

.2 Commissioning:

.1 In accordance with Section 01 91 00 – Commissioning, and Section 23 08 00 – Commissioning of Mechanical Systems.

.2 For each refrigeration system, complete the "CSC Commissioning Form – Refrigeration or Air-Conditioning System". Include the form(s) in the O&M manual and provide a copy to the Departmental Representative.

3.5 Cleaning

.1 Proceed in accordance with Section 01 01 50 – General Instructions.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 33 00	Submittal Procedures
.2	Section 01 35 33	Health Safety Requirements
.4	Section 01 61 00	Product Requirements
.5	Section 01 74 11	Cleaning
.6	Section 01 74 19	Waste Management Disposal
.7	Section 01 78 00	Closeout Submittals
.8	Section 01 91 13	General Commissioning (Cx) Requirements
.9	Section 23 05 13	Common Motor Requirements for HVAC Equipment
.10	Section 23 05 48	Vibration & Seismic Controls for HVAC Piping & Equipment
.11	Section 23 08 00	Commissioning of Mechanical Systems
.12	Section 23 33 00	Air Duct Accessories

1.2 References

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C273.3-M91, Performance Standard for Split-System Central Air-Conditioners and Heat Pumps.

.2 CAN/CSA-C656-M92, Performance Standard for Single Package Central Air Conditioners and Heat Pumps.

.2 Environment Canada, (EC)/Environmental Protection Services (EPS)

.1 EPS 1/RA/2-1996, Code of Practice for Elimination of Fluorocarbons Emissions from Refrigeration and Air Conditioning Systems.

.2 Environment Canada-1994, Ozone-Depleting Substances Alternatives and Suppliers List.

1.3 Scope

.1 Packaged indirect fired make-up air unit.

1.4 Quality Assurance

.1 Comply with local and Provincial Regulations and have CSA, CGA or CETL approval stickers.

.2 All units and major components shall be product of manufacturer regularly engaged in production of such units who issues complete catalogue data on such products.

.3 The unit shall be fully assembled, wired and tested prior to shipment. A detailed pre-shipment report shall be provided to the Consultant. If necessary, the unit may be broken down for shipment.

.4 Fans shall conform to AMCA bulletins regarding construction and testing.

.5 Filter media shall be UL listed, Class I or Class II as approved by local authorities.

.6 Test operation of the unit before and after installation.

.7 Motors shall be high efficiency as specified in Section 23 05 03.

1.5 Submittals

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

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

.3 Provide:

.1 Fan performance curves showing point of operation, BHP and efficiency.

.2 Sound rating data at point of operation.

.4 Indicate:

.1 Motors and sheaves details.

.5 Quality assurance submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.

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

.2 Instructions: submit manufacturer's installation instructions.

.6 Closeout Submittals:

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

1.6 Delivery, Storage And Handling

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Product Requirements.

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

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management Disposal.

1.7 Alternatives

.1 Size, NBS test efficiency, initial and final resistance of alternate manufacturer's filters shall be same as types specified.

.2 Pressure drops and such features as cleanability, service access, frames and supports, shall be the same as types specified.

1.8 Warranty

.1 Provide 5 years unconditional parts warranty on heat exchangers.

1.9 Extra Materials

.1 Provide maintenance materials in accordance with Section 01 01 50 – General Instructions.

.2 Furnish following spare parts:

.1 One set of spare filters.

PART 2 PRODUCTS

2.1 Type

.1 Provide blow through packaged indirect fired make-up air unit of unitary design, suitable for low pressure operation and in configurations as shown on the drawings.

.2 Unit shall consist of basic fan filter section plus accessories, including gas fired heat exchangers, motorized outdoor air damper, remote panel.

2.2 Casing

.1 Heavy formed structural steel framework shall mount equipment and support exterior steel panels. Reinforce panels where required.

.2 Provide hinged access doors to provide access to sections and components requiring servicing. Minimum size of *450 mm**18 in.* x *full height.* complete with lever door handle fasteners and gasket seals.

.3 Construct indoor units of galvanized steel, finished in electrostatically applied air-dried enamel.

.4 Drain pans shall be heavy gauge one piece stainless steel with welded corners.

2.3 Insulation

.1 Insulate entire unit panels with *25 mm**1 in.*** neoprene coated fibreglass insulation, 'K' value at *24°C**75°F*** maximum *0.035 W/m°C**0.25 Btu-in/(hr ft^2 °F)***.

.2 Protect all internal insulation with perforated metal liner.

2.4 Fan

.1 Refer to Section 23 34 00 for acceptable fan manufacturers.

.2 Forward curve, double inlet, statically and dynamically balanced centrifugal fan. Heavy duty shaft and pre-lubricated self-aligning bearings, rubber mounted V-belt drive, adjustable variable pitch motor pulley, rubber isolated hinge mounted motor.

.3 Fan motor assembly shall be mounted on a free floating angle iron frame and internally isolated from rest of the unit using base isolators and canvas connectors.

.4 Entire fan assembly shall be seismically restrained using approved methods.

2.5 Filters

.1 Refer to Section 23 44 00 for detailed filter specification.

.2 Provide filter section complete with removable *50 mm**2 in.*** thick pleated disposable filters in metal frames. Average efficiency 30-35% on ASHRAE Test Standard 52-76.

.3 Arrangement: Flat filter section to limit filter velocity, based on gross area, to less than *2 m/s.**400 fpm.*** Provide access doors minimum *450 mm**18 in.*** x height of unit both sides.

2.6 Gas Fired Heat Exchanger

.1 Heating Section shall be natural gas fired complete with 100% safety shut off, electronic spark ignition, pressure regulator manual shut off valve, high temperature cut out, adjustable air supply limit switch and modulating control.

.2 Heat exchanger shall be a cylindrical drum and tube design constructed of stainless steel.

.3 The burner assembly shall be a blow through positive pressure type with an intermittent pilot ignition system to provide a high seasonal efficiency. Flame surveillance shall be with a solid-state programmed flame relay c/w flame rod. The burner and gas train shall be in a cabinet enclosure. Insulation in the burner section shall be covered by a heat reflective galvanized steel liner. Atmospheric burners, or burners requiring power assisted venting are not acceptable.

2.7 Control

.1 All control components to be provided by unit manufacturer. Unit to be able to be controlled by building digital control system.

.2 Unit(s) incorporating discharge air control and wherever specified, shall include 15:1 turndown (HT burner) for all inputs in range from 100MBH to 1400MBH (29.3kw to 410kw).

The high turndown burner minimum input shall be capable of controlling at 6.7% of its rated input without on-off cycling. Efficiency shall increase from hi to lo fire.

.3 The following functions shall be provided or monitored by building automation system:

- unit on/off control.
- filter high pressure drop alarm.
- unit off on low temperature alarm.
- discharge temperature adjustment.

PART 3 EXECUTION

3.1 Installation

.1 Install where indicated and in accordance with manufacturer's instructions.

.2 Install outdoor units. For flashing, roofing, weatherproofing, refer to Architectural drawings.

.3 Secure with hold-down bolts.

.4 Make duct connections through flexible connections.

.5 Level unit with fans running. Align ductwork. flexible connections. Misalignment with fan stopped not to strain or damage flexible connection.

.6 Make piping connections.

.7 Nothing to obstruct ready access to components or to prevent removal of components for servicing.

.8 Assemble low and medium pressured units by bolting sections together to make a single unit.

3.2 Start-up and Commissioning

.1 In accordance with Section 01 91 13 – General Commissioning (Cx) Requirements, and Section 23 08 00 – Commissioning of Mechanical Systems.

3.3 Cleaning

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 33 00	Submittal Procedures
.2	Section 01 35 33	Health Safety Requirements
.4	Section 01 61 00	Product Requirements
.5	Section 01 74 11	Cleaning
.6	Section 01 74 19	Waste Management Disposal
.7	Section 01 78 00	Closeout Submittals
.8	Section 01 91 13	General Commissioning (Cx) Requirements
.9	Section 23 05 13	Common Motor Requirements for HVAC Equipment
.10	Section 23 05 48	Vibration & Seismic Controls for HVAC Piping & Equipment
.11	Section 23 08 00	Commissioning of Mechanical Systems
.12	Section 23 33 00	Air Duct Accessories

1.2 References

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C273.3-M91, Performance Standard for Split-System Central Air-Conditioners and Heat Pumps.

.2 CAN/CSA-C656-M92, Performance Standard for Single Package Central Air Conditioners and Heat Pumps.

.2 Environment Canada, (EC)/Environmental Protection Services (EPS)

.1 EPS 1/RA/2-1996, Code of Practice for Elimination of Fluorocarbons Emissions from Refrigeration and Air Conditioning Systems.

.2 Environment Canada-1994, Ozone-Depleting Substances Alternatives and Suppliers List.

1.3 Scope

.1 Packaged indirect fired heating and ventilation unit.

1.4 Quality Assurance

.1 Comply with local and Provincial Regulations and have CSA, CGA or CETL approval stickers.

.2 All units and major components shall be product of manufacturer regularly engaged in production of such units who issues complete catalogue data on such products.

.3 The unit shall be fully assembled, wired and tested prior to shipment. A detailed pre-shipment report shall be provided to the Consultant. If necessary, the unit may be broken down for shipment.

.4 Fans shall conform to AMCA bulletins regarding construction and testing.

.5 Filter media shall be UL listed, Class I or Class II as approved by local authorities.

.6 Test operation of the unit before and after installation.

.7 Motors shall be high efficiency as specified in Section 23 05 03.

1.5 Submittals

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

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

.3 Provide:

.1 Fan performance curves showing point of operation, BHP and efficiency.

.2 Sound rating data at point of operation.

.4 Indicate:

.1 Motors and sheaves details.

.5 Quality assurance submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.

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

.2 Instructions: submit manufacturer's installation instructions.

.6 Closeout Submittals:

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

1.6 Delivery, Storage And Handling

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Product Requirements.

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

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management Disposal.

1.7 Alternatives

.1 Size, NBS test efficiency, initial and final resistance of alternate manufacturer's filters shall be same as types specified.

.2 Pressure drops and such features as cleanability, service access, frames and supports, shall be the same as types specified.

1.8 Warranty

.1 Provide 5 years unconditional parts warranty on heat exchangers.

1.9 Extra Materials

.1 Provide maintenance materials in accordance with Section 01 01 50 – General Instructions.

.2 Furnish following spare parts:

.1 One set of spare filters.

PART 2 PRODUCTS

2.1 Type

.1 Provide blow through packaged indirect fired make-up air unit of unitary design, suitable for low pressure operation and in configurations as shown on the drawings.

.2 Unit shall consist of basic fan, filter, and mixing sections plus accessories, including gas fired heat exchangers, motorized outdoor air damper, remote panel.

2.2 Casing

.1 Heavy formed structural steel framework shall mount equipment and support exterior steel panels suitable for outdoor installations. Reinforce panels where required.

.2 Provide hinged access doors to provide access to sections and components requiring servicing. Minimum size of *450 mm**18 in.* x *full height.* complete with lever door handle fasteners and gasket seals.

.3 Drain pans shall be heavy gauge one piece stainless steel with welded corners.

2.3 Insulation

.1 Insulate entire unit panels with *25 mm**1 in.*** neoprene coated fibreglass insulation, 'K' value at *24□C**75□F*** maximum *0.035 W/m□C**0.25 Btu-in/(hr ft^2 □F)***.

.2 Protect all internal insulation with perforated metal liner.

2.4 Fan

.1 Refer to Section 23 34 00 for acceptable fan manufacturers.

.2 Forward curve, double inlet, statically and dynamically balanced centrifugal fan. Heavy duty shaft and pre-lubricated self-aligning bearings, rubber mounted V-belt drive, adjustable variable pitch motor pulley, rubber isolated hinge mounted motor.

.3 Fan motor assembly shall be mounted on a free floating angle iron frame and internally isolated from rest of the unit using base isolators and canvas connectors.

.4 Entire fan assembly shall be seismically restrained using approved methods.

2.5 Filters

.1 Refer to Section 23 44 00 for detailed filter specification.

.2 Provide filter section complete with removable *50 mm**2 in.*** thick pleated disposable filters in metal frames. Average efficiency 30-35% on ASHRAE Test Standard 52-76.

.3 Arrangement: Flat filter section to limit filter velocity, based on gross area, to less than *2 m/s.**400 fpm.*** Provide access doors minimum *450 mm**18 in.*** x height of unit both sides.

2.6 Gas Fired Heat Exchanger

.1 Heating Section shall be natural gas fired complete with 100% safety shut off, electronic spark ignition, pressure regulator manual shut off valve, high temperature cut out, adjustable air supply limit switch and modulating control.

.2 Heat exchanger shall be a cylindrical drum and tube design constructed of stainless steel.

.3 The burner assembly shall be a blow through positive pressure type with an intermittent pilot ignition system to provide a high seasonal efficiency. Flame surveillance shall be with a solid-state programmed flame relay c/w flame rod. The burner and gas train shall be in a cabinet enclosure. Insulation in the burner section shall be covered by a heat reflective galvanized steel liner. Atmospheric burners, or burners requiring power assisted venting are not acceptable.

2.7 Control

.1 All control components to be provided by unit manufacturer. Unit to be able to be controlled by building digital control system.

.2 Unit(s) incorporating discharge air control and wherever specified, shall include 15:1 turndown (HT burner) for all inputs in range from 100MBH to 1400MBH (29.3kw to 410kw).

The high turndown burner minimum input shall be capable of controlling at 6.7% of its rated input without on-off cycling. Efficiency shall increase from hi to lo fire.

.3 The following functions shall be provided or monitored by building automation system:

- unit on/off control.
- filter high pressure drop alarm.
- unit off on low temperature alarm.
- discharge temperature adjustment.

2.8 Dampers

.1 Damper frames shall be U-shaped galvanized metal sections securely screwed or welded to the air handling unit chassis. Pivot rods of 1/2" (13mm) aluminum shall turn in nylon or bronze bushings. Rods shall be secured to the blade by means of straps and set screws.

.2 Blades shall be 18 gauge (1.3mm) galvanized metal with two breaks on each edge and three breaks on centerline for rigidity. The pivot rod shall "nest" in the centerline break. Damper edges shall interlock. Maximum length of damper between supports shall be 48"(1219 mm). Damper linkage brackets shall be constructed of galvanized metal.

.3 Dampers shall be:

.1 Low leak dampers with blade ends sealed with an adhesive backed foamed polyurethane gasketting. Interlocking blade edges shall include an all weather PVC seal fastened with a positive lock grip and pliable overlap edges on both the entering and leaving air sides.

.2 Modulating damper shall be extruded aluminum low leak airfoil.

.3 Outdoor and relief air damper shall be extruded aluminum, low leak thermally broken, insulated blade.

.4 Mixing dampers shall be parallel blade type.

PART 3 EXECUTION

3.1 Installation

.1 Install where indicated and in accordance with manufacturer's instructions.

.2 Install outdoor units. For flashing, roofing, weatherproofing, refer to Architectural drawings.

.3 Secure with hold-down bolts.

.4 Make duct connections through flexible connections.

.5 Level unit with fans running. Align ductwork. flexible connections. Misalignment with fan stopped not to strain or damage flexible connection.

.6 Make piping connections.

.7 Nothing to obstruct ready access to components or to prevent removal of components for servicing.

.8 Assemble low and medium pressured units by bolting sections together to make a single unit.

3.2 Start-up and Commissioning

.1 In accordance with Section 01 91 13 – General Commissioning (Cx) Requirements, and Section 23 08 00 – Commissioning of Mechanical Systems.

3.3 Cleaning

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section

.1	Section 01 01 50	General Instructions
.2	Section 01 91 00	Commissioning
.3	Section 23 05 13	Common Motor Requirements for Mechanical Equipment
.4	Section 23 05 48	Vibration & Seismic Controls for Ductwork, Piping & Equipment
.5	Section 23 08 00	Commissioning of Mechanical Systems
.6	Section 23 73 12	Halocarbon Management

1.2 References

.1 Air Conditioning and Mechanical Contractors (AMCA)

.1 ANSI/AMCA 99-10, Standards Handbook.

.2 ANSI/AMCA 210-07, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.3 ANSI/AMCA 300-08, Reverberant Room Method for Sound Testing of Fans.

.4 AMCA 301-90, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.2 American National Standards Institute/Air-Conditioning and Refrigeration Institute (ANSI/ARI)

.1 ANSI/ARI 430-2009, Central Station Air Handling Units.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.4 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE/IESNA 90.1-2013; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 ANSI/ASHRAE 15-2013, Safety Code for Mechanical Refrigeration.

.5 Federal Halocarbon Regulations, 2003.

1.3 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.

.2 Indicate the following:

.1 Unit configuration including plan and elevations drawn to scale.

.2 Fan curve showing point of operation

.3 Fan sound power information.

.4 Fan vibration isolation detail.

.5 Motor data

.6 Shipping detail and operating weight.

.7 Detailed total static pressure calculations.

.8 Coil selections.

.9 VFD

.10 Unit sound data.

1.4 Closeout Submittals

.1 Provide maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

.2 Include the "CSC Commissioning Form – Refrigeration or Air-Conditioning System" in the O&M manual and provide a copy to the Departmental Representative.

1.5 Waste Management and Disposal

.1 Separate and recycle waste materials in accordance with Section 01 01 50 – General Instructions.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

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

.5 Divert unused paint material from landfill to official hazardous material collections site.

.6 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.

1.6 Extra Materials

.1 Provide maintenance materials in accordance with Section 01 01 50 – General Instructions.

.2 Furnish following spare parts:

.1 One set of spare filters.

PART 2 PRODUCTS

2.1 General:

.1 The contractor shall furnish and install package rooftop unit(s) as shown and scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

.2 Unit furnished and installed shall be packaged rooftop as scheduled on contract documents and these specifications. Cooling capacity ratings shall be based on AHRI Standard. Unit(s) shall consist of insulated weather-tight casing with compressor(s), air-cooled condenser coil, condenser fans, evaporator coil, return-air filters, supply motors and unit controls.

.3 Unit shall be 100% factory run tested and fully charged with R-410A

.4 Unit shall have labels, decals, and/or tags to aid in the service of the unit and indicate caution areas.

.5 Units shall be convertible airflow design as manufactured.

.6 Wiring internal to the unit shall be colored and numbered for identification.

2.2 Type

.1 Provide blow through packaged indirect fired roof top unit of unitary design, suitable for low pressure operation and in configurations as shown on the drawings.

.2 Unit shall consist of basic fan filter section plus accessories, including gas fired heat exchangers, motorized outdoor air damper, remote panel.

2.3 Casing

.1 Cabinet: Galvanized steel, phosphatized, and finished with an air-dry paint coating with removable access panels. Structural members shall be 18 gauge with access doors and removable panels of minimum 20 gauge.

.2 Units cabinet surface shall be tested 1000 hours in salt spray test in compliance with ASTM B117.

.3 Cabinet construction shall allow for all service/ maintenance from one side of the unit.

.4 Cabinet top cover shall be one piece construction or where seams exits, it shall be double-hemmed and gasket-sealed.

.5 Access Panels: Water- and air-tight panels with handles shall provide access to filters, heating section, return air fan section, supply air fan section, evaporator coil section, and unit control section.

.6 Units base pan shall have a raised 1 1/8 inch high lip around the supply and return openings for water integrity.

.7 Insulation: Provide 1/2 inch thick fiberglass insulation with foil face on all exterior panels in contact with the return and conditioned air stream. All edges must be captured so that there is no insulation exposed in the air stream.

.8 Provide openings either on side of unit or through the base for power, control, condensate, and gas connections.

.9 The base of the unit shall have 3 sides for forklift provisions. The base of the units shall have rigging/lifting holes for crane maneuvering.

2.4 Fans and motors

.1 Refer to Section 23 34 00 for acceptable fan manufacturers.

.2 Provide evaporator fan section with forward curved, double width, double inlet, centrifugal type fan.

.3 Provide self-aligning, grease lubricated, ball or sleeve bearings with permanent lubrication fittings.

.4 Provide unit with direct drive, multiple speed, dynamically balanced supply fans.

.5 Provide units 6 tons and above with belt driven, supply fans with adjustable motor sheaves.

.6 Outdoor and Indoor Fan shall be permanently lubricated and have internal thermal overload protection.

.7 Outdoor fans shall be direct drive, statically and dynamically balanced, draw through in the vertical discharge position.

.8 Provide shafts constructed of solid rolled steel, ground and polished with key-way and protectively coated with lubricating oil.

.9 Entire fan assembly shall be seismically restrained using approved methods.

2.5 Filters

.1 Refer to Section 23 44 00 for detailed filter specification.

.2 Air Filters: Factory installed filters shall mount integral within the unit and shall be accessible through access panels. One-inch thick glass fiber disposable media filters shall be provided with the provisions within the unit for 50mm thick filters to be field-provided and installed.

.3 Arrangement: Flat filter section to limit filter velocity, based on gross area, to less than *2 m/s.**400 fpm.*** Provide access doors minimum *450 mm**18 in.*** x height of unit both sides.

2.6 Gas Fired Heating Section

.1 Completely assembled and factory installed heating system shall be integral to unit, UL or CSA approved specifically for outdoor applications for use downstream from refrigerant cooling coils. Threaded connection with plug or cap provided. Provide capability for gas piping

.2 Heating section shall be factory run tested prior to shipment.

.3 Induced draft combustion type with direct spark ignition system, redundant main gas valve, and 2-staged heat.

.4 Gas Burner Safety Controls: Provide safety controls for the proving of combustion air prior to ignition, and continuous flame supervision. Provide flame rollout switches.

.5 Induced draft blower shall have combustion air proving switches and built-in thermal overload protection on fan motor.

.6 Heat Exchanger: Provide tubular section type constructed from stainless steel.

.7 Burners: Burners shall be of the in-shot type constructed of stainless steel.

.8 Limit controls: High temperature limit controls will shut off gas flow in the event of excessive temperatures resulting from restricted indoor airflow or loss of indoor airflow.

2.7 Evaporator Coil

.1 Provide configured aluminum fin surface mechanically bonded to copper tubing coil.

.2 Provide an independent expansion device for each refrigeration circuit. Factory pressure tested at 450 psig and leak tested at 200 psig.

.3 Provide a removable, reversible, cleanable double sloped drain pan for base of evaporator coil constructed of PVC.

2.8 Condenser Section

.1 Provide vertical discharge, direct drive fans with aluminum blades. Fans shall be statically balanced. Motors shall be permanently lubricated, with integral thermal overload protection in a weather tight casing.

2.9 Refrigeration System

.1 Compressor(s): Provide direct-drive hermetic, reciprocating type compressor(s) with centrifugal oil pump providing positive lubrication to moving parts and automotive type pistons, rings to prevent gas leakage, internal suction and discharge valves and crankcase heater. Motor shall be suction gas-cooled with internal temperature and current sensitive motor overloads. Internally isolated motors on springs.

.2 Units shall have cooling capabilities down to 0 degree F as standard For field-installed low ambient accessory, the manufacturer shall provide a factory-authorized service technician that will assure proper installation and operation.

.3 Provide each unit with single refrigerant circuit(s) factory-supplied completely piped with liquid line filter-drier, suction and liquid line pressure ports.

2.10 Outdoor Air Section

.1 Provide 100% return air.

.2 Provide economizer with dry bulb economizer.

.3 Provide adjustable minimum position control located in the economizer section of the unit.

.4 Provide spring return motor for outside air damper closure during unit shutdown or power interruption.

2.11 Roof Curb

.1 Contractor shall provide factory supplied roof curb, 16 gauge perimeter made of zinc coated steel with supply and return air gasketing and wood nailer strips. Ship knocked down and provided with instructions for easy assembly.

.2 Curb shall be manufactured in accordance with the National Roofing Contractors Association guidelines.

2.12 Control

.1 All control components to be provided by unit manufacturer. Unit to be able to be controlled by building digital control system.

.2 Provide microprocessor unit-mounted DDC control which when used with an electronic zone sensor provides proportional integral room control. This UCM shall perform all unit functions by making all heating, cooling, and ventilating decisions through resident software logic.

.3 Provide factory-installed indoor evaporator defrost control to prevent compressor slugging by interrupting compressor operation.

.4 Provide an anti-cycle timing and minimum on/off between stages timing in the microprocessor.

.5 Economizer Preferred Cooling - Compressor operation is integrated with economizer cycle to allow mechanical cooling when economizer is not adequate to satisfy zone requirements. Compressors are enabled if space temperature is recovering to cooling setpoint at a rate of less than 0.2 degrees per minute. Compressor low ambient lockout overrides this function.

.6 The following functions shall be provided or monitored by building automation system:

- ☐ unit on/off control.
- ☐ filter high pressure drop alarm.
- ☐ unit off on low temperature alarm.
- ☐ discharge temperature adjustment.

PART 3 EXECUTION

3.1 Installation

.1 Install where indicated and in accordance with manufacturer's instructions.

.2 Install outdoor units. For flashing, roofing, weatherproofing, refer to Architectural drawings.

.3 Secure with hold-down bolts.

.4 Make duct connections through flexible connections.

.5 Level unit with fans running. Align ductwork. flexible connections. Misalignment with fan stopped not to strain or damage flexible connection.

.6 Make piping connections.

.7 Nothing to obstruct ready access to components or to prevent removal of components for servicing.

.8 Assemble low and medium pressured units by bolting sections together to make a single unit.

3.2 Start-up and Commissioning

.1 In accordance with Section 01 91 13 – General Commissioning (Cx) Requirements, and Section 23 08 00 – Commissioning of Mechanical Systems.

3.3 Cleaning

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 91 00	Commissioning
.3	Section 23 05 13	Common Motor Requirements for Mechanical Equipment
.4	Section 23 05 48	Vibration & Seismic Controls for Ductwork, Piping & Equipment
.5	Section 23 08 00	Commissioning of Mechanical Systems

1.2 References

.1 American Conference of Governmental Industrial Hygienists (ACGIH)

.1 ACGIH Industrial Ventilation Manual of Recommended Practices, 24 th Edition.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.3 National Fire Protection Association (NFPA)

.1 NFPA 91-2010, Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids.

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

.1 Material Safety Data Sheets (MSDS).

.5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 ANSI/SMACNA 006-2006, HVAC Duct Construction Standards, Metal ad Flexible, 3rd Edition.

.2 SMACNA HVAC Air Duct Leakage Test Manual, 2nd Edition, 2012.

.3 IAQ Guideline for Occupied Buildings Under Construction 1995, 1st Edition.

1.3 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.

.2 Indicate the following:

.1 Unit configuration including plan and elevations drawn to scale.

.2 Fan curve showing point of operation

.3 Fan sound power information.

.4 Fan vibration isolation detail.

.5 Motor data

.6 Shipping detail and operating weight.

.7 Detailed total static pressure calculations

.8 Unit sound data.

1.4 Closeout Submittals

.1 Provide maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.5 Quality Assurance

.1 Certification of Ratings:

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.6 Delivery Storage and Handling

.1 Protect on site stored or installed absorptive material from moisture damage.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and recycling and place in designated containers in accordance with Waste Management Plan.

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.7 Fold up metal and plastic banding, flatten and place in designated area for recycling.

1.7 Extra Materials

.1 Provide maintenance materials in accordance with Section 01 01 50 – General Instructions.

PART 2 PRODUCTS

2.1 General:

.1 The contractor shall furnish and install welding and tail pipe fume exhaust systems as shown and scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

2.2 Fume Exhaust Fans

.1 Provide direct driven centrifugal fan in sheet metal casing.

.2 Single wheel with fan in factory fabricated casing complete with vibration isolators and seismic control measures, motor and other accessories as scheduled and noted on drawings.

.3 Flexible hose assemblies shall be manufactured of heat resistant glass fibre cloth impregnated with high temperature silicone and held in a spiral wound stainless steel helix. Provide pull up arrangement to swing hoses out of way when not in use, consisting of hose band, steel wire rope, solid type pulleys, eye screws, wall mounted, gear driven, reversible winch.

.4 Provide hoods and connections as indicated on drawings and schedule.

2.3 Tailpipe Exhaust System

.1 Provide an overhead ducted carbon monoxide exhaust system as indicated on drawings and specified herein.

.2 Fume Extraction Fans

.1 The fans shall be the centrifugal low pressure blower type with a 16 blade modified radial tip and a direct drive motor.
.2 Blower wheel shall be direct drive operating at 3400 rpm.
.3 Blower housing shall be 14 gauge. A polyester epoxy lacquered galvanized sheet metal housing shall provide round outlet for easy flange, pipe or hose connection.
.4 Blower wheel shall be die-cast Silumin (aluminum-silicon), which is non-sparking. To assure smooth operation, wheels shall be balanced by means of material removal only, no balancing weights of any type shall be used. Wheel hub shall be an integral part of the wheel casting. Wheels shall be mounted and locked onto motor shaft by means of a flat washer and hex-head machine screw. All motors shall be continuous duty type and exceed IP54 protection standards.
.5 The fan shall have a very low noise level of less than 68 dB(A) as measured in accordance with ISO 6081.

.3 Motorized Hose Reel

.1 Provide motorized hose reel as scheduled and indicated on drawings.
.2 Drum and frame shall be comprised of heavy steel, coated with a 15 micron thickness of aluminum zinc alloy. Flanged ends of drum shall be polypropylene reinforced with glass fibre. Hose guide shall be mounted to the drum.

.3 Complete with motor, electric drive unit, electro-magnetic brake, hose adaptor, limit switches, transformer, mounting bracket and template,
.4 Lifting capacity: maximum 30 kg for 6" dia. hose and 50 kg for 8" dia. hose.

.4 Flexible Hose

.1 Provide high temperature hose as scheduled for use with motorized hose reel. Length and diameter as scheduled.
.2 Hose shall withstand high stress and exhaust air up to 650 deg. C continuous use and 750 deg. C intermittent use.
.3 Hose shall be flame retardant, constructed of Kevlar fabric.

.5 Fan Control

.1 FCM 3/1-5 Fan Control shall include Operation Box, FC Fan Contactor for 3 phase motor 1 to 5 amp, 24V / 20 watt transformer, overload protection.

.6 Accessories: as scheduled.

.7 Fittings shall be riveted and soldered air tight. Ductwork shall be constructed to 2500 Pa (10" W.C.) pressure class.

.8 Fan shall be mounted directly to hose reel outlet using factory fan bracket. Provide flexible connections at blower outlet. Provide roof outlet terminating with flashing and counter-flashing. Duct arrangement shall be as shown on the drawings.

2.4 Warrantee

.1 Provide a written warrantee for a period of three (3) years from date of shipment for all components.

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PART 3 EXECUTION

3.1 Installation

.1 Install where indicated and in accordance with manufacturer's instructions.

.2 For flashing, roofing, weatherproofing, refer to Architectural drawings.

.3 Nothing to obstruct ready access to components or to prevent removal of components for servicing.

3.2 Start-up and Commissioning

.1 In accordance with Section 01 91 13 – General Commissioning (Cx) Requirements, and Section 23 08 00 – Commissioning of Mechanical Systems.

3.3 Cleaning

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 35 33	Health and Safety Requirements
.3	Section 23 05 00	Common Work Results – Mechanical
.4	Section 26 05 00	Common Work Results for Electrical

1.2 References

.1 National Electrical Manufacturer's Association (NEMA)

.2 Canadian Standards Association (CSA International):

.1 CSA C22.2 No.46-2013, Electric Air-Heaters.

1.3 Product Data

.1 Submit product data in accordance with Section 01 01 50 – General Instructions

.2 Submit product data sheets for unit heaters. Include:

.1 Product characteristics.

.2 Performance criteria.

.3 Mounting methods.

.4 Physical size.

.5 kW rating, voltage, phase.

.6 Cabinet material thickness.

.7 Limitations.

.8 Colour and finish.

.3 Manufacturer's Instruction: Provide to indicate special handling criteria, installation sequence, cleaning procedures.

1.4 Closeout Submittals

.1 Provide operation and maintenance data for unit heaters for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.5 Waste Management and Disposal

.1 Separate and recycle waste materials in accordance with Section 01 01 50 – General Instructions.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling.

.4 Diver unused metal and wiring materials from landfill to metal recycling facility.

1.6 Quality Assurance

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

PART 2 PRODUCTS

2.1 Electric Baseboard Heaters

.1 General: Electric baseboard heater to CSA/cUL, commercial grade, standard watt density where indicated as scheduled on drawings with maximum surface temperature of 38°C (150°F) on front cover at 21°C ambient suitable for direct mounting on combustible surfaces.

.2 Heaters shall have thermal limit control running entire length of element. Provide connection boxes on each heater large enough to allow installation of temperature control components.

.3 Heater casings shall be in 18 gauge minimum front cover with baked enamel finish. Support brackets shall be in 18 gauge.

2.3 Electric Wall Heaters

.1 General: Electric wall heater to CSA/cUL, designed for wall mounting, surface or recessed mounting.

.2 The backbox shall be designed for duty as a recessed rough-in box in either masonry or frame installations and is also used with the surface mounting frame in surface mounting installations. The backbox shall be heavy gauge galvanized steel and shall contain knockouts through which power leads are brought.

.3 The heater assembly which fits into the backbox shall consist of a heavy gauge steel fan panel upon which is mounted all of the operational parts of the heater. The inner frame assembly shall be completely pre-wired.

.4 The heating element shall be of the non-glowing design consisting of an 80/20 nickel-chromium resistance wire enclosed in a steel sheath to which plate fins are copper brazed. It shall be warranted for 5 years. The element shall cover the entire air discharge area to ensure uniform heating of all discharge air.

.5 A double-pole single throw disconnect switch shall be mounted on the back box for positive disconnect of power supply. It will be completely concealed behind the front cover.

.6 The fan motor shall be impedance protected, permanently lubricated and with totally enclosed motor. Fan control shall be of the bi-metallic, snapaction type and shall activate fan after heating element reaches operating temperature, and continue to operate the fan after the thermostat is satisfied and until all heated air has been discharged. The thermostat shall be single pole type on all models. Thermal cutout shall be bi-metallic, snapaction type designed to shut off heat in the event of overheating. The fan shall be five-bladed aluminum. Depending on amperage, line-voltage or low-voltage remote thermostats with transformer/relays can control power to the wall heater. The room thermostat with vandal proof guard and control wiring will be provided by the Control Contractor.

.7 The louvered security front cover shall be of heavy 14-GA gauge steel with a powder paint finish.

PART 3 EXECUTION

3.1 Installation

.1 Install in accordance with manufacturer's instructions.

.2 Suspend unit from ceiling or mount on wall as indicated.

.3 Maintain sufficient clearance to permit performance of service maintenance.

.4 Install thermostats in locations indicated.

3.2 Field Quality Control

.1 Perform test in accordance with Section 26 05 00 – Common Work Results for Electrical.

.2 Test cut-out protection when air movement is obstructed.

.3 Test fan delay switch to assure dissipation of heat after element shuts down.

.4 Test unit cut-off when fan motor protection has operated.

.5 Ensure heaters and controls operate correctly.

3.3 Cleaning

.1 Proceed in accordance with Section 01 01 50 – General Instructions.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

FUME EXHAUST FANS												
Mark	FEF-1		FEF-2		FEF-3							
Service	111		111		107							
Application	Welding shop		Welding shop		Vehicle Maint.							
Hose Type	125mm high temp		160mm(158°F max)		152mm high temp							
Extraction Arm	7.5m long		4.0m long									
Hose Dia. mm (in.)	127	5	160	6.3	127	5						
Fan type	Direct drive		Direct drive		Direct drive							
Air Flow - L/s (cfm)	208	440	278	589	283	600						
External S.P. - Pa (in w.g.)	1375	5.5	1250	5	1250	5						
Horsepower	1		1		1							
Voltage	208		208		208							
Phase	3		3		3							
Mounting	Wall		Wall		Ceiling							
Notes	1,2,4,5		1,2,4,5		1,2,3,6							

Refer to Specification for accessories not scheduled. Refer to drawings for installation details.

1. Fume exhaust fan to be manually switched at local position.
2. Fume exhaust fan to be c/w support bracket for mounting on building structure.
3. Extractor" to be c/w manual override on the motor.
4. Refer to drawings for contractor supplied wall discharge ducted elbow discharge.
5. FEF to be c/w medium duty (welding application) extraction arm with light.
6. Provide 127 dia. 10.5M extraction hose matching the motorized hose reel drum assembly.

ROOFTOP AIR CONDITIONING UNITS								
Mark	RTU-1		RTU-2					
Service	Administration		Meeting					
Model								
Supply Fan Air Flow - L/s (cfm)	1133	2400	305	650				
Supply Fan External S.P. - Pa (in w.g.)	150	0.60	125	0.50				
Supply Fan Size/Type	10/10 DWDI FCF							
Supply Fan Horsepower	2		1					
Gas Input Kw (Btuh)	29.3(100)		19(64)					
Gas Output Kw (Btuh)	23(80)		15(52)					
Turndown	15:1							
Net Cooling Capacity - kW (MBH)	23.1	79	7.0	24				
Sensible Cooling Capacity - kW (MBH)	20.2	69	5.2	18				
M.C.A.	16		8					
Minimum Outdoor Air Percentage	25		30					
Filter Area - Square Meters (sq. Ft.)	0.8	8.9	0.8	8.8				
Weight - kg (lbs.)	1364	3000	455	1000				
Notes	1-9, 11		1,3,5-10, 11					

Refer to Specification for accessories not scheduled. Refer to drawings for installation details.
Interlock operation with exhaust fans as noted on the exhaust fan schedule.
Static pressures noted are external to the unit. Fan total pressure to include all cabinet effects as well as an allowance of 75 Pa (0.3" w.g.) for dirty filters. Motors to be sized so normal operating load is not more than 90% of rated motor capacity.
Units rated at 26.7°Cdb/17.8°Cwb evaporator entering air temperature and 35°C condenser entering air temperature.
Units to be suitable for 600/3/60 power.
Notes:
1. Unit c/w 305mm seismic rated roof curb.
2. Unit c/w 3 pass heat exchanger
3. Unit c/w economizer section.
4. Unit c/w DMJ controller, discharge air control.
5. Unit to be single power supply with disconnect switch.
6. Internal vibration isolation.
7. Separated dual circuit ref. circuits.
8. CO2 sensor.
9. Fire alarm shutdown.
10. Unit to be suitable for 208/1/60 power.
11. Provide flue extension 1m above top of custom RTU outdoor air intake hood or provide manufacturer's "vertical vent extension kit" for pre-manufactured rootop package unit.

ROOF TOP HEATING AND VENTILATING UNITS								
Mark	HV-1		HV-2					
Service	Vehicle Maint.		Carp./Weld.					
Model								
Supply Fan Air Flow - L/s (cfm)	1652	3500	2200	4660				
Supply Fan External S.P. - Pa (in w.g.)	312.5	1.25	312.5	1.25				
Supply Fan Size/Type	12/12 MPFCF		18/18 MPFCF					
MCA	8A		8A					
Supply Fan Horsepower	5		3					
Gas input Kw(MBH)	73(250)		88(300)					
Gas output Kw(MBH)	59(200)		70(240)					
Turndown	15:1		15:1					
Minimum Outdoor Air Percentage	78		64					
Filter Area - Square Meters (sq. Ft.)	0.7	7.3	1.2	12.5				
Weight - kg (lbs.)	590(1300)		1410(2000)					
Notes	1-8		1-8					

Refer to Specification for accessories not scheduled. Refer to drawings for installation details.
Interlock operation with exhaust fans as noted on the exhaust fan schedule.
Static pressures noted are external to the unit. Fan total pressure to include all cabinet effects as well as an allowance of 75 Pa (0.3" w.g.) for dirty filters. Motors to be sized so normal operating load is not more than 90% of rated motor capacity.
Units to be suitable for 600/3/60 power.

1. Unit c/w 305mm seismic rated roof curb.
2. Unit c/w 3 pass heat exchanger
3. Unit c/w DMJ controller, discharge air control.
4. Unit to be single power supply with disconnect switch.
5. Internal vibration isolation.
6. CO2 sensor.
7. Fire alarm shutdown.
8. Provide flue extension 1m above top of custom HV unit outdoor air intake hood.

MAKE UP AIR UNITS - GAS FIRED								
Mark	MUA-1							
Service	Carpentry							
Model								
Supply Fan Air Flow - L/s (cfm)	944	2000						
Supply Fan External S.P. - Pa (in w.g.)	125	0.5						
Supply Fan Size/Type	9/9 MPFC							
Supply Fan Horsepower	1.5							
Heating Input kw (MBH)	43.95	150						
Heating Output kw (MBH)	35.16	120						
Air Temperature Rise - °C (°F)	36.0	65						
Filter Area - Square Meters (sq. Ft.)	0.7	7.3						
Weight - kg (lbs.)	900(2000)							
Notes	1-9							

Refer to Specification for accessories not scheduled. Refer to drawings for installation details.
Interlock operation with exhaust fans as noted on the exhaust fan schedule.
Static pressures noted are external to the unit. Fan total pressure to include all cabinet effects as well as an allowance of 75 Pa (0.3" w.g.) for dirty filters. Motors to be sized so normal operating load is not more than 90% of rated motor capacity.
Units to be suitable for 600/3/60 power.

1. Unit c/w 305mm seismic rated roof curb.
2. Unit c/w 3 pass heat exchanger
4. Unit c/w DMJ controller, discharge air control.
5. Unit to be single power supply with disconnect switch.
6. Internal vibration isolation.
7. Fire alarm shutdown.
8. Interlock with dust collector DC-1
9. Provide flue extension 1m above top of custom MUA unit outdoor air intake

CEILING FANS										
Mark	CF-1		CF-2		CF-3		CF-4			
Service	107		107		108		112			
Model										
Fan Dia. mm (in.)	1219	48	1219	48	1219	48	1219	48		
Mounting Hgt AFF mm (ft.)	6497	21.3	6497	21.3	6497	21.3	6497	21.3		
Max Air Flow - L/s (cfm)	12980	27500	12980	27500	12980	27500	12980	27500		
Watts (high speed)	110		110		110		110			
Max RPM	320		320		320		320			
Max Velocity m/s (fpm)	3.05	600	3.05	600	3.05	600	3.05	600		
Downrod Length mm (in.)	813	32	813	32	813	32	813	32		
Weight kg (lbs)	6	13	6	13	6	13	6	13		
Colour	White		White		White		White			
Control	105FR		105FR		105FR		105FR			
Notes	1,2		1,2		1,2		1,2			

Refer to specification for accessories not scheduled. Refer to drawings for installation details.
Ceiling fans shall be suitable for 120/1/60 power unless noted otherwise.

1. Fan to be operated by variable speed control switch, forward and reverse supplied with fan.
2. Fan to be complete with totally enclosed impact resistant fan guard.

EXHAUST FANS										
Mark	EF-1		EF-2		EF-3		EF-4		EF-5	
Service	107		103		105		104		106	
Type	Wall Propeller		Ceiling Cabinet		Ceiling Cabinet		Ceiling Cabinet		Ceiling Cabinet	
Air Flow - L/s (cfm)	1180	2500	47	100	47	100	47	100	47	100
External S.P. - Pa (in w.g.)	62.5	0.25	62.5	0.25	62.5	0.25	62.5	0.25	62.5	0.25
Horsepower	0.33		1.14A		1.14A		1.14A		1.14A	
RPM	825		950		950		950		950	
Tip Speed	5200									
Sones			2		2		2		2	
Notes	2, 6, 7		2,3,8		2,3,8		2,3,8		2,3,8	

Mark	EF-6		EF-7		EF-8		EF-9		EF-10	
Service	102		111		208/209		202		204	
Type	Inline Ceiling		Inline Ceiling		Roof		Inline Ceiling		Ceiling Cabinet	
Air Flow - L/s (cfm)	94	200	802	1700	130	275	47	100	47	100
External S.P. - Pa (in w.g.)	62.5	0.25	62.5	0.25	62.5	0.25	62.5	0.25	62.5	0.25
Horsepower	.5A		6.6A		1/20		.62A		.62A	
RPM	900		1130		1300		1050		1050	
Tip Speed										
Sones	1		4.5		5.5		0.9		0.9	
Notes	1,2,9		2,5,9		2,4		2		2,8	

Mark	EF-11		EF-12		EF-13		EF-14		EF-15	
Service	212		211		207		117		116	
Type	Inline Ceiling		Inline Ceiling		Ceiling Cabinet		Ceiling Cabinet		Ceiling Cabinet	
Air Flow - L/s (cfm)	472	1000	755	1600	47	100	100	220	236	500
External S.P. - Pa (in w.g.)	62.5	0.25	62.5	0.25	62.5	0.25	62.5	0.25	32	0.125
Horsepower	6.6A		6.6A		.62A		55W		224W	
RPM	1015		1130		1050		900		1070	
Tip Speed										
Sones	2.5		4.5		0.9		2.5		4.5	
Notes	1,2,9		2,9		2,3,8		1,2,5,8		1,2,5,8	

Fans shall be suitable for 120/60/1 power. Refer to Specifications
for accessories not scheduled. Refer to drawings for installation details.

1. Fan to be operated by DDC controls when room temperature exceeds set point.
2. C/w matching backdraft damper.
3. Complete with solid state speed controller
4. Complete with fan manufacturer's factory fabricated roof curb.
5. Complete with fan manufacturer's matching wall discharge terminal hood.
6. Side wall propeller fan c/wfan manufacturer's matching wall housing and discharge cowl terminal.
7. Fan to be suitable for 208/1/60 power.
8. Fan to be ceiling type exhaust fan.
9. Fan to be inline cabinet type exhaust fan.

ROOF EXHAUST HOODS								
Mark	RH-1		RH-2					
Service	Exhaust		Exhaust					
Model								
Air Flow - L/s (cfm)	189	400	236	500				
Air P.D. - Pa (in w.g.)	0	0.001	7	0.027				
Throat Width - mm (in.)	1219	48	457	18				
Throat Length - mm (in.)	457	18	457	18				
Free Area - Sq. Metres (Sq. Ft.)	0.56	6	0.21	2.25				
Overall Width - mm (in.)	737	29	711	28				
Overall Length - mm (in.)	1524	60	914	36				
Notes	1, 2		1, 2					

Contractor to install field built curb. Refer to Mechanical drawings for installation details.
Standard mill finish.

1. Hood panels and bases shall be constructed of aluminum c/w aluminum birdscreen.
2. Specified pressure drop is with two (2) of four (4) sides blocked off, per drawing notes.

LOUVRES								
Mark	L-1		L-2		L-3		L-4	
Service	114		212		212		211	
Model								
Air Flow - L/s (cfm)	1510	3200	472	1000	472	1000	755	1600
Width - mm (in.)	1524	60	914	36	914	36	914	36
Height - mm (in.)	610	24	508	20	508	20	508	20
Free Area - Square Metres (Sq. Ft.)	0.4	3.97	0.2	2.3	0.2	2.3	0.2	2.3
Air P.D. - Pa (in w.g.)	25	0.1	15	0.06	15	0.06	15	0.06
Finish								
Notes	1		1		1		1	

Mark	L-5		L-6		L-7			
Service	107		301		116/117			
Model								
Air Flow - L/s (cfm)	1180	2500			288	610		
Width - mm (in.)	1219	48	457	18	610	24		
Height - mm (in.)	610	24	457	18	457	18		
Free Area - Square Metres (Sq. Ft.)	0.3	3.14	0.1	0.61	0.1	0.95		
Air P.D. - Pa (in w.g.)	37.5	0.15	25	0.1	25	0.1		
Finish								
Notes	1		1		1			

Select louvre fastening type to suit building construction.
Air P.D. =25 Pa (0.10 in. w.g.) at beginning point of water A26penetration, 243 m/min (800 FPM).
Provide 12mm birdscreen on all louvres.
See architectural drawing for flange option and flashing detail.

1. Custom baked enamel finish. Colour to be selected by Architect at shop drawing review.

MOTORIZED DAMPERS								
Mark	MD-1		MD-2		MD-3		MD-4	
Service	212		114		107		111	
Type	Insulated Blades		Insulated Blades		Insulated Blades		Uninsulated Blades	
Air Flow - L/s (cfm)	472	1,000	1,510	3,200	1,180	2,500		
Width - mm (in.)	914	36	1,524	60	1,219	48	610	24
Height - mm (in.)	508	20	610	24	610	24	305	12
Free Area - Square Metres (Sq. Ft.)	0.5	5.0	0.9	10.0	0.7	8.0		
Face Velocity - m/s (FPM)	1.0	200	1.6	320	1.6	313		
Notes	1, 2		1,3		1,4		1,5	

Mark	MD-5		MD-6					
Service	117		116					
Type	Insulated Blades		Insulated Blades					
Air Flow - L/s (cfm)	52	110	236	500				
Width - mm (in.)	254	10	356	14				
Height - mm (in.)	203	8	254	10				
Free Area - Square Metres (Sq. Ft.)	0.1	0.6	0.1	1.0				
Face Velocity - m/s (FPM)	1.0	198	2.6	514				
Notes	1, 6		1,7					

Dampers shall be insulated airfoil blade.

1. Air P.D. shall be less than 7 Pa (0.03 in. w.g.) at 5.08 m/s (1,000 FPM).
2. To be Interlocked with EF-11 by controls contractor.
3. To be Interlocked with EF-12 by controls contractor.
4. To be Interlocked with EF-1 by controls contractor.
5. To be Interlocked with fume exhaust fans by controls contractor.
6. To be Interlocked with EF-14 by controls contractor.
7. To be Interlocked with EF-15 by controls contractor.

RADIANT TUBE HEATER UNITS								
Mark	RTH-1		RTH-2		RTH-3			
Location	107		107		112			
Model								
Amps	5.5A		5.5A		5.5A			
Length-m	12.2		6.1		6.1			
Gas Connection-mm	12		12		12			
Input Heating Capacity - kW (mbh)	29	100	15	50	15	50		
Flue - mm (inches)	102	4	102	4	102	4		
Notes								

Vented radiant tube heaters shall consist of cast iron burner with aluminized steel combustion chamber. Units shall be suitable for 120/1/60 power unless noted otherwise.
Provide vent terminals, chain mounting kit and accessories as indicated.
Control contractor to provide relay for external control of unit by DDC system from temperature sensors. Coordinate with Div. 26. Two (2) stage heat, forced draft motor with thermal overload switch, balanced air rotor, radiant tube of aluminized steel and hot rolled steel with stainless steel air preheated and baffles, gas shut off cock, built in draft hood and aluminized reflector for heater length.

GAS FIRED UNIT HEATERS								
Mark	UH-1		UH-2		UH-3		UH-4	
Model								
Horsepower	1/12		1/12		1/15		1/12	
RPM	1050		1050		1550		1050	
Air Flow - L/s (cfm)	703	1490	703	1490	238	505	703	1490
Input Heating Capacity - KW (MBH)	29	100	29	100	9	30	29	100
Output Heating Capacity - KW (MBH)	23	80	23	80	7	24	23	80
Intake/exhaust Flue - mm (inches)	102	4	102	4	76	3	102	4
Notes	1		1		1		1	

Mark	UH-5		UH-6					
Model								
Horsepower	1/12		1/12					
RPM	1050		1050					
Air Flow - L/s (cfm)	703	1490	703	1490				
Input Heating Capacity - KW (MBH)	29	100	29	100				
Output Heating Capacity - KW (MBH)	23	80	23	80				
Flue - mm (inches)	102	4	102	4				
Notes	1		1					

Units shall be suitable for 120/1/60 power. Refer to Specifications for accessories not scheduled. Refer to drawings for installation details.

Notes:

1. Single stage units. Control contractor to provide relay for external control of the unit by DDC. from temperature sensors. Coordinate with Div. 26.

ELECTRIC FORCE FLOW HEATERS								
Mark	FFH-1		FFH-2		FFH-3		FFH-4	
Model								
Location	Stair A1		100A		Stair D1		110	
Heating Cap. - kW (MBH)	4	13.7	4	13.7	4	13.7	4	13.7
Power Supply	208/1/60		208/1/60		208/1/60		208/1/60	
Amps	6.7		6.7		6.7		6.7	
Notes	1, 2		1, 2		1, 2		1, 2	

Mark	FFH-5		FFH-6		FFH-7			
Model								
Location	not used		115		Stair A3			
Heating Cap. - kW (MBH)			1.5	5.1	4	13.7		
Power Supply			120/1/60		208/1/60			
Amps			12.5		6.7			
Notes			1, 3		1, 2			

Refer to Specification for accessories not scheduled.

Notes:
1. Control contractor to provide relay for external control of the unit by DDC from temperature sensors. Coordinate with Div. 26.
2. Provide 50mm deep surface mounting frame for semi-recessed.
3. Provide ceiling surface mounting frame.

ELECTRIC BASEBOARD HEATER								
Mark	EBH-1		EBH-2		EBH-3		EBH-4	
Model								
Location	109		100		116		212	
Type	Heavy duty		Heavy duty		Heavy duty		Heavy duty	
Heating Cap. - W (Btuh)	1000	3413	750	2560	750	2560	750	2560
Length - mm (in.)	1168	46	864	34	864	34	864	34
Power Supply	120/1/60		120/1/60		120/1/60		120/1/60	
Notes	1		1		1		1	

Mark	EBH-5		EBH-6					
Model								
Location	207		117					
Type	Heavy duty		Heavy duty					
Heating Cap. - W (Btuh)	750	2560	750	2560				
Length - mm (in.)	864	34	864	34				
Power Supply	120/1/60		120/1/60					
Notes	1		1					

Refer to Specification for accessories not scheduled.

Notes:

1. Control contractor to provide relay for external control of the unit by DDC. from temperature sensors. Coordinate with Div. 26.

ELECTRIC DUCT HEATERS								
Mark	EDH-1		EDH-2		EDH-3		EDH-4	
Model								
Location	205		205		205		205	
Width - mm (in.)	914	36	254	10	254	10	305	12
Height - mm (in.)	356	14	152	6	152	6	203	8
Air Flow - L/s (cfm)	802	1700	66	140	66	140	137	290
Heating Cap. - kW (MBH)	8	27500	0.75	2560	0.75	2560	1.49	5100
Weight - Kg (lbs)								
Voltage/Phases	208/3		120/1		120/1		120/1	
Type	SC		SC		SC		SC	
Type of Controller	SCR		SCR		SCR		SCR	
Notes								

Mark	EDH-5							
Model								
Location	205							
Width - mm (in.)	254	10						
Height - mm (in.)	152	6						
Air Flow - L/s (cfm)	66	140						
Heating Cap. - kW (MBH)	0.75	2560						
Weight - Kg (lbs)								
Voltage/Phases	120/1							
Type	SC							
Type of Controller	SCR							
Notes								

Refer Specification for accessories not scheduled.

1. SC denotes Slip-in open coil type.

PUMPS										
Mark	DWP-1		DWP-2							
Model										
Location	115		115							
Service	DHW Circ.		DHW Recirc.							
Flow - L/sec (usgpm)	0.63	10	0.32	5						
Head - kPa (ft.)	30	10	30	10						
Pump Conn. Size - mm (in.)	38	1.5	25	1						
Horsepower	1/6		1/6							
Notes	1,2		1,2							

1. Pumps to be bronze construction for all domestic water applications.
2. Motors to be suitable for 120/1/60 power and 1750 rpm unless noted otherwise.

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 91 00	Commissioning
.3	Section 23 05 00	Common Work Results - Mechanical
.4	Section 23 08 00	Commissioning of Mechanical Systems

1.2 General

.1 Provide, install, program and commission a BACnet-based DDC controls system to achieve the performance specified in the following clauses.

.2 Work covered by sections referred to above consists of fully operational EMCS, including, but not limited to, following:

.1 Building Controllers.

.2 Control devices as listed in I/O Summaries.

.3 Data communications equipment necessary to effect an EMCS data transmission system including gateway and LAN hardware and software for connection to BACnet network.

.4 Field control devices.

.5 Software and graphics upgrade complete with full documentation for software and equipment.

.6 Complete operating and maintenance manuals and field training of operators, programmers and maintenance personnel.

.7 Acceptance tests, technical support during commissioning, full documentation.

.8 Wiring interface co-ordination of equipment supplied by others.

.9 Miscellaneous work as specified in these sections and as indicated.

.10 Firestopping for new penetrations through existing fire rated assemblies. Refer to Section 23 05 00 – Common Work Results – Mechanical (Section 07 84 00 – Fire Stopping).

.11 Line voltage power required for controls from dedicated circuits determined on site by Controls Contractor.

.12 Provide fire alarm / smoke detectors interlocks with air handling equipment.

.13 Relocate existing DDC Operator Workstation from the existing CFM Office to the Maintenance Building in room 205 as noted on drawings.

.14 Provide Ethernet Switch at DDC workstation.

.15 Provide Network Fiber Optic Switch in the Communication Cabinet.

.3 The DDC system shall be tied to existing Reliable DDC system in Building 103. See Electrical Drawings for location.

.4 The EMCS contractor shall ensure that all required BACnet values, interfaces, objects, etc., are provided on the EMCS System to facilitate the integration to the existing BACnet operator workstation and so that values and interoperation between the workstation and the BACnet EMCS system operator interface requirements is consistent with the existing operator user interface.

1.3 Metric Reference

.1 Conform to CAN/CSA-Z234.1.

.2 Provide required adapters between Metric and Imperial components.

1.4 Standard Compliance

.1 All equipment and material to be from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.

.2 Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.

.3 Submit proof of compliance to specified standards with shop drawings and product data. Label or listing of specified organization is acceptable evidence.

.4 In lieu of such evidence, submit certificate from testing organization, approved by Departmental Representative, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.

.5 For materials whose compliance with organizational standards/codes/specifications is not regulated by an organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.

1.5 Existing Control Components

.1 Utilize any existing control wiring and/or piping as indicated.

.2 Field control devices that are usable in their original configuration may be re-used provided that they conform to applicable codes, standards, specifications. Do not modify original design of any existing devices without written permission from the Departmental Representative. Provide for new, properly designed device where components are not certain as to reusability. Provide list of equipment so included in bid. Include unit price of all for this equipment.

.3 Within 30 days of award of contract, and prior to installation of any new devices, inspect and test all existing devices intended for re-use. Furnish test report listing each component to be re-used and indicating whether it is in good order or requires repair by Departmental Representative.

.4 Non-functioning items:

.1 Provide with report specification sheets or written functional requirements to support findings.

.2 Departmental Representative will provide directions related to repair or replacement existing items judged defective yet deemed necessary for EMCS.

.5 Submit written request for permission to disconnect any controls and to obtain equipment downtime before proceeding with work.

.6 Assume responsibility for existing controls to be incorporated into EMCS, to commence upon approval for disconnection of controls or equipment downtime.

.1 Be responsible for repair costs due to negligence or abuse of Departmental Representative's equipment.

.2 Responsibility for existing devices to terminate upon acceptance of EMCS or applicable portions thereof.

.7 Remove existing controls not re-used or not required. Place in approved storage for disposition as directed.

1.6 Submittals

.1 Submit in accordance with Section 01 01 50 – General Instructions.

.2 Provide six copies of schematic control diagrams for review. Each valve, actuator and instrument shall be given an identification label which will refer directly to control diagram.

.3 Provide damper shop drawings which include data such as arrangement, velocities, and static pressure drops for each system on shop drawings.

.4 Provide shop drawings including complete operating data, system drawings, wiring diagrams, and type written detailed operational description of sequences, and desription and engineering data on each control system component.

.5 At completion of work, make detailed check of automatic control system and submit written report to the Departmental Representative.

.6 Provide sufficient copies of complete parts and repair manuals for binding in O&M Manuals.

.7 Provide "record" control drawings and schedules; incorporate into O&M Manuals.

.8 The submittals shall be prepared using the dynamic graphics software normally provided with system and be incorporated into the dynamic graphics system for on-line reference. Provide original, registered software disks of Windows, the Graphics Software package, the Operating System software, and the project graphic schematics, floor plan layouts, and control drawings.

1.7 Preliminary Design Review Meeting

.1 Convene a Preliminary Design Review meeting within 45 working days of award of contract to:

.1 Undertake functional review of preliminary design documents, resolve inconsistencies.

.2 Resolve conflicts between contract document requirements and actual items (e.g.: points list inconsistencies).

.3 Review interface requirements of materials supplied by others.

.4 Review "Sequence of Operations".

.2 Contractor's programmer to attend meeting.

.3 Departmental Representative retains right to revise sequence or subsequent Control Description Logic prior to software finalization without cost to Departmental Representative and Owner.

1.9 Monitoring and Control Features

.1 Operator defined digital and analogue alarms and automatic alarm condition reporting.

.2 Direct keyboard override of all inputs and outputs, with an indication on the display for any point that is operating under keyboard override.

.3 Addition, deletion, definition and modification of all points from operator keyboard.

.4 Trend log graphing and reporting of user selected points at user defined intervals.

.5 Run time logging of digital points.

.6 Ability to accept a variety of standard analogue and digital input signals.

.7 Ability to generate a variety of standard analogue and digital output signals.

1.10 Offline Storage

.1 The DDC system shall have the capability to be taken off-line in the event of failure or for maintenance and returned to operation without the need for entering any portion of the software program manually.

.2 An off-line disk storage device shall be utilized to provide software backup and reload. Backup and verification of the entire system, with full applications software, shall be less than TWO (2) seconds per real point.

1.11 Power Surge Protection

.1 The DDC system shall be protected from power line surges and voltage transients by installation of a power line filter.

1.12 Power Failure Protection

.1 The DDC system shall have automatic protection from any power failure of at least TWENTY-FOUR (24) hours duration.

.2 This protection shall at a minimum include continuous real-time clock operation and automatic system restart upon power return.

.3 Outputs shall have the option of being set to "staggered start" upon power reset.

1.13 Electrical Components, and Conduit

.1 Provide all control system components, except those supplied as part of packaged equipment controls, but including all auto sequencing devices, electric relays, safety devices and electrical interlocks required to accomplish specified sequences. Refer to the electrical motor schedule in the electrical drawings and/or specification, which delineate the limits of electrical work in Division 26 (Electrical) serving mechanical systems.

.2 Provide all control circuit transformers required for control systems and not supplied by Division 26 including line voltage power connection from indicated outlets shall be included by Division 25.

.3 All line voltage wiring shall be copper with RW90 X-Link P.E. insulation #12 minimum size. AWG wire shall be sized to meet code.

.4 All wiring installed under this contract shall be plenum rated FT-6, or FT-4 if installed in conduits. Locate wiring away from top or bottom of ceiling joists or trusses to minimize possibility of accidental damage. Number 18 gauge wire may be used in Class 2 circuits unless voltage drops are excessive. THHN wire will not be acceptable. Twisted shielded wiring, minimum of 22 gauge wire shall be used for all DDC or co-axial communication wiring. Line voltage alternating current wiring shall not be run in the same conduit, or cabling as DDC wiring.

.5 Use 1m of flexible conduit for all connections to vibrating equipment. Use liquid tight flex cable and connections where required.

.6 The Control Contractor shall locate magnetic starters from the electrical drawings. All electrical work provided by this Contractor shall comply with all requirements of the Division 26 electrical specification, the Canadian Electrical Code and Local Codes and Ordinances.

.7 Wire all line voltage thermostats, pressure switches or aquastats for single phase equipment.

.8 Division 26 has been requested to provide specific devices, including magnetic starters supplied with 120 volt holding coils, HOA switching and space for the addition of auxiliary contacts. The Control Contractor shall provide all necessary normally open and normally closed contacts, wired to a terminal strip within the starter enclosure, required to achieve the specified control interlocking and sequencing. Manual starters for 120 volt equipment are to contain On-Off selector, external H.O.A., integral overload protection and pilot lights. The Controls Contractor shall provide control wiring interlocks from the control contacts provided on the automatic branch lines of the assembly, which will be contained within the associated Motor Control or Starter Assembly.

.9 Refer to Division 26 Specifications and Motor Schedule for the scope of work to be provided by the Electrical Contractor. Division 25 shall supply and install all components, in addition to those outlined within the Division 26 documents, as may be deemed necessary to provide all interlocks or sequences as called for elsewhere within the specifications. Include for the supply and installation of 2- 4 pair U.T.P. Level 5, plenum rated cables from the hub location to the communications backboard. Coordinate with Division 26 and the Owner for interconnection of the hub into the Telephone System services.

.10 All power supplies for controls are this Contractor's responsibility unless otherwise specified in the Electrical Specifications. All control transformers to be located in fan rooms or mechanical rooms only and are to be mounted in serviceable locations.

.11 Line voltage will not be run with signal or trunk wiring or be present in the same junction box.

.12 All shielded wiring will be grounded at the BMS panels and prevented from grounding at the terminal end.

.13 Run all wiring parallel to building lines. All wiring to be installed in a neat, workmanlike manner.

.14 Support wiring independent of piping, ductwork, and equipment. Keep wiring clear of hot piping, ductwork/equipment.

.15 Identify all junction boxes with control company label.

.16 There are to be no splices in any of the control wiring except at devices or control panels.

.17 LAN wiring shall be CAT5E UTP to TIA/EIA-568.

1.14 Identification, Calibration and Programming

.1 Provide a written sequence of operation for each piece of equipment or system being controlled that does not require knowledge of DDC programming. Provide a print out of the complete data base, including program listings, inputs, outputs, controllers, virtual points, trend logs, alarm points, etc. Provide in an organized manner, separated for each panel.

.1 Procedures for daily operation of the system.

.2 Theory of operation of the equipment.

.3 Theory of operation of the control program.

.2 Mount an input/output layout sheet within each controller. This sheet shall include the name of the points connected to each controller channel.

.3 Identify all controllers and associated devices with symbols relating directly to the control diagram. Provide plastic labels for each input and output point with the following information:

.1 Point descriptor.

.2 Point type and channel number.

.3 Corresponding controller number.

.4 Program each controller immediately following installation. Setup and tune all control loops during the initial startup of the systems. Submit a well-documented print out of the controller program for review.

.5 At the time of the Owner's Demonstration and Instruction Period:

.1 Demonstrate and confirm that all systems are programmed and operating correctly. Submit trend logs, 1 week in duration, that confirm systems are operating as designed and follow the internal building loads in an energy efficient manner.

.2 Submit CD's (including back-up diskettes) containing up to date copies of the programs in each controller.

.3 Submit (4) CD's with printed PDF copies of the final programs that include all point definitions, weekly and annual schedule settings, controller set points and tuning parameters, and documented general control language programs. (As Built control shop drawings)

.4 Provide the original software diskettes and the users manuals for all software programs provided as part of this contract. Provide one set of original disks for each notebook, laptop, and desktop computer the software has been installed on. The controls contractor shall be responsible for registering all software with the manufacturer in the owner's name. Provide copies of the registration of all software to the Departmental Representative as part of the final inspection.

.6 Check sensor calibration and control system operation twice during the first year of operation including the first heating season and prior to the first cooling season. Include all parts and labour in service. Following each visit submit:

.1 A report indicating all work performed.

.2 Printed graphs of trend logs one week in duration with hourly samples for all analog inputs connected to each controller.

.3 Update printed and diskette copies of any changes made to programs for any controller.

.7 Provide one day of on-site instruction to the Owner's operating personnel during the first year of operation, scheduled as requested by the Owner, during one or more of the 2 visits.

1.15 Controller Software

.1 Each stand-alone control panel shall contain a complete software development system in each panel. The software development system shall consist of a menu driven, prompted programming language containing complete libraries of control algorithms for DDC, Energy Management, and Facilities Management functions. These resident libraries of algorithms shall be drawn from for the creation of the application specific programming of each individual stand-alone control panel.

.2 Four user access levels shall be provided with a user access code available at each level. Each level shall permit identifiable multiple user access.

.3 Point names shall be defined using a minimum of 128 alphanumeric characters to provide an English language description of the point function.

.4 The stand alone control panel shall be capable of generating sorted alarm, trend log, energy management, maintenance time remainder, and exception log reports on a prioritized basis. Segregated report generation shall be invoked by manual request, time of day, calendar, accumulated run time, or event occurrence.

.5 DDC Control:

.1 The network of standalone control panels shall individually perform set point reset, ramping functions, 2-position ON/OFF control, PID loop control, linear sequencing, rotating s equencing, binary sequencing, HI/LO/AVE selection, energy dead band, and thermostat controls as required to control their connected systems of equipment.

.6 Energy Management Control:

.1 The network of standalone control panels shall individually perform time of day scheduling, optimum start/stop, enthalpy optimization, trend logging, demand limiting and all control optimization strategies, such as supply air reset, and soft ramp-up, for their connected systems of equipment.

.2 Coordination of strategies involving multiple systems of equipment shall be performed by sharing of necessary data between the stand-alone control panels on the communicating network.

.7 Facilities Management Control:

.1 The Owner shall be provided the ability to read out temperatures and other values and to adjust specific items from localized, as well as remote centralized location. Every controller shall provide the following reports:

.2 Facility Diagnostics

.1 The facilities management system shall provide diagnostic reports for selected systems of equipment as specified.

.3 Alarm Occurrence Status

.1 When specified alarm conditions occur, provide a report available to printout, listing the status of specific items associated with the equipment generating the alarm. Report shall be routed through auto dial out feature to a specific printer or combination of printers. Report shall record the time the status information was taken, and shall allow operational personnel to use this information to diagnose the alarm situation.

.8 SAC and Micro Controller Trend Logs:

.1 Controllers shall be capable of storing up to twenty-five (25) full trend logs with a minimum of 200 data samples each. They shall be able to collect and store samples of the value of any system variable (i.e. temperature). The operator shall be able to create a trend log, with each trend log containing up to 4 points. The sample frequency shall be selectable for each trend log between 1 second and 24 hours. The ability to graphically display to 4 points on the screen simultaneously, print a log, or store a log on disk in an ASCII format that can be imported into a standard spreadsheet program shall be provided. This capability shall be provided for all forms of access.

.9 Network Communication/Controllers Trend Logs:

.1 Trend logs shall be provided to collect and store samples of the value of a point i.e., temperature. The network communication/controllers shall have sufficient memory to create and store 200 full trendlogs. Each BacNet trendlog shall be capable of monitoring 1 I/O or virtual point from any controller or combination of controllers across the network, and storing a minimum of 2000 data samples for each trended point. The sample frequency shall be selectable for each trend log between 1 second and 24 hours. The network communication/controllers shall be capable of archiving the trended data to the Host computer or dialing out to a remote trend computer and downloading the data automatically. The ability to indefinitely retain the contents of a trend log in the controller or automatically transfer the contents of a trend log to disk storage, printer or remote site and restart the log shall be provided.

.10 Historical Data Collection and Retrieval:

.1 The system shall have a historian software program with the ability to store historical data on a central wide area network mass storage device. Provide on-line capability to retrieve and graphically display this historical data for analysis. An archived historical library shall be maintained containing the point name, date of occurrence, and value of occurrence.

.11 Host Level Trending:

.1 Shall be provided to collect and store samples of the value of any system variable (i.e. temperature Trend Logs: Shall be provided to collect and store samples of the value of any system variable. The operator shall be able to create a BACnet trend log, with each trend log containing 1 point. The sample frequency shall be selectable for each trend log between 1 second and 99 hours. The ability to link multiple single point BACnet trend logs to be displayed on a 8 point Multi-trend log for comparative analysis shall be provided. Ability to print a log, or store a log on disk in an ASCII format that can be imported into a standard spreadsheet program shall be provided. This capability shall be provided for all forms of access.

.12 The Ethernet interface with the remote operator's terminal shall provide all features listed above.

1.16 Computer Graphics Software

.1 Incorporate the following standards for the required host capabilities and installed features:

.1 The host computer operator interface, network interface and graphical interface software shall be Microsoft Windows based.

.2 Provide one licensed copy of the complete HOST software package complete with operating manuals, installation manuals, setup manuals, programming manuals, and original diskettes.

.3 Host operator interface.

.2 The following functionality shall be available to the operator from either the onsite host, remote host, or colour laptop connected to anywhere on the network inside the building. These workstations shall operate as graphic interface devices. Attention must be paid to developing an interface to the system using a minimum of user keystrokes. The primary user interface must be the mouse.

Provide functionality such that any of the following may be performed simultaneously, at either workstation and in any combination, via user-sized windows.

.1 Dynamic color graphics and graphic control

.2 Alarm management and control

.3 Time of day scheduling

.4 Trend data definition and presentation

.5 Graphic definition

.6 Graphic construction

.7 Database functions

.3 Graphic generation and design:

.1 Provide a default graphic consisting of a visual overview of the entire control system. The display shall be in a tree format. Indicate the various branches of graphic access available from the tree for each mechanical system and building zone. The site plan of the facility should be used as a reference tree to show the relationship of each system to a particular building zone. Graphic links for each zone must be available to allow the user to link directly to the desired graphic or step systematically forward or backward through the tree to each graphic associated with the mechanical system. The operator must be able to return directly to the default from any level of graphic menu penetration.

.2 As a minimum, provide the following graphic screens and dynamic linking:

.1 A default graphic to be used as a central starting point for penetrating the menu of available graphic screens.

.2 Zone summary graphic. Dynamically indicate zone high select (Hsel) and low select (Lsel) temperatures, AHU supply air temperatures and setpoints, and status of the air handling units serving the zone.

.3 Dynamic graphic floor plans for each building zone, scaled appropriately to be readable from a laptop. Indicate room temperatures, architectural room number, control valve position, supply fan system serving the area, and any associated equipment such as exhaust fans, fume hoods, etc. From this screen the operator shall be able to command the control valve, adjust the room setpoint, access the graphic screen for the supply fan system, view a trend log of the room temperature, or access a graphic for associated mechanical equipment.

.4 A schematic of each mechanical system. As a minimum, each graphic will indicate all DDC I/O points and software variables associated with each system. Indicate the DDC point names, current status value, and operator priority.

All graphic screens shall be created using the same software supplied to the owner. Provide the graphic data files in a format suitable for inclusion into the graphical operator interface and for direct loading into the graphic editor. The graphic data files shall be the sole property of the Owner.

DEFAULT GRAPHIC COLOURS			
Normal On	GREEN	Text Arial 12 pt	BLACK
Heating Equipment	RED	Normal Off	BLACK
Background	WHITE	Cooling Equipment	BLUE
Ducts	BLACK	**ALARM**	**RED**
Sensors	BLUE		

.3 Graphical links:

.1 All system graphical links will be located in the upper left corner of the screen. These links will be displayed in sequential order representative of the menu tree.

.4 Graphics shall be reviewed and approved by Departmental Representative prior to implementation.

1.17 Related Work

.1 The following incidental work shall be furnished by the mechanical sub-contractor under the supervision of the controls subcontractor:

.1 Installation of control dampers including duct transitions, assembly and interconnection of multiple section dampers.

.2 Supply and installation of sheet metal baffles as required to eliminate air stratification.

.3 Supply and installation of access panels for service and installation of control equipment.

.4 Installation of automatic valves, wells, flow switches, and other pipe related control devices.

PART 2 PRODUCTS

2.1 Fibre Media Converters and Fibre Ethernet Switches

.1 Media Converters shall provide one channel for media conversion between 10/100Base-TX and 100Base-FX.

.2 Fibre Ethernet Switches shall have multiple port 10/100Base-TX and 100Base-FX.

.3 Standalone device or with a standard chassis for installation in communication rack. Complete with AC/DC power adapter. Provide rack chassis for installation in communication rack.

.4 Fibre Media:

- .1 Multi-mode fibre using SC or ST connectors.
- .2 Single-mode fibre using SC connectors.

.5 Features:

- .1 Auto negotiation of speed and duplex mode on TX port.
- .2 Auto MDIX on TX port.
- .3 DIP switch configuration for:
  - .1 Link-fault-pass-through.
  - .2 Fixed speed.
  - .3 Half/full duplex.
  - .4 Back-pressure & IEEE802.3x compliant flow control.
  - .5 Front panel status LED.
  - .6 Hot swappable when used with a chassis.

.6 Forward rate: 14,880/148,800pps for 10/100 Mbps.

.7 Emissions: FCC Part 15, Class A; CE.

2.2 Fibre Optic Switch

.1 Provide in the Communication Cabinet, with the following minimum features:

- 8port 10/100M RJ-45
- 8port 100Base-Fx
- Store and forward mode
- 10/100M auto-negotiation, maximum speed to 20/200M (full-duplex)
- Supports IEEE 802.3x full-duplex flow control and back pressure half-duplex flow control
- Support MAC self-learning
- Automatic MDI/MDI-X configuration
- Port base VLAN
- Built-in 12Kx64 SRAM
- Supports 2048 MAC addresses table
- LED status of Link, activity, Full/half duplex, speed and power on diagnostic function
- Steel case, rack mountable

PART 3 EXECUTION

3.1 General

.1 Check and verify location of thermostats and other exposed control sensors with plans and room details before installation. Locate thermostats and temperature sensors 1.5m above floor.

.2 Install damper motors on outside of ducts. Do not locate in outside air stream.

.3 The installation shall conform to each manufacturer's recommended procedures and to all applicable codes, statutes and ordinances.

.4 All equipment installed shall be mechanically stable and, as necessary, fixed to wall or floor. Anti-vibration mounts to be provided, if required, for the proper isolation of the equipment.

.5 Equipment shall be installed so as to allow for easy maintenance access. Equipment shall be installed such that it does not interfere in any way with access to adjacent equipment and personnel traffic in the surrounding space.

.6 Equipment shall be installed in locations providing adequate ambient conditions for its specified functioning, allowing for adequate ventilation.

.7 Permanently identify each wire, cable, conduit and tube at each terminal.

.8 Wiring and tubing shall be identified at each DDC panel by termination number. Wiring and tubing shall be identified at terminal device by termination and DDC panel numbers.

.9 All transmitters, interfaces, terminations and control relays, etc. shall be mounted in field cabinets that may be locked.

.10 Freeze protection devices shall be hard wired and also wired to alarm through DDC system.

.11 All wall mounted devices in new finished space shall be mounted on a wall box. The wall box shall be connected to the ceiling space by a conduit stub. On renovations, when sensors are mounted in existing finished walls, wiring or tubing may be fished into the walls without conduit.

.12 Provide tamperproof screws to new and relocated equipment, controls enclosures and devices which are located in inmate accessible areas. Tamperproof screws shall be stainless TORX with pin.

3.3 Enclosure and Conduit

.1 Relays, transformers, and I/O devices and peripherals shall be installed in separate enclosures and not in the enclosures containing the controllers.

.2 All wires penetrating the enclosure that are not required to be in conduit must be neatly bundled and strapped in place.

.3 All Building Controllers will be installed in CSA rated enclosures that are complete with hinged and key-locked doors. The door will be painted and labeled suitably bearing the manufacturer's system name/logos, the controller address, and the installing contractor's contact information. This enclosure will be mounted at a height that provides easy access without the need of a ladder.

.4 A hard points list shall be affixed on the inside of the door/cover of the enclosure.

.5 The inside bottom of the enclosure shall be clean of dirt, metal shavings, and debris.

.6 Wiring is to be in EMT conduit with set screw metal fittings in all wall spaces and exposed locations as well as in pipe chases, service spaces, attics, and crawl spaces which are entered for service access. Wiring in suspended ceiling spaces does not require conduit but shall be neatly installed parallel to building lines using bridle rings. All conduits shall be piped smoothly and neatly following building lines. Wiring above existing ceilings and wall cavities may be run free-air.

.7 Liquid-tight flexible conduit to be used for rooftop unit wiring c/w liquid-tight fittings. Provide spun aluminum roof jack where control wiring penetrates roof unless penetration is within waterproof rooftop unit curb.

.8 All junction boxes will have covers properly and firmly affixed after installation completion.

.9 Control panels located in occupied areas for relays or other similar field devices shall be accessible and located above corridor ceilings. For areas accessible by inmates, provide security type access panels. Refer to Section 23 05 00 – Common Work Results – Mechanical.

.10 Prior to start of construction, submit proposed locations of control panels to Departmental Representative for review and approval.

3.4 I/O Wiring

.1 All input/output device wiring will use #18-2 solid core cable with individually jacked conductors and jacketed sheath over the pair.

.2 Use plenum cable where required.

.3 All I/O wiring passing near or within the enclosure of a VFD will be shielded, with the shield terminated at the device end.

.4 All I/O wiring will be identified using Panduit adhesive wire-marker at the controller and end device ends. Description of point to include point mnemonic, point type and network location.

.5 All I/O wiring within controller enclosure shall be neat and tidy and suitably bundled and strapped or contained in plastic wire duct or equivalent.

.6 All I/O wiring that requires a transition to a different conductor to meet electrical code requirement shall be executed using a terminal strip.

.7 Low voltage I/O wiring may be mixed together within a conduit. Low and line voltages may not be mixed together within a conduit.

3.5 Power Wiring

.1 Provide power wiring and transformers and grounding to each controller and transducer as per the manufacturer's specification.

.2 Each Building Controller will have its own dedicated power supply. No other controller or I/O device will be powered from this supply.

.3 Power wiring shall not be mixed with I/O wiring in a conduit.

3.6 LAN Wiring

.1 Provide LAN wiring as per manufacturer's specification.

.2 Provide patch panel for terminating optical fibre wiring. Provide optical fibre patch cables between patch panel and Media Converters and/or Fibre Ethernet Switches.

3.7 Control System Commissioning

.1 Upon completion of the installation of the controls system and the calibration of all sensors, this Subcontractor shall carry out all required testing, debugging, and revision of operations to suit the intent of the Sequence of Operation and to the review of the Departmental Representative.

.2 The contractor is to supply digital point and non-digital checkout data sheets for all controlled components installed in this contract, including components supplied by others. The data sheets shall indicate each components physical installation is complete, End to End, identification, tagged, the result of the functional test, calibration deviation recorded, set points and set-up of each device, digital and non-digital.

.3 Each digital input or control device shall be checked by physical operation of the monitored device in the field with the result noted. Each digital output or controlled device shall be commanded or tested On/Off, Open/Close as required and the corresponding field device checked for correct operation with the result and comments noted.

.4 Each analog input or control device shall have its field values measured with a calibrated test instrument, with the deviation recorded and adjusted, if necessary, at the AI set up. The field measurement and analog point deviation must be reported. A hard copy of the set up for each digital and non-digital controller with adjustments is required. Field set up and set points of other devices shall be reported.

.5 Each analog output, control or controlled device shall be field tested. The physical test data sheet is to indicate each controlled device function through its range 0, 25, 50, 75, 100% and 1 to 100% as required with no leakage or bypass of the controlled medium.

.6 Submit copies of all test data sheets intended to be used to the Departmental Representative and Commissioning Authority prior to the contractor's verification at least three months before the scheduled substantial completion of the project.

.7 The controls contractor shall provide sequence of operation check sheets, to the Departmental Representative, Commissioning Agent and Commissioning Authority, in standard letter size for each DDC and non DDC system sequence. Each sequence to be verified with each item/page signed off with comments noted.

.8 The commissioning contractor is not to commence controls checks until the above documentation is received. The Temperature Control Supplier and Installer shall loan a current copy of all control software/devices needed for full access to the control system, at no charge to the Commissioning Agent. The software/devices shall be returned to the Control Supplier in good working order at the completion of the commissioning process, or the Commissioning Agent must reimburse the Temperature Control Supplier for the purchase price of the material.

.9 All documentation, tagging, identification, as-builts, software, instruction manuals, special control connection to access all devices and panels must be in place before the granting of substantial performance.

.10 The Controls Contractor shall loan a current copy of all control software/devices needed for full access to the control system, at no charge to the Commissioning Agent. The software/devices shall be returned to the Controls Contractor in good working order at the completion of the commissioning process, or the Commissioning Agent must reimburse the

Controls Contractor for the purchase price of the material. The Temperature Control Supplier shall cooperate fully with the Commissioning Agent to work together to obtain a fully operating system, providing additional technicians and trades people to assist the designated commissioning person as required. Refer to Section 01 91 00 – Commissioning.

.11 The controls contractor is to provide the technicians for field checks, calibration, checkouts, and commissioning necessary for a complete and fully operational system. Provide two 2-way portable radios for the commissioning period.

3.8 Third Party BACnet Integration

.1 Where third party systems are installed with a BACnet compatible control panel, it is the responsibility of this contractor to integrate the system into the DDC control system.

.2 The contractor shall map over BACnet points that made available in the third party panels and provide control for ALL BACnet points permitted by the third party panels. The number of points to be allowed for shall be as follows:

.1 Variable speed drives – 10 points each

.2 Electrical main power meter – 20 points each

.3 Electrical sub power meters – all Modbus points, refer to Division 26 specifications

.3 Integrate the third party system into the DDC sequence of operation. This includes scheduling, outdoor conditions (temperature and ambient lighting levels), alarms, and any other information required to operate, diagnose, and maintain the equipment.

.4 Provide a detailed graphical display(s) depicting the third party equipment. The graphical display(s) shall contain ALL points that were mapped over from the third party system.

3.9 Cleaning

.1 Proceed in accordance with Section 01 01 50 – General Instructions.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 01 01 50 — General Instructions

.2 Section 25 05 01 — EMCS: General Requirements

1.2 References

.1 Canadian Standards Association (CSA)

.1 C22.2 No.205-12, Signal Equipment.

.2 Institute of Electrical and Electronics Engineers

.1 IEEE C37.90.1-2002, Standard Surge Withstand Capabilities (SWC) Test for Protective Relays and Relays Systems.

1.3 Maintenance Procedures

.1 Provide manufacturers recommended maintenance procedures for insertion in Section 01 01 50 – General Instructions, and 25 05 01 – EMCS: General Requirements.

1.4 Submittals

.1 In accordance with Section 01 01 50 – General Instructions, and Section 25 05 01 – EMCS: General Requirements. Submit product data sheets for each product item proposed for this project.

PART 2 PRODUCTS

2.1 System Descriptions

.1 Provide a fully networked system of controllers which use LAN communications to support the distributed control features as specified herein. Each controller shall be connected directly to the LAN. Each controller shall have equal LAN access priority and shall NOT REQUIRE A SEPARATE GATEWAY or interface controller to accomplish normal, network communications.

.2 Provide a means to ensure communication integrity. At a minimum indicate for each controller in system: on-line/off-line status, residence of program or no program, the scan rate (frequency at which the controller updates all I/O and runs all programs), the number of network points imported and exported.

.3 The system will display an error message, in the event of a communication error.

.4 To prevent damage to the system, each connection to the LAN shall be provided with a means of isolation, either optically or fast-blow fuse or by some other means.

.5 Upon failure of the LAN to communicate information, each controller will retain the last legitimate value of its imported network points, and continue to control the systems based on those values. Failure of any controller, or any part of a controller on the LAN, shall not affect the ability of the LAN to communicate among the remaining controllers.

.6 Each hard point and soft point shall have a user-definable, unique, system-wide logical point mnemonic. The format of the point mnemonic shall conform to the naming convention of the incumbent system.

2.2 Memory

.1 Each controller shall have enough random access memory for all of the following:

.1 Variables - ONE (1) for each hard point connected to the controller.

.2 PID Controllers - TWO (2) for each analogue output point connected to the controller.

.3 Weekly Schedules - ONE (1) for every major system connected to the controller.

.4 Annual Schedule - ONE (1) for the entire LAN.

.5 Trend Logs - ONE (1) for each pair of hard points connected to the controller with 100 samples each.

.6 Runtime Logs - ONE (1) for each digital hard and soft point.

.7 Programs - ONE (1) for each output point connected to the controller. Each program must contain enough memory for TWENTY (20) syntactically correct lines of OCL with at least four operators.

2.3 Processing Speed

.1 Scan Rate - The maximum permissible scan rate is ONE (1) second. The scan rate is defined as the time it takes to controller CPU to sample all inputs, calculate all variables, update all timers and PID controllers, check all schedules, update all trend logs and runtime logs execute all OCL programs and assign values to all outputs.

2.4 Building Controllers

.1 Building Controllers shall reside on the main LAN or highest level of communication.

.2 The controller shall communicate on the main LAN using either Ethernet (IEEE.802.3) with TCP/IP and/or EIA-485.

.3 In addition to main LAN communications, the controller shall support EIA-485 subLANs, PC, modem and intelligent thermostat communications.

.4 The controller shall have at least one port (other than the PC port) which can be configured to BACnet conformance class 3 using EIA-232 point-to-point communications for interface to other BACnet products.

.5 The controller must be modular in design with removable I/O device terminations on separate I/O cards for ease of expansion and replacement.

.6 Controllers will accommodate a maximum of 160 universal I/O points on board using a single address.

.7 All I/O points must be universal (i.e. user definable as digital or analogue). Dedicated analogue/digital points will not be accepted.

.8 All outputs must have optional HOA on board for easy override by non DDC users.

2.5 VAV Controller

.1 VAV Controller (BACnet overview): A VAV Controller is VAV terminal unit controller with integral damper actuator and on-board differential pressure based flow measurement.

.1 Data Sharing - Ability to provide the values of any of its BACnet objects and Ability to allow modification of some or all of its BACnet objects by another device.

.2 Device and Network Management - Ability to respond to information about its status.

.2 VAV Controllers shall be used for dual duct mixing boxes and single duct air terminal units.

.3 VAV Controllers shall communicate on the main LAN or subLAN using EIA-485 (MSTP). In addition to main or subLAN communications, the controller shall support PC and/or modem communications and intelligent thermostat communications.

.4 Programming the controller shall be accomplished over the LAN or directly via PC and will not require the mandatory use of any other special interface hardware or a Building Controller. Firmware based programming will be accepted.

.5 Provide 120v-24vac transformers for controls.

2.6 Custom Application Controllers

.1 An AAC (B-AAC) is a general purpose, field programmable controller capable of carrying out a variety of building automation and control tasks.

.2 Custom Application Controllers shall communicate on the main BACnet Ethernet LAN or BACnet MSTP subLAN. In addition to main or subLAN communications, the controller shall support PC and/or modem communications.

.3 Programming the controller shall be accomplished over the LAN or directly via PC and will not require the mandatory use of any other special interface hardware or a Building Controller.

.4 Operator Control Language shall be fully supported with this controller. FIRMWARE BASED FUNCTIONS OR PROGRAMMING WILL NOT BE ACCEPTED.

2.7 Application Specific Controllers:

.1 ASC BACnet overview: An ASC (B-ASC) is a controller with limited resources relative to a AAC. It is intended for use in a specific application and supports limited programmability.

.2 Application Specific Controllers shall be used for the following mechanical systems:

.1 VAV, Fan Coils, radiation and reheat

.2 Radiant heating and reheat control

.3 Application Specific Controllers shall communicate on the main LAN or subLAN using EIA-485 (MSTP). In addition to main or subLAN communications, the controller shall support PC and/or modem communications and intelligent thermostat communications.

.4 Programming the controller shall be accomplished over the LAN or directly via PC and will not require the mandatory use of any other special interface hardware or a Building Controller. Operator Control Language programming and editing shall be fully supported with this controller. FIRMWARE BASED FUNCTIONS WILL NOT BE ACCEPTED.

2.8 Stand Alone Controllers:

.1 Stand Alone Controllers common requirements (B-BC, B-AAC) (Peer to Peer): Provide a fully distributed processing system such that each major piece of mechanical equipment is controlled by its own stand-alone controller. The DDC system shall operate independently from the Host Computer. Mount all stand alone controllers at locations where indicated on drawings. Provide an outlet port for plug in of a portable PC in each mechanical room containing stand-alone controllers.

.2 The stand-alone digital control panel shall be 16-bit microcomputer based, providing a multi-tasking operating system for simultaneous operation and control of:

.1 facility management functions

.2 DDC control functions

.3 energy management functions

.4 man-machine interface

.5 system communications

.3 Analog to digital and digital to analog conversions shall have a minimum 10 bit resolution.

.4 Panel input points shall be universal allowing each point to be defined as an analog input, or digital input.

.5 The control panel shall contain a real time clock capable of being synchronized with other real time clocks in the network.

.6 Control panel software shall be protected from loss due to power failure for a minimum period of 72 hours.

.7 All sensing inputs shall be provided via the following industry standards:

.1 0 to 20 mA

.2 4 to 20 mA

.3 0 to 5 VDC

.4 0 to 10 VDC

.5 10k type 3 thermister resistance signals

.8 Modulating outputs shall be fully proportional. Pulse width modulation, without analog feedback, shall not be used for analog output signals. Outputs must be capable of being scaled and produce a 0% to 100% output with a fractional PID control algorithm.

.9 Digital outputs shall be capable of directly switching the following voltages. This contractor shall provide solid state relays that will accept this signal:

.1 24 VAC @ 36 VA operating

.2 120 VA`C @ 120 VA operating

2.9 Field Panels

.1 Provide local panels of unitized cabinet type for relays/devices. Mount relays, switches, transducers and controllers with set point adjustment in cabinet and pilot lights, push buttons, and switches flush on cabinet panel face.

.2 Fabricate panels from 3.0 mm furniture steel with baked enamel finish and removable hinged key lock door.

.3 Mount panels adjacent to associated equipment on vibration free walls or free standing angle iron supports.

.4 Field panels are not to be located in ceiling spaces.

.5 All main panels are to be located in Mechanical/Fan Rooms only.

.6 All panels serving microzone controllers (reheat/radiation) should be located in fully recessed panels located in mechanical rooms, fan rooms, storage rooms or janitors' rooms. The panel locations are to be approved by the consultant during the shop drawing stage.

.7 All field panels shall be labeled with lamicoid labels.

PART 3 EXECUTION

3.1 General

.1 The installation shall conform to each manufacturer's recommended procedures and to all applicable codes, statutes and ordinances.

.2 All equipment installed shall be mechanically stable and, as necessary, fixed to wall or floor. Anti-vibration mounts to be provided, if required, for the proper isolation of the equipment.

.3 Equipment shall be installed so as to allow for easy maintenance access. Equipment shall be installed such that it does not interfere in any way with access to adjacent equipment and personnel traffic in the surrounding space.

.4 Equipment shall be installed in locations providing adequate ambient conditions for its specified functioning, allowing for adequate ventilation.

.5 System Expansion: Provide five spare input and five spare output points in each Mechanical Room for future expansion and renovations. In addition, further expansion of the system shall be possible by simply adding more controllers to the network. The system shall be expandable to a maximum capacity in excess of 2500 points without making any of the original equipment redundant. The central control console shall directly support a minimum of 99 stand-alone controllers.

.6 The DDC panel points shall be defined such that the primary input sensor for a PID loop resides on the same panel as the output.

.7 Application specific controllers shall only be used where specified.

.8 Controller Memory: The non-volatile ROM, EPROM, EEPROM memory will, as a minimum, support all performance and technical specifications, communications, operating system, executive, application subroutines, etc. and other configuration description software. Tape or disk media systems are not acceptable. All control algorithms, application functions, and operating data or software shall reside in EEPROM. or battery backed RAM. That is, data or control program (such as I/O point characteristics,

schedules, set points, alarm limits, and control sequences) must remain in EEPROM and/or RAM and hence modifiable on-line through an operators terminal connected to any panel on the system.

RAM must include battery or other backup for a minimum of 72 hours to eliminate operating data reload in case of power failure.

.9 Controller Diagnostics: Control panel diagnostics, for both the primary controller and the micro-controllers, shall consist of built-in, continuous operational and board level tests, software control sequence analysis and alarm exception logging. Light emitting diodes and/or the alphanumeric display shall annunciate hardware failures, and control program errors or problems.

.10 All micro-controllers and central communications controllers shall be located in Mechanical rooms, Electrical rooms or Janitor rooms. Locations elsewhere shall be subject to Engineer's prior approval.

.11 Application specific controllers shall have a minimum of one spare universal input and one spare universal output point for future connections. Point expander cards are not to be used in the original installation.

.12 All controllers shall contain ports to interface to a Personal Computer. This access port shall provide full capabilities including programming.

.13 The control system shall operate independently from the Host Computer Workstation. All control, inter-panel communications and data collection functions shall continue to operate when the Host Computer Workstation is taken off line.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 01 01 50 — General Instructions

.2 Section 25 05 01 — EMCS: General Requirements

1.2 References

.1 American National Standards Institute (ANSI)

.1 ANSI C12.7-1993, Requirements for Watthour Meter Sockets.

.2 ANSI/IEEE C57.13-1978(R1987), Requirements for Instrument Transformers.

.2 National Electrical Manufacturer's Association (NEMA)

1.3 Submittals

.1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 01 01 50 – General Instructions and Section 25 05 01 – EMCS: General Requirements.

.2 Include:

.1 Information as specified for each device.

.2 Manufacturer's detailed installation instructions.

.3 Pre-Installation Tests

.1 Submit samples at random from equipment shipped, as requested by Departmental Representative, for testing before installation. Replace devices not meeting specified performance and accuracy.

.4 Manufacturer's Instructions

.1 Submit manufacturer's installation instructions for specified equipment and devices.

1.4 Closeout Submittals

.1 Submit operating and maintenance data for inclusion in operation and maintenance manual in accordance with Section 01 01 50 – General Instructions and Section 25 05 01 – EMCS: General Requirements.

PART 2 PRODUCTS

2.1 General

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration-proof, heat resistant assembly.

.3 Operating conditions: 0 - 32 °C with 10 - 90 % RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Transmitters to be unaffected by external transmitters (eg. walkie talkies).

.6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.7 Outdoor installations: use weatherproof construction in NEMA 3R enclosures.

.8 Devices to be installed in user occupied space must not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

2.2 Averaging Duct Sensors

.1 Shall be installed in all mixed air ducts and/or plenums, discharge air ducts and/or plenums, or any duct and/or plenum where stratification occurs.

.2 Shall have a minimum length of 1.5 meters with a duct and/or plenum cross sectional area of .75 square meters or less, and a minimum length of 6 meters for duct and/or plenum cross sectional areas in excess of .75 square meters.

.3 The sensor shall have thermistor sensing elements with a scale range lookup table in the DDC producing a linear output over its sensing range.

.4 Accuracy: plus or minus 0.05°C at 21°C.

.5 Minimum sensing range: -40°C to 40°C.

2.3 Duct Temperature Sensors

.1 Shall be installed in all ducts and/or plenums where stratification of the air flow does not occur.

.2 Shall have thermistor sensing elements with a scale range lookup table in the DDC producing a linear output over its sensing range.

.3 Minimum length: 203mm.

.4 Accuracy: plus or minus 0.2% over its operating range.

.5 Minimum sensing range: 4.5° C to 60°C.

2.4 Outdoor Air Temperature Sensors:

.1 Shall have 10,000 Ohm thermistor sensing elements with a scale range lookup table in the DDC producing a linear output over its sensing range.

.2 Accuracy: plus or minus 0.05°C at 21°C.

.3 Minimum sensing range: -40°C to 40°C.

.4 Shall be complete with sun shield

.5 Install at north side of building.

2.5 Immersion Sensors

.1 Shall be complete with a brass immersion well.

.2 Shall have thermistor sensing elements with a scale range lookup table in the DDC producing a linear output over its sensing range.

.3 Accuracy: plus or minus 0.05°C at 21°C.

.4 Minimum sensing range: -40°C to 40°C.

2.6 Room Temperature Sensors

.1 Shall have a flush-mounted stainless steel blind cover for all applications unless noted otherwise.

.2 Room temperature sensors for offices, room temperature sensors shall permit occupant control of set point within a pre-defined range which is software programmable. Sensor shall display set point temperature and ambient temperature upon demand by occupant and have 4 programmable function push buttons.

.3 Shall have a thermister sensing element producing a linear output over its sensing range.

.4 Accuracy: plus or minus 0.2% over its operating range.

.5 Minimum sensing range: 4.5°C to 35°C.

2.7 Duct Humidity Sensors

.1 Shall be ultra-fast response polymer capacitance sensor, not affected by condensation, fog, high humidity, or contaminants.

.2 Sensor to be suitable for 12-40 VDC/12-35 VAC unregulated supply voltage and 4-20 ma 2 wire output, or field selectable 0-5 VDC/0-10 VDC output.

.3 Sensor shall have an accuracy of plus or minus 2%/3% and a range of 0-100% RH. Sensor shall have ABS plastic wall mount complete with blank cover with a clear Lexan guard.

2.8 Differential Pressure Sensors (DPS)

.1 Shall vary the output voltage with changes in differential pressure.

.2 End to end accuracy: not less than +1% of span including non-linearity, repeatability and hysteresis.

.3 Application: building pressurization control shall have auto-zeroing feature.

2.9 Current Sensors (CT)

.1 Shall vary the output voltage with a change in current.

.2 Provide actual analog current indication for status of all motors 1 horsepower and larger.

.3 In software provide multiple switch points to determine both motor status and belt breakage. Size for inrush and F.L.A.

.4 Provide alarm indication for high and low current.

.5 Provide digital current indication for all motors 3/4 HP and smaller by using current switches (CS) which shall open or close a contact from motor induced current to indicate motor status.

2.10 Carbon Dioxide Sensor (CDS):

.1 Shall be non-dispersive, infrared type, duct mount or wall mount as required.

.2 Accuracy: 3% or 50ppm, whichever is greater over typical conditions of 0-50C and 0-95% RH non-condensing.

.3 Shall automatically calibrate to compensate for drift.

.4 Shall have a five year calibration guarantee.

.5 Shall not require any additional software/hardware for configuration or diagnosis.

2.11 Motion Detector (MD):

.1 Shall be utilizing microwave and PIR technology plus a micro controller, using adaptive threshold technology to provide false alarm immunity.

.2 Sensor shall have electronic temperature compensation and microwave pattern shaping to match the PIR pattern.

.3 Mounting location, model and number of detectors to be in accordance with manufacturer's recommendations.

2.13 Airflow Measuring Station:

.1 Thermal dispersion airflow measuring station. Bead-in-Glass thermistors, waterproof epoxy sensor, 304 stainless steel mounting, FEP plenum rated cable, microprocessor-based with high performance A/D converter, 2% sensor airflow accuracy, 0 to 5,000 FPM airflow operating range, -20°F to 160°F temperature operating range, 24VAC power supply; analog, RS-485 and Ethernet (BACnet Ethernet, TCP/IP) output.

2.14 Combination Relay, HOA and Current Sensor (CR-HOA)

.1 Enclosed relay, current sensor, SPST and built in HOA for manual control. Designed for fractional HP motors (up to 1 HP at 120/1/60).

.2 Relay type: One (1) SPST.

.3 Relay status: LED with

.4 Current sensor range: adjustable set point;

.5 Current sensor range: 0-10 Amps

.6 Current sensor output: 0-5 VDC, 0-10 VDC.

2.11 Control Valves and Actuators

.1 Provide automatic temperature control valves as scheduled and indicated on drawings. Sufficient clearance above control valves shall be provided to allow removal of superstructure without removing body from line. All valve stems shall be vertical. All electric valves, including zone valves, scheduled for modulating service shall be fully proportional (no floating control) suitable for 0-10 volt, or 4-20 mA input signal.

.2 Control valves, both 2 and 3 way configuration, shall have the following minimum characteristics:

.1 Body shall be brass meeting ANSI Standard B16.15 Class 250 for all valves 50 mm and smaller. Larger valves shall be cast iron, Class 125, meeting ANSI Standard B16.15.

.2 Valve stem shall be 316 stainless steel.

.3 Valves shall have brass plug, composition seat with maximum seat leakage of 0.01% of flow rating per ANSI B16.104, and equal percentage flow characteristic.

.4 Valves for terminal zone coils, fan coils and radiation shall have EPT or TFE packing material and NPT, union or flare connections.

.5 Valves for primary equipment sized 50 mm and smaller shall have screwed connections. Valves sized 65 mm and larger shall have flanged connections.

.6 Ball Valves are not acceptable for control applications.

.3 When more than one control valve is used for temperature or pressure control on a system, or equipment item they shall be sequenced. e.g. two valves on a heating coil or pressure reducing station; heating and cooling coil valves on an air handling system.

.4 Valves on hazardous services shall fail to a safe position. e.g. Valves controlling heating to domestic hot water shall fail closed to heating when not powered.

.5 Actuators shall be of the rotary or piston type for either modulating or two position control. Actuators shall be powered by an overload-proof synchronous motor. Control voltage shall be either 120 VAC, 24 VAC, 10 VDC, or 4-20 mA with spring return on power failure, where required. (ie outdoor air dampers and HVAC primary heating valves). Actuators (motors) shall have repair kits available, and be re-buildable in the field. Provide proportional actuator position feedback on all primary equipment (air handling units) to prove actuator position.

.6 All control valves shall have replaceable bonnets, and packing. The packing shall be replaceable in the field without having to remove the valve from the piping network.

.7 All control valves shall be sized to deliver the specified flow rate in the 100% open position. Control valves using a "limited stroke" to achieve the proper flow coefficient shall not be used.

2.12 Dampers and Actuators

.1 All control dampers not furnished with packaged equipment shall be supplied by the controls subcontractor and installed by the sheet metal subcontractor. Provide damper actuators for all dampers shown or specified.

.2 All dampers in a mixing application shall be parallel blade with direction of closing producing opposed air streams for optimal mixing. Return air dampers shall be a tight closing, low leakage type with replaceable blade and edge seals, T.A. Morrison Series 1000 or approved equal.

.3 Actuators shall be electronic, direct coupled, as manufactured by Belimo, Siemens, or Approved Equal. Control voltage shall be 0-10 VDC, or 4-20 mA with an internal spring return on power failure. Provide a 2-10 VDC proportional actuator position feedback signal on all primary equipment (air handling units, relief air and emergency generators) to prove actuator position. Actuators shall permit manual positioning of damper when actuator is not powered.

PART 3 EXECUTION

3.1 General

.1 Check and verify location of thermostats and other exposed control sensors with plans and room details before installation. Locate thermostats and temperature sensors 1.5m above floor.

.2 Install damper motors on outside of ducts. Do not locate in outside air stream.

.3 The installation shall conform to each manufacturer's recommended procedures and to all applicable codes, statutes and ordinances.

.4 Equipment shall be installed so as to allow for easy maintenance access. Equipment shall be installed such that it does not interfere in any way with access to adjacent equipment and personnel traffic in the surrounding space.

.5 All transmitters, interfaces, terminations and control relays, etc. shall be mounted in field cabinets that may be locked.

.6 Freeze protection devices shall be hard wired and also wired to alarm through DDC system.

.7 All wall mounted devices in new finished space shall be mounted on a wall box. The wall box shall be connected to the ceiling space by a conduit stub. On renovations, when sensors are mounted in existing finished walls, wiring or tubing may be fished into the walls without conduit.

.8 Provide tamperproof screws to new and relocated equipment, controls enclosures and devices which are located in inmate accessible areas. Tamperproof screws shall be stainless TORX with pin.

3.2 Sensors

.1 Sensors provided shall be installed in accordance with the Manufacturer's prescribed procedures.

.2 Sensors shall be rigidly mounted and mountings shall be adequate for the environment within which the sensor operates.

.3 Averaging type temperature sensors shall be used wherever mixed air or stratified temperature is to be monitored. They shall be installed in a serpentine configuration with adequate provision for the mechanical protection of the sensor and such that it is supported as required along its entire length.

.4 Duct type thermistors shall be used for the monitoring of all uniform air temperature. Length shall be such that the sensing element is installed to not less than one third of the duct width or duct diameter from the duct wall.

3.3 Combination Relay, HOA and Current Sensor (CR-HOA)

.1 Provide Combination Relay, HOA and Current Sensor for equipment up to 3/4 horsepower (e.g., unit ventilators, fan coil units, unit heaters, fans, circulating pumps, etc.) where starters are not provided under Division 26.

3.4 Digital Gas Detectors for Carbon Monoxide (CO), Nitrogen Dioxide (NO2) and Propane (C3H8)

.1 Provide remote mount digital sensor transmitters with BACnet MS/TP output signal, three sensor capability for Carbon Monoxide (CO) from gas engine exhaust, with an electrochemical sensor for CO with a detection range of 0 - 200 ppm and Nitrogen Dioxide (NO2) from diesel engine exhaust, with an electrochemical sensor for NO2

with a detection range of 0 – 10 ppm and a remote combustible sensor for propane (C3H8) and gasoline vapours with a detection range of 0 – 100% LEL and a splash guard. The sensor transmitter and shall be housed in a rugged, water/dust tight, wall mount, polycarbonate junction box with a secured, hinged door. The remote mount CO/NO2 sensor transmitters shall operate on low voltage power supplied by the installer. Install the CO and NO2 sensor at approximately 4' to 6' from the floor (breathing zone). The lower mounted Propane/gasoline vapour sensor/transmitter shall be housed in a rugged water/dust tight, wall mount, polycarbonate junction box with a secured, hinged door and splash guard. Install the C3H8 sensor at 6" from the floor (C3H8 and gasoline vapours are heavier than air).

.2 In all cases use liquid tight conduit hubs when entering any water tight enclosure types to maintain water tight status. Install to the wall only by the provided enclosure mounting locations. Failure to do so voids any damage from water intrusion.

.3 System operation shall be as follows: Upon detection of 25 ppm CO, 0.7 ppm NO_2 or 10% LEL Propane the transmitters shall illuminate the Low alarm LED and the Low alarm relay inside the LPT-B will be activated immediately and the value detected will be digitally sent to the DDC. The DDC system shall activate and keep the fans running for a minimum of 10 minutes to avoid cycling.

.4 Upon detection of 50 ppm CO, 0.9 ppm NO_2 or 15% LEL Propane the value detected will be digitally sent to the DDC indicating an increase in interior exhaust build up.

.5 Upon detection of 100 ppm CO, 1.0 ppm NO_2, or 20% LEL Propane the value detected will be digitally sent to the DDC indicating continued increase in interior exhaust build up. The internal audible alarms inside the LPT-B transmitters shall be activated and any other audible/visual alarms in the service area shall be activated as a warning.

.6 The contractor shall provide all wiring (digital), conduit and interconnection required for a successful installation. Wiring must be 4-conductor, network style, 16-18 gauge, stranded, shielded, low capacitance. System shall be tested and commissioned after installation by a trained, authorized service representative of the manufacturer, with a detailed service report provided after the site visit.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 25 05 01 EMCS: General Requirements

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 Sequence of Operation

.1 Domestic Hot Water Recirculation Pump Control

.1 Domestic hot water recirculation pump (DWP-2) shall be switched by the building DDC control system to control pump operation in accordance with time of day schedule.

.2 Domestic hot water pump (DWP-1) for instantaneous domestic hot water heater shall be cycled by aquastat furnished and installed by Electrical Contractor.

.3 Provide current transformer to monitor status of circulating pumps.

.3 Air Handling Units – Heating & Ventilating (HV-1 and HV-2):

.1 The DDC control system shall switch the system room "occupied" to "unoccupied" mode of operation and shall allow override capability from the room sensor to restore "occupied" mode of operation. The room sensor shall maintain reduced temperature during "unoccupied" periods and shall be integrated with the system optimal start feature.

.2 During "occupied" mode of operation the outdoor air damper and return air dampers shall be positioned as determined by the balancing contractor to provide the scheduled minimum outdoor air volume, except during economizer control.

.3 During the heating season, the heating gas valve shall modulate to maintain scheduled discharge air temperature set point. Upon demand for cooling the heating control valve shall close.

.4 Upon a continued demand for cooling, the outdoor air damper shall modulate open from minimum position to 100%. The mixed air temperature shall be maintained at the highest temperature allowable without causing overheating or allowing the outdoor air volume to fall below the minimum setting. The mixed air temperature of the air handling system shall be limited to a minimum of 12.8°C (55°F) during a demand for cooling.

.5 The outdoor air dampers are to remain closed during the morning warm-up period until the return air temperature is 20° C.

.6 Air handling unit is to run continuously during "occupied" mode of operation and are to cycle to maintain a reduced temperature with the outdoor air damper remaining closed during "unoccupied" periods. An optimal start program shall

control the morning start-up of all air handling unit to reach the "occupied" temperature set point at the required time. The calculation shall compensate for outdoor air temperature, actual indoor air setback temperature, and warm up period required, based upon past performance. Under "heating" mode of control the startup shall be delayed as long as possible. Under "cooling" mode of control, the unit shall start and run on 100% outdoor air when appropriate to pre-cool the building to set point temperature using free cooling.

.7 If the mixed air temperature falls below a low limit, the outdoor air damper shall maintain the normal minimum ventilation set point until the mixed air return to normal.

.8 Provide analog pressure differential sensor across each filter bank and monitor status of fan operation and filter pressure drop for each air handling unit.

.9 Provide damper position feedback at the DDC.

.10 Provide motorized outdoor air dampers MD-2 and MD3.

.1 When the outdoor air temperature is below 12.8°C (55°F) and there is a call for cooling, enable fan and modulate HV-1 and HV-2 outdoor air and return air damper to maintain minimum 12.8°C (55°F) supply air temperature. Open relief air damper.

.2 When the outdoor air temperature is above 12.8°C (55°F) and there is a call for cooling, enable exhaust fan and modulate outdoor air damper to 100%.

.3 When there is no call for cooling, close outdoor air damper.

.4 When the outdoor air temperature is above 12.8°C (55°F) and there is a call for cooling, enable exhaust fan EF-12 and modulate HV-2 outdoor air damper to 100%. When the Dust Collector is switched on, exhaust fan EF-12 to be disabled and motorized damper MD-2 shall open.

.5 When the outdoor air temperature is above 12.8°C (55°F) and there is a call for cooling, enable exhaust fan EF-1 and modulate HV-2 outdoor air damper to 100% and motorized damper MD-3 shall open.

.11 Provide damper actuators for motorized dampers furnished with equipment. Provide damper position feedback at the DDC.

.4 Packaged DX Air Handling Units (RTU-1 and RTU-2):

.1 The DDC control system shall switch the system from “occupied” to “unoccupied” mode of operation and shall allow override capability from the room sensor to restore “occupied” mode of operation. The room sensor shall maintain reduced temperature during "unoccupied" periods and shall be integrated with the system optimal start feature.

.2 During "occupied" mode of operation the outdoor air damper and return air dampers shall be positioned as determined by the balancing contractor to provide the scheduled minimum outdoor air volume, except during economizer control.

.3 During the heating season, the heating gas valve shall modulate to maintain scheduled discharge air temperature set point. Upon demand for cooling the heating control valve shall close.

.4 Upon a continued demand for cooling, the outdoor air damper shall modulate open from minimum position to 100%. The DDC shall enable the packaged condensing unit and provide an analog signal to the remote condensing unit controller to control discharge air control with reset from the DDC. The mixed air temperature shall be maintained at the highest temperature allowable without causing overheating or allowing the outdoor air volume to fall below the minimum setting. The mixed air temperature of the air handling system shall be limited to a minimum of 12.8°C (55°F) during a demand for cooling. Coordinate with air handling unit manufacturer on controls.

.5 When free cooling is unable to satisfy the cooling demand, the DDC shall enable the packaged DX cooling. The modulating outdoor air damper shall revert to the minimum outdoor air damper position and the DDC shall enable the condensing unit to maintain the required supply air temperature to prevent overheating.

.6 The outdoor air dampers are to remain closed during the morning warm-up period until the return air temperature is 20° C.

.7 Air handling unit is to run continuously during "occupied" mode of operation and are to cycle to maintain a reduced temperature with the outdoor air damper M remaining closed during "unoccupied" periods. An optimal start program shall control the morning start-up of all air handling unit to reach the "occupied" temperature set point at the required time. The calculation shall compensate for outdoor air temperature, actual indoor air setback temperature, and warm up period required, based upon past performance. Under "heating" mode of control the startup shall be delayed as long as possible. Under "cooling" mode of control, the unit shall start and run on 100% outdoor air when appropriate to pre-cool the building to set point temperature using free cooling.

.8 If the mixed air temperature exceeds a high limit or falls below a low limit, the outdoor air damper shall maintain the normal minimum ventilation set point until the mixed air return to normal.

.9 Provide analog pressure differential sensor across each filter bank and monitor status of fan operation and filter pressure drop for each air handling unit.

.10 Provide damper position feedback at the DDC.

.11 Provide CO2 sensor and install in the space, location as indicated on drawings. The CO2 sensor shall modulate the outdoor air damper, for each mode of operation, to prevent CO2 levels exceeding 700 ppm above outdoor air CO2 level (adjustable). To maintain slight positive building space pressure, the outdoor air damper shall never modulate fully closed. During the heating mode when the CO2 level is high, the outdoor air damper shall modulate open to maximum allowable position, without the mixed air temperature dropping below the minimum set point. The CO2 controls shall be locked out when the unit is running 100% outdoor air for free cooling.

.12 During the “occupied” and “unoccupied heating mode, DDC shall enable/disable the Electric Duct Heaters to maintain scheduled space temperature setting of the space temperature sensor.

.13 Provide damper actuators for motorized dampers furnished with equipment. Provide damper position feedback at the DDC.

.5 Gas-Fired Make Up Air Unit (MUA-1):

.1 The unit shall be started, stopped and monitored at DDC, interlocked to operate when the dust collector DC-1 operates.

.2 Provide room temperature sensor to maintain scheduled room temperature.

.6 Gas-Fired Unit Heaters/Radiant Heaters Controls (UH-1 to UH-6; RTH-1 to RTH-3):

.1 The units shall be started, stopped and monitored at DDC. Provide room temperature sensor to maintain scheduled room temperature.

.7 Electric Baseboard Heaters Controls (EBH-1 to EBH-5):

.1 Provide room temperature sensor to modulate the heater and maintain room temperature.

.8 Cabinet Unit Heater Control (FFH)

.1 On cabinet type force flows, provide, wall mounted temperature sensor to control fan. Fan shall cycle with heater to maintain space temperature. Fan to be de-energized or remain Off if heat is not available.

.9 Exhaust Fans:

.1 EF-2 shall be started, stopped and monitored at the DDC. Fan shall operate continuously 24-7.

.2 EF-1, EF-7, EF-8 and EF-12 shall be started, stopped and monitored at the DDC.
Exhaust Fan EF-1 shall operate on the same schedule as HV-1.
Exhaust Fans EF-7 and EF-12 shall operate on the same schedule as HV-2.
Exhaust Fan EF-8 shall operate on the same schedule as RTU-1.

.3 EF-6, EF-11, EF-14 and EF-15 shall be started, stopped and monitored at the DDC. Provide room temperature sensor to cycle the fan to maintain room temperature set point.

.4 EF-3, EF-4, EF-5 and EF-13 shall be controlled by wall switches, furnished and installed by Division 26.

.5 EF-9 and EF-10 shall be started, stopped and monitored at the DDC. Fan shall be interlocked with building occupied mode.

.10 Motorized Dampers (MD-1 to MD-6):

.1 Motorized dampers interlocked with exhaust fans, refer to equipment schedules.

.11 Sanitary Sump Pump Stations:

.1 Monitor pump status at DDC and high water level alarm.

.12 Optimal Start Program

.1 An optimal start program shall control the morning start-up of all air handling units to reach the "occupied" temperature set point at the required time. The calculation shall compensate for outdoor air temperature, actual indoor air setback temperature, and warm up period required, based upon past performance. Under "heating" mode of control the start-up shall be delayed as long as possible. Under "cooling" mode of control, the unit shall start and run on 100% outdoor air when appropriate to pre-cool the building to setpoint temperature using free cooling. The outdoor air dampers are to remain closed during the morning warm up period until the return air temperature is 20°C.

.13 Fire Alarm Interlock

.1 The Control Contractor shall coordinate with Division 16 for all DDC controlled fan starters to be interlocked with smoke control contacts, provided by Division 16, to shut down and/or override all fan operation if any fire alarm initiating zones are activated.

.2 Division 16 will supply and install smoke detectors within the air plenums or ductwork of the fan units and will provide relay contacts for connection of the fan control circuits of the starter assemblies.

.3 The DDC System shall sequentially restart all fan systems after a fire alarm has been reset.

.4 The interlock between the smoke detector and the relays shall be supplied and installed by the Electrical Subcontractor. Refer to electrical drawings for location of these relay contacts. Division 15 shall provide wiring between the shutdown relays and the starter assemblies. The Sheet Metal Subcontractor shall provide duct access panels as required for the smoke detectors; coordinate with Division 16.

.14 Miscellaneous Controls

.1 Domestic Water Meter:

.1 Water meter will be furnished and installed by Mechanical Contractor. Controls Contractor shall provide transmitter (Neptune model Tricon/E3) and wiring between the water meter and DDC. Domestic water consumption shall be monitored at DDC and installed per manufacturer's instructions.

.2 Gas Meter:

.1 Gas consumption shall be monitored at DDC. Controls Contractor shall furnish and install gas meter at the Building incoming gas main to monitor the building gas consumption. Gas meters shall be as manufactured by Sage or approved equal.

.3 Electrical Power Meter:

.1 Electrical power meter (w/ Modbus points) will be furnished by Division 26. Controls Contractor shall monitor provide wiring and monitor power consumption at DDC. Coordinate with Division 26 for details. Review with Departmental Representative the points to be mapped (including but not limited to amperage and voltages for the three phases, power consumption, power factor, max/min values).

.4 Refer to Points List for additional control and monitoring points.

.5 Provide low voltage wiring for FEF-3 (Garage Hose).

.6 Provide outdoor air temperature sensor.

3.2 Point List

.1 The following point lists are typical of the Analog and Digital output and input points required to achieve the intended sequence of operation and provide the required level of monitoring and control. They are intended to set a minimum level of acceptability. All additional points required to achieve the specified features and sequence of operation shall be provided by the control contractor.

AIR HANDLING UNIT – HEATING & VENTILATING (HV-1 and HV-2)							
	POINTS				ALARM/INDICATION		
POINT DESCRIPTION	**AI**	**AO**	**DI**	**DO**	**HI**	**LO**	**FAIL**
SUPPLY FAN START/STOP/STATUS	CT			CR			X
SUPPLY AIR TEMPERATURE	DTS				X	X	
RETURN AIR TEMPERATURE	DTS				X	X	
MIXED AIR TEMPERATURE	ATS					X	
MIXING DAMPERS	PF	DMA					
OUTDOOR AIR DAMPER	PF	DMA					
FILTER STATUS	DPS				X	X	
RELIEF AIR DAMPER (MD)				DMD			

PACKAGED DX AIR HANDLING UNITS (RTU-1 AND RTU-2)							
	POINTS				ALARM/INDICATION		
POINT DESCRIPTION	**AI**	**AO**	**DI**	**DO**	**HI**	**LO**	**FAIL**
SUPPLY FAN START/STOP/STATUS	CT			CR			X
SUPPLY AIR TEMPERATURE	DTS					X	
RETURN AIR TEMPERATURE	DTS					X	
MIXED AIR TEMPERATURE	ATS					X	
MIXING DAMPERS	PF	DMA					
OUTDOOR AIR DAMPER	PF	DMA					
DX PACKAGED CONTROLLER SUPPLY AIR TEMP SETPOINT		X					
DX PACKAGED CONTROLLER STATUS			R-ST				X
FILTER STATUS	DPS				X		
COOLING STAGES % ON		X					X
CO2 SENSOR	CDS				X		

ELECTRIC DUCT HEATERS (EDH-1 to EDH-5)							
	POINTS				ALARM/INDICATION		
POINT DESCRIPTION	**AI**	**AO**	**DI**	**DO**	**HI**	**LO**	**FAIL**
SUPPLY AIR TEMPERATURE		X			X	X	
SPACE TEMPERATURE	RTS	SCR			X	X	
REHEAT DUCT HEATER		CT					X

FUME EXHAUST FANS (FEF-1, FEF-2 AND FEF-3)							
	POINTS				ALARM/INDICATION		
POINT DESCRIPTION	**AI**	**AO**	**DI**	**DO**	**HI**	**LO**	**FAIL**
FAN STATUS	CT			X			X

MAKE-UP AIR UNIT (MUA-1)							
	POINTS				ALARM/INDICATION		
POINT DESCRIPTION	**AI**	**AO**	**DI**	**DO**	**HI**	**LO**	**FAIL**
UNIT START/STOP/STATUS	CT			CR			X
SUPPLY AIR TEMPERATURE	DTS						
FILTER STATUS	DPS				x	x	
SPACE TEMP.	RTS				x	x	

GAS-FIRED UNIT HEATERS/RADIANT HEATERS (UH-1 to UH-6; RTH-1 to RTH-3)							
	POINTS				ALARM/INDICATION		
POINT DESCRIPTION	**AI**	**AO**	**DI**	**DO**	**HI**	**LO**	**FAIL**
FAN START/STOP/STATUS	CT			CR			X
SPACE TEMPERATURE (TYP.)	RTS				X	X	

ELECTRICAL FORCE FLOW HEATERS (FFH-1 TO FFH-6)							
	POINTS				ALARM/INDICATION		
POINT DESCRIPTION	**AI**	**AO**	**DI**	**DO**	**HI**	**LO**	**FAIL**
SPACE TEMPERATURE	RTS			CR	X	X	

ELECTRICAL BASEBOARD HEATERS (EBH-1 TO EBH-6)							
	POINTS				ALARM/INDICATION		
POINT DESCRIPTION	**AI**	**AO**	**DI**	**DO**	**HI**	**LO**	**FAIL**
SPACE TEMPERATURE	RTS				X	X	

EXHAUST FANS							
	POINTS				**ALARM/INDICATION**		
POINT DESCRIPTION	**AI**	**AO**	**DI**	**DO**	**HI**	**LO**	**FAIL**
EXH. FANS (EF-1 TO EF-5, EF-7 TO EF-10, EF-12 AND EF-13 START/STOP/STAT	CT			CR			X
SPACE TEMPERATURE SENSOR (EF-6, EF-11, EF-14 AND EF-15)	RTS						

SAWDUST COLLECTION UNIT (DC-1)							
	POINTS				**ALARM/INDICATION**		
POINT DESCRIPTION	**AI**	**AO**	**DI**	**DO**	**HI**	**LO**	**FAIL**
UNIT STAR/STOP/STATUS	CT			CR			X
FILTER STATUS	DPS				X	X	
SHAKER MECHANISM	CT			CR			X
DC-1 FIRE ALARM INPUT			DCI				

GAS-FIRED RADIANT HEATERS (RTH-1 to RTH-3)							
	POINTS				**ALARM/INDICATION**		
POINT DESCRIPTION	**AI**	**AO**	**DI**	**DO**	**HI**	**LO**	**FAIL**
SPACE TEMPERATURE (TYP.)	RTS			CR	X	X	

MISCELLANEOUS							
	POINTS				**ALARM/INDICATION**		
POINT DESCRIPTION	**AI**	**AO**	**DI**	**DO**	**HI**	**LO**	**FAIL**
OUTDOOR AIR TEMPERATURE	DTS						
OUTDOOR AIR HUMIDITY	DHS						
OUTDOOR AIR CO2 SENSOR	CDS						
DHW RECIRC. PUMP (DWRP-1, DWRP-1(*), DWRP-2(*)) START/STOP/STATUS	CT			CR			X
SANITARY SUMP PUMP STATUS (DUPLEX)	CT						X
SANITARY SUMP HIGH LEVEL ALARM			R-ST		X		
BUILDING WATER METER	Pulse		Pulse				
BUILDING MAIN GAS METER	Pulse		Pulse				
ELECTRICAL POWER METER	MODBUS POINTS ONLY						
MOT. DAMPERS (MD-1 TO MD-6)	CT			CR			X
DIGITAL GAS DETECTORS	X				X		X

NOTE: POINT COUNT IS APPROXIMATE. CONTROLS CONTRACTOR SHALL VERIFY EXACT QUANTITY AND PROVIDE ADDITIONAL POINTS AS REQUIRED TO ACHIEVE THE SEQUENCE OF OPERATION DESCRIBED IN THE CONTRACT DOCUMENT.

ATS Averaging Temperature
ASD Adjustable Speed Drive
CDS Carbon Dioxide Sensor
CS Current Switch
CR Digital Relay
CT Analog Current Transformer
DCI Dry Contact Input
DHS Duct Humidity Sensor
DMA Damper Motor (Analog)
DMD Damper Motor Digital
DPS Diff. Press. Switch (Analog)
DTS Duct Temperature Sensor
DHS Duct Humidity Sensor
ES End Switch
FSA Flow sensor - Air
FSW Flow sensor - Water
LTS Low Temperature Switch
MOP Proportional A.O. (4-20 ma)
MD Motion Detector
O-SW Override Switch
OTS Outdoor Air Temp.
PF Position Feedback
POT Potentiometer
R-ST Relay Status
RHS Room Humidity Sensor
RTS Room Temperature
VMA Valve Motor (Analog)
VMD Valve Motor (Digital)
VPM Variable pump motor
WTS Water Temperature
SCR Cascade Controller

END OF SECTION

1.1 GENERAL

.1 The General Conditions, Supplements and Amendments shall govern this Section (read in conjunction with Instructions to Tenders/Bidders). This Section covers items common to Sections of Division 26, 27, and 28. This section supplements requirements of Division 01.

.2 Reference to "Electrical Division" shall mean all related Electrical Sections and components including Division 26.

.3 The word "Provide" shall mean "Supply & Install" the product and services specified. "As Indicated" means that the item(s) specified are shown on the drawings.

.4 Provide materials, equipment and devices of specified design, performance, intent and quality; and, current models with published certified ratings for which replacement parts are readily available. Provide project management and on-site supervision to undertake administration, meet schedule, ensure timely performance, ensure coordination and establish orderly completion and the delivery of a fully commissioned installation.

.5 The most stringent requirements of this section, other electrical sections and drawings shall govern.

.6 All work shall be in accordance with the PROJECT Drawings and Specifications and their intents, complete with all necessary components, including those not normally shown or specified but required for a complete installation.

1.2 CODES AND STANDARDS

.1 Do complete installation in accordance with Canadian Electrical Code, CSA C22.1-2012.

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

.3 Perform work in accordance with CSA Z462 - Workplace Electrical Safety and WorkSafeBC.

1.3 DEFINITIONS

.1 Electrical and Electronic terms: unless otherwise specified or indicated, terms used in these specifications and on drawings are those defined by IEEE SP1122.

1.4 PERMITS, FEES

.1 Submit to Electrical Inspection Department necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Obtain and pay for an electrical permit to cover all electrical, and telecommunications work.

.4 Submit a copy of electrical permit to the Departmental Representative prior to commencement of work on site.

.5 Departmental Representative will provide drawings and specifications required by Electrical Inspection Department at no cost.

.6 Notify Departmental Representative of changes required by Electrical Inspection Department prior to making changes.

.7 Furnish Certificates of Acceptance from Electrical Inspection Department on completion of work to Departmental Representative.

1.5 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

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

.2 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

.3 Where applicable, include wiring, single line and schematic diagrams.

.4 Include wiring drawings or diagrams showing interconnection with work of other Sections.

1.6 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Division 1.

.2 Additional maintenance material requirements are included under various other Sections.

1.7 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into operation and maintenance manual specified in Division 1.

.2 Include in operations and maintenance data:

.1 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.

.2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.

.3 Wiring and schematic diagrams and performance curves.

.4 Names and addresses of local suppliers for items included in maintenance manuals.

.5 Copy of reviewed shop drawings.

1.8 CARE, OPERATION AND START-UP

.1 Instruct Departmental Representative and operating personnel in the operation, care and maintenance of equipment.

.2 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.9 VOLTAGE RATINGS

.1 Operating voltages: to CAN3-C235-83 (R1996).

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.10 MATERIALS AND EQUIPMENT

.1 Equipment and material to be new and CSA certified, and manufactured to standard quoted.

.2 Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Inspection Department.

1.11 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.1 Lamicoid 3 mm thick plastic engraving sheet, white face and black core, self-adhesive unless specified otherwise.

.2 Nameplates

NAMEPLATE SIZES

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 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.

.3 Allow for average of twenty-five (25) letters per nameplate.

.4 Identification to be English.

.5 Nameplates for junction boxes to indicate system and/or voltage characteristics.

.6 Nameplates for pull boxes to indicate system and type of cable.

1.12 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, numbered plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding for 347/600 V, and 120/208V wiring throughout.

1.13 WIRING IDENTIFICATION IN UNDERGROUND PULL BOXES

.1 LABELS:

- .1 Stainless steel, type 304, 0.737 mm thickness.
- .2 Round, approximately 38mm diameter.
- .3 Hole at one end of label.
- .4 Loop in label hole in addition to tie-wrap fastener on cable. Extra loop required to ensure label hangs freely. Stainless steel ring.
- .5 Remove sharp edges.
- .6 Cable identification laser-etched on label.
- .7 Submit samples of etched label complete with holes, lop and tie-wraps for approval by Departmental Representative.
- .8 Tie-wraps:
  - .1 Stainless steel (316) with locking device in head
  - .2 At least 4.5mm width for fastening to cables.
- .9 Text 3 mm height minimum. Maximize text size to aid readability.

1.14 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

1.15 PROTECTION

.1 Protect exposed live equipment during construction for personnel safety.

.2 Shield and mark live parts "LIVE 120 VOLTS", or with appropriate voltage.

1.16 CONDUIT AND CABLE INSTALLATION

.1 Refer to drawings for type of conduit and cable to be used.

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

.3 Run parallel or perpendicular to building lines.

1.17 CUTTING, CORING AND PATCHING

.1 Make arrangements with General Contractor for all cutting, coring and patching in this work.

.2 Conduct ground penetrating radar (GPR) scans prior to coring or cutting existing concrete slabs or walls.

1.18 FIRESTOPPING

.1 Where cables or conduits pass through fire rated ceilings and fire rated walls, pack space full with a ULC approved firestopping system.

1.19 FIELD QUALITY CONTROL

.1 Conduct and pay for testing, commissioning, demonstration and training of the following:

- .1 Insulation resistance testing:
  - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
  - .2 Check resistance to ground before energizing.
- .2 Circuits originating from branch distribution panels.
- .3 Lighting and associated controls.

.2 Refer to each Section for additional testing requirements.

.3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.4 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that each system is taken out of service the shortest possible amount of time.

.5 Submit test results for Departmental Representative review.

1.20 POWER INTERRUPTIONS

.1 Contractor shall work closely with Institutional personnel to arrange all interruptions of any portion of the existing electrical distribution systems.

.2 All interruptions to existing electrical distribution systems and shutdown of existing 600V distribution in building 115 shall be carried out outside normal working hours, or on weekends. Normal working hours of the Institution are considered to be 0730 to 1600 hours, Monday through Friday, except holidays.

.3 Shutdown time of the 1200A, 600V Emergency Distribution shall be kept to an absolute minimum. Maximum duration of one shutdown shall be one (1) hour.

.4 Contractor shall submit request for any power shutdown 10 working days prior to such power shutdown. Request shall indicate start time of interruption and

duration of interruption. Indicate in request exactly what buildings and/or systems will be affected by the requested power shutdown.

.5 No interruptions to power shall be carried out without the approval of the Departmental Representative.

1.21 CLEANING

.1 Do final cleaning in accordance with Division 1.

.2 At time of final cleaning, clean luminaire reflectors, lenses, and other luminaire surfaces that have been exposed to construction dust and dirt.

1.22 RECORD DRAWINGS

.1 Refer to Division 1.

.2 Indicate conduit and cable runs, junction boxes and circuit numbers.

1.23 ENVIRONMENTAL PROTECTION AND WASTE MANAGEMENT

.1 Refer to Division 1.

.2 Refer to Division 1.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C68.3-97(R2006), Shielded and Concentric Neutral Power Cables Rated 5-46 kV.

.2 CSA-C233.1-87(R2004), Gapless Metal Oxide Surge Arresters for Alternating Current Systems.

.2 National Electrical Manufacturers' Association (NEMA)/Insulated Cable Engineers Association (ICEA)

.1 NEMA WC3-1992/ICEA S-19-81, Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

.2 NEMA WC74/ICEA S-93-639-2012, 5-46kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 01 50 – General Instructions.

.2 Provide product data in accordance with Section 01 01 50 – General Instructions.

.1 Provide manufacturer's printed product literature, specifications, data sheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse or recycling in accordance with Section 01 01 50 – General Instructions.

Part 2 Products

2.1 CONCENTRIC NEUTRAL POWER CABLES (5001 - 15000 V)

.1 Concentric neutral power cable: to NEMA WC74-1992/ICEAS-66-524, AEIC CS5, ICEA S-66-524 and CSA-C68.3.

.2 Single aluminum conductor, size as indicated.

.3 Semi-conducting strand shield.

.4 Class 2 compact round stranding per ASTM B4596:

.1 All strand interstices to be filled during stranding operation and each wire and successive layers of wires to be sealed with approved sealing compound.

.2 Acceptable products: Canada Wire "STRAND BLOCK"; Pirelli "STRANDSEAL."

.5 Insulation: tree-retardant cross-linked thermo-setting polyethylene (TR-XLPE) rated 90°C and 15 kV for 100 % voltage level.

.6 Semi-conducting insulation shielding layer.

.7 Copper neutral wires applied helically over insulation shield equivalent to 100 % full capacity.

.8 Separator tape over neutral wires.

.9 Insulation shield of semi-conducting thermo-setting XLPE applies as a co-extrusion with the insulation and the conductor shield.

.1 Semi-conducting insulation shield to be marked with words "SEMI-CONDUCTING – REMOVE WHEN SPLICING OR TERMINATING."

.10 Jacket, encapsulating linear low density polythethylene.

.11 Acceptable manufacturers: General Cable, Nexans, Noramco, Pirelli

2.2 CABLE TERMINATORS

.1 At BC Hydro incoming service location: Single piece indoor cable terminator 25 kV, 125kV BIL for 25kV primary system, consisting of:

.1 External insulation –non-skirted tubular design, constructed of tracking resistant silicone rubber.

.2 One-piece, non-skirted, silicone rubber termination with solderless mechanical ground assembly, and shall accommodate Tape (ribbon), Wire, or Shielded cables.

.3 Termination of a pre- stretched cold shrink design, installed without the application of a heat source.

.4 Stress relief control device.

.5 Installation procedure shall not require silicone grease.

.6 Aluminum compression connector to terminate connector.

.7 Cross arm mounting bracket complete with ground connection stud.

.2 Terminations at locations other than at BC Hydro incoming service: Single piece indoor cable terminator 15 kV, 95 kV BIL for 15 kV primary system, consisting of:

.1 Dead break elbow connectors 600 A, 15 kV, 95 kV BIL, consisting of:

.1 Arc follower.

.2 Male contact, tin-plated copper.

.3 Elbow connector housing, moulded EPDM compound.

.4 Conductor contact, copper crimp type.

.5 Voltage test point with hot stick removable cap.

.6 Grounding eye moulded in elbow housing.

.7 Moulded stress relief in elbow housing.

.8 Moulded outer jacket conductive shield.

Part 3 Execution

3.1 INSTALLATION

.1 Install concentric neutral power cables in ductbank and conduit in accordance with manufacturer's instructions.

.2 Provide supports and accessories for installation of high voltage power cable.

.3 Install stress cones, terminations and splices in accordance with manufacturer's instructions

.4 Install grounding in accordance with local inspection authority having jurisdiction.

.5 Provide cable identification tags and identify each phase conductor of power cable.

.6 Terminate cables with cable terminators as indicated and where necessary to complete the primary distribution system. Install all cable terminations to the manufacturers' specifications and instructions.

.7 Install cable terminations to each phase of a three-phase system in primary switch enclosure as per manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

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

.2 Use of qualified tradespersons for installation, splicing, termination and testing of high voltage power cables.

.3 Engage an independent testing agent to test high voltage power cable:

.1 Existing high voltage power cables to be non-destructively tested using the very low frequency test method

.2 New high voltage power cables to be tested using hi-pot test.

.4 Submit test result and inspection certificate.

END OF SECTION

PART 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

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

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Division 1.

1.3 ENVIRONMENTAL PROTECTION

.1 Refer to Division 1.

PART 2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger, minimum size 12 AWG.

.2 Copper conductors with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

2.2 ARMOURED CABLES

.1 Type AC90. Conductors: Insulated, copper, minimum size 12 AWG.

.2 Armour: interlocking type fabricated from aluminum strip.

PART 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34 – Conduits, Fastenings and Fittings.

.2 In underground ductbank systems in accordance with Section 26 05 44 – Installation of Cables in Ducts.

.2 Provide a green insulated bond conductor in all conduits sized in accordance with CSA C22.1-2012, Canadian Electrical Code, Part 1.

3.2 INSTALLATION OF ARMOURED CABLES

.1 Use armoured cables for final connection to luminaires installed in T-Bar ceiling.

.2 Terminate cables using connectors approved for armoured cable.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 14 – Power Cable and Terminations (1001V and Over)

1.2 REFERENCES

.1 CSA Group

.1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.

.2 CSA C22.2 No.41-13, Grounding and Bonding Equipment (Tri-National Standard, with NMX-J-590ANCE and UL 467).

.3 CSA C22.2 No.65-13, Wire connectors (Tri-National Standard, with UL 486A-486B NMX-J-543-ANCE).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 01 50 – General Instructions.

.1 Provide product data in accordance with Section 01 01 50 – General Instructions.

.1 Provide manufacturer's printed product literature, specifications, data sheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 01 50 – General 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 indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect connectors and terminations.

.3 Replace defective or damaged materials with new.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50 – General Instructions

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

.1 Aluminum long barrel compression connectors to CSA C22.2 No.65 as required sized for conductors.

.2 Contact aid for aluminum cables where applicable.

2.2 STRESS CONES

.1 Provide stress cones for 15000V TR-XLPE shield cable.

Part 3 Execution

3.1 INSTALLATION

.1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.

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

.3 Connectors for feeders and terminations over 1000V per section 26 05 14.

END OF SECTION

PART 1 General

1.1 RELATED WORK

.1 This Section covers items common to Sections of Division 26, 27 and 28. This Section supplements requirements of Division 01.

1.2 REGULATORY REQUIREMENTS

.1 Restraints shall meet the requirements of the National Building Code, B.C. Building Code and other local applicable building codes and amendments.

.2 All electrical and communications equipment that is new or being relocated is to be seismically restrained.

1.3 SEISMIC RESTRAINT DESIGN AND INSPECTION

.1 Arrange and pay for the services of a Professional Engineer registered in the Province of BC. "Seismic Engineer" shall provide all required engineering services related to seismic restraints of the electrical and communications equipment.

.2 The Seismic Engineer shall provide assistance to the Contractor during the course of the equipment install if necessary.

.3 The Seismic Engineer shall inspect the completed seismic installation and shall submit a letter to the Departmental Representative stating that the complete seismic installation is installed in accordance with the Seismic Engineer's drawings and it complies with all regulatory requirements.

1.4 SUBMITTALS

.1 Submit shop drawings of all restraining devices, including details of attachments to the structure, either tested in an independent testing laboratory or approved by a BC Registered Professional Engineer.

1.5 SCOPE OF WORK

.1 Provide restraint for electrical equipment, including transformers, panels and suspended luminaires, etc., to prevent injury or hazard to persons and equipment and to retain equipment in its normal position in the event of an earthquake.

.2 Provide all seismic restraint related hardware, including bolts and anchors, from point of attachment to equipment through to and including attachment to structure.

.3 It is the entire responsibility of equipment manufactures to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

PART 2 Products

2.1 GENERAL

.1 Provide anchor bolts, straps and other mounting materials as specified by Seismic Engineer.

PART 3 Execution

3.1 INSTALLATION

.1 Carry out all seismic restraint works on electrical equipment as per the recommendations of the Seismic Engineer and in accordance with all regulatory requirements.

.2 Co-ordinate the work with other trades as required.

END OF SECTION

PART 1 General

1.1 REFERENCES

.1 CSA C22.1-2012 Canadian Electrical Code, Part 1.

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Division 1.

1.4 ENVIRONMENTAL PROTECTION

.1 Refer to Division 1.

PART 2 Products

2.1 EQUIPMENT (GENERAL)

.1 Clamps for grounding of conductor, size as required.

.2 System and circuit, equipment, grounding conductors, bare stranded copper, untinned, soft annealed, size as indicated.

.3 Insulated grounding conductors: green, type RW90.

.4 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

- .1 Grounding and bonding bushings.
- .2 Protective type clamps.
- .3 Bolted type conductor connectors.
- .4 Bonding jumpers, straps.
- .5 Pressure wire connectors.

PART 3 Execution

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous, communications, equipment, grounding systems including, conductors, connectors, accessories, as indicated, to conform to requirements of Departmental Representative, and local authority having jurisdiction over installation.

.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 Provide a green insulated bond conductor in all conduits and ducts.

3.2 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of secondary 120/208V system.

3.3 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to transformers, panels, telephone protection blocks, and telephone cabinet.

3.4 FIELD QUALITY CONTROL

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

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing equipment.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Division 1 for Construction/Demolition Waste Management and Disposal.

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 1 for Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal, conduit and wiring 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, suspended.

PART 3 Execution

3.1 INSTALLATION

.1 Secure equipment to masonry, tile and plaster surfaces with lead anchors or nylon shields.

.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 designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole 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 For surface mounting of two or more conduits use channels at 5 m on centre spacing.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of the Departmental Representative.

.13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

PART 1 General

1.1 RELATED WORK

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

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Division 1.

1.4 ENVIRONMENTAL PROTECTION

.1 Refer to Division 1.

PART 2 Products

2.1 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

.3 Minimum size: 104 mm square.

PART 3 Execution

3.1 JUNCTION AND PULL BOX INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 All junction and pull boxes are not indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

.3 Ground pull boxes as indicated.

3.2 TELEPHONE CABINET INSTALLATION

.1 Install telephone cabinet as indicated.

.2 Install all equipment as indicated within cabinet.

.3 Ground cabinet to communications ground bar using #6 insulated ground wire in EMT conduit.

3.3 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Install size 2 identification lamicoids indicating system name on pull boxes and junction boxes.

.3 Install size 6 identification lamicoid on telephone cabinet.

END OF SECTION

PART 1 General

1.1 REFERENCES

.1 CSA C22.1-2012 Canadian Electrical Code, Part 1.

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Division 1.

1.4 ENVIRONMENTAL PROTECTION

.1 Refer to Division 1.

PART 2 Products

2.1 RECESSED OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 102 mm square outlet boxes for lighting fixture outlets.

.4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished walls.

.5 Gang boxes where wiring devices are grouped.

.6 Blank cover plates for boxes without wiring devices.

2.2 SURFACE CONDUIT AND DEVICE BOXES

.1 Cast aluminum, one or two gang FS or FD boxes with factory threaded hubs and mounting feet for all boxes mounted on structural steel or finished wall finish.

2.3 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 and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

PART 1 General

1.1 LOCATION OF CONDUIT

.1 Drawings do not show all conduits. Those shown are in diagrammatic form only.

1.2 CONDUIT SIZES

.1 Note that conduit sizes referenced in the 2012, Canadian Electrical Code are used.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Division 1.

1.4 ENVIRONMENTAL PROTECTION

.1 Refer to Division 1.

PART 2 Products

2.1 CONDUITS

.1 Underground ducts: rigid type DB2, size as indicated.

.2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.3 Rigid steel conduit: to CSA C22.2 No. 45, galvanized steel, threaded.

.4 Flexible metal conduit: to CSA C22.2 No. 56, steel.

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller.

.2 Two hole steel straps for conduits larger than 50 mm.

.3 Channel type supports for two or more conduits at 1.5 m on centre.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 EMT couplings and connectors shall be malleable steel, set screw type. Connectors shall have insulated throats. Cast fittings are not acceptable.

2.4 FISH CORD

.1 Polypropylene.

PART 3 Execution

3.1 INSTALLATION

.1 Install concrete encased DB2 ducts for electrical and communications systems as indicated and in accordance with CAN/CSA A23.1.

.2 All wiring to be in Electrical metallic tubing (EMT) type conduit unless otherwise indicated on drawings.

.3 Install wiring in threaded Rigid Steel Conduit where indicated on drawings.

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

.5 Conceal conduits above T-Bar Ceiling.

.6 Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.

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

.8 Mechanically bend steel conduit over 21 mm diameter.

.9 Dry conduits out before installing wire.

.10 Install fish cord in empty conduits.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Group conduits wherever possible on surface channels.

.3 Do not pass conduits through structural members except as indicated.

3.3 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

END OF SECTION

PART 1 General

1.1 REFERENCES

.1 CSA C22.1-2012 Canadian Electrical Code, Part 1.

1.2 RELATED WORK

.1 Division 1.

.2 Section 26 05 00 – Common Work Results – Electrical.

.3 Section 26 05 21 – Wire and Cables.

.4 Section 26 05 34 – Conduits, Fastenings and Fittings.

1.3 ENVIRONMENTAL PROTECTION

.1 Refer to Division 1.

1.4 ENVIRONMENTAL PROTECTION

.1 Refer to Division 1.

PART 2 Products

2.1 NOT USED

.1 Not used.

PART 3 Execution

3.1 INSTALLATION

.1 Install cables as indicated in ducts.

.2 Do not pull spliced cables in ducts.

.3 Install multiple cables in ducts simultaneously.

.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.5 Use specified rope to pull cables into ducts.

.6 Before pull cables into ducts and until cables are properly terminated, seal end of cables with moisture seal tape.

.7 After installation of cables, seal duct ends with duct seal compound.

.8 Provide pull string in all ducts for future use.

3.2 FIELD QUALITY CONTROL

.1 Perform tests of each type of cable and system as indicated.

.2 Remove and replace entire length of cable if cable fails to meet any test criteria.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials, components, cabinets, instruments and installation for metering and switchboard Instruments.

1.2 RELATED SECTIONS

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

1.3 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI C39.1-1981, Requirements, Electrical Analog Indicating Instruments.

.2 Canadian Standards Association, (CSA International)

.1 CAN3-C17-M84(R2004), Alternating-Current Electricity Metering.

.2 CAN3-C13-M83(R2003), Instrument Transformers.

1.4 PRODUCT DATA

.1 Indicate meter, instrument, outline dimensions, panel drilling dimensions and include cutout template.

1.5 QUALITY CONTROL

.1 General:

.1 Contractor to be responsible for quality control of the products and installation in this section.

.2 Submit all information and material required for the Quality Management System, in accordance with Section 26 05 00 – Work Results for Electrical.

.3 Quality Control Program Submittals:

.1 Quality Control Check Sheet

.4 Quality Control Check Sheet:

.1 Prepare and maintain Quality Control Check Sheets.

.2 Check sheet to be kept on site and be made available for review by the Engineer at any time.

.3 Check sheets to be filled in and submitted for review, prior to substantial completion.

.4 Check sheets for each metering and switchboard instruments to include the following information:

.1 Metering and switchboard instruments specifications and installation details

.2 Itemize a check list for the following:

.1 Type of meter and instruments
.2 Proper connections
.3 Characteristics of each meter and instrument
.4 Check for correct and proper calibration

.3 For each tabulated item, state the following:
.1 Does the item comply with the specification? Yes/No/Not Applicable.

.5 Identify any areas of non compliance and the proposed action to make it complaint.

Part 2 Products

2.1 METER

.1 Secondary 600V digital power meter with display for kW demand, kWhr energy, and percent power factor provides power consumption data for information. Digital power meter shall be IP based and have communication port supporting the RS485 standard. 10 Base T Ethernet port is also required.

.2 The contractor shall supply and install an appropriate converter to interface new digital meter with the existing Institution DDC system to make a complete and fully operation monitoring system.

2.2 SHOP INSTALLATION

.1 All wiring and inter-wiring shall be factory installed. Provide slip on plaster label for wiring identification to match schematic wiring diagram supplied.

.2 Install meters and instrument transformers in separate compartment of switchboard.

.3 Install instruments on switchboard.

.4 Ensure adequate spacing between current transformers installed on each phase.

.5 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources, electrical supplies.

Part 3 Execution

3.1 METERING INSTALLATION

.1 Install meters and instruments in location free from vibration and shock.

.2 Make connections in accordance with diagrams.

.3 If applicable, ensure power factor corrective equipment connected on load side of meter.

.4 Connect meter and instrument transformer cabinets to ground.

.5 Installation of communication cable from communication port for interfacing the power meter with Institution DDC system and the Institution system is by others.

.6 Locate meter integrated within the front panel of the switchboard enclosure.

3.2 FIELD QUALITY CONTROL

.1 Conduct tests in accordance with Section 26 05 00 - Common Work Results – Electrical, and in accordance with manufacturer's recommendations.

.2 Perform simulated operation tests with metering, instruments disconnected from permanent signal and other electrical sources.

.3 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources and electrical supplies.

.4 Perform tests to obtain correct calibration.

.5 Do not dismantle meters and instruments.

.6 Provide a written report for commissioning of the metering operation.

.7 Provide onsite training for owner's maintenance staff.

END OF SECTION

PART 1 General

1.1 RELATED WORK

.1 Section 26 05 00 – Common Work

.2 Section 26 05 25 – Seismic Restraints

PART 2 Products

2.1 CUSTOMER METERING SYSTEM

.1 To consist of Measurement Canada Approved electronic meters, current transformers, and communications system as shown on drawings and described herein. The system shall be the Schneider Power Measurement ION 7330 or approved equal.

.2 The meter shall be capable of displaying the following: Voltage, current, power, frequency, power factor, demand, energy, time-of-use metering, harmonics measurement (up to 31st), Sequence-of-events, historical trends, and high-speed snapshot recording

.3 The meters will be capable of remote communication, utilizing the following protocols: Modbus RTU, Modbus TCP

.4 Provide a software package to install in the department representative's remote computer for meter reading, data storage and generating billing information via web server (Ethernet LAN/WAN).

.5 System shall have backup storage power to key components so that no data is lost during power outages. The system shall continue to function after resumption of power.

.6 Failure of the building electrical normal power system shall not result in loss of data and will not require manual restarting of the metering system.

.7 Provide interconnection to the existing site power metering network. Allow for all cabling, software and reprogramming requirements for interconnection.

2.2 SYSTEM MEASUREMENT

.1 Meters shall be complete with a Liquid Crystal Display (LCD) to access all measurements and phase diagnostics.

.2 Measurement Parameters:

.1	KWHR	real consumption
.2	KW	average demand
.3	KW	instantaneous demand

.4 KVAH apparent consumption

.5 KVA apparent demand

.6 Meter readings at the meter

.7 Provide training and software manual for Department representative's staff.

2.3 METERS

.1 Schneider Power Measurement ION 7330 or approved equal.

2.4 ENCLOSURE

.1 NEMA 1 multi-meter enclosure for up to 10 meters.

2.5 METER COMMUNICATIONS

.1 Modbus protocol for data communications.

.2 Ethernet LAN/WAN communications.

.3 RS232, port for modem connections.

2.6 METER SOFTWARE

.1 Meter Interface Software shall be Windows compatible and able to export meter data into database and spreadsheet programs.

.2 Software shall be capable of providing locked levels of access to various users.

PART 3 Execution

3.1 WIRING AND CONNECTIONS

.1 Refer to manufacturer's installation drawings for wiring details.

.2 Provide metering points as shown on Drawings.

.3 Provide circuit breakers for power feeding the meters.

3.2 FIELD VERIFICATION, ACCEPTANCE & TRAINING

.1 Manufacturer's representative shall verify, adjust and test the system. Verification to be carried out with the assistance of the electrical contractor. Upon completion, the manufacturer shall issue a "CERTIFICATE OF ACCEPTANCE" to the Departmental Representative and Contractor.

.2 Manufacturer's representative shall demonstrate operation of the system as follows:

END OF SECTION

PART 1 General

1.1 PRODUCT DATA

.1 Submit product data in accordance with Division 1 for Submittal Procedures.

1.2 WASTE MANAGEMENT AND DISPOSAL

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

.2 Construction/Demolition Waste Management and Disposal, and with the Waste

.3 Reduction Workplan.

.4 Place materials defined as hazardous or toxic waste in designated containers.

.5 Ensure emptied containers are sealed and stored safely for disposal away from children.

.6 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

PART 2 Products

2.1 OUTDOOR PHOTOELECTRIC SENSOR

.1 Wall mounting using stem and swivel.

.2 Thermal type control with built-in relay to ensure that the controlled lighting does not switch off due to light striking the photocell from car headlights or lightning.

.3 Self-contained line voltage type capable of switching 1800W of lighting at 120V.

.4 Voltage variation: ±10%.

.5 Temperature range: -40°C to 70°C.

.6 Housing: high impact polycarbonate.

.7 Activation: 1-50 Lux ON; 3-15 Lux OFF

.8 Color coded leads: 150mm long.

2.2 INDOOR OCCUPANCY SENSOR

.1 Ceiling mounted self-contained line voltage type mounted on single gang electrical box.

.2 360° coverage and dual technology with PIR / Microphonics detection

.3 Capable of switching 800W of lighting at 120V.

.4 Green LED activity indicator.

.5 Temperature range: -10°C to 70°C.

.6 Relative humidity: 20 to 90% non-condensing.

.7 Adjustable ON timer with minimum of 15 minutes.

.8 Adjustable OFF time delay: from 3 seconds to 20 minutes.

.9 Minimum 8.5 m radial coverage when mounted to 2.7 m ceiling.

.10 Minimum acceptable standard: Sensorswitch CMR PDT9 and PDT10 or approved equal.

.11 Wall mounted self-contained line voltage type mounted on single gang electrical box.

.12 Shall be 100% digital PIR detection – with good RF immunity

.13 Shall provide small motion detection up to 20 ft

.14 Dual Technology (PDT) utilizes PIR / Microphonics detection

.15 Shall provide 100% passive detection, for no potential of interference with other building systems

.16 Shall provide low current leakage (<0.5 mA) when connected via ground

.17 Line power and load wires are interchangeable - impossible to wire backwards

.18 Shall be compatible with LEDs, Electronic & Magnetic Ballasts, CFLs, & Incandescent.

.19 Provides push-button programmable without removing cover plate - adjustable time delays & operating modes

.20 Provides non-volatile settings memory

.21 Minimum acceptable standard: Sensorswitch WSX or approved equal.

PART 3 Execution

3.1 INSTALLATION

.1 Install all lighting control devices in accordance with manufacturer's instructions.

3.2 FIELD QUALITY CONTROL

.1 Perform tests for correct operation.

END OF SECTION

PART 1 General

1.1 RELATED WORK

.1 Materials and components for dry type transformers up to 600 V primary, equipment identification and transformer installation.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 19 - Waste Management and Disposal.

.3 Section 26 05 00 - Common Work Results.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.2 CAN/CSA-C22.2 No. 47-M90 (R2001), Air-Cooled Transformers (Dry Type)

.3 CSA C9-M1981 (R2001), Dry-Type Transformers

.4 National Electrical Manufacturers Association (NEMA)

1.4 PRODUCT DATA

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

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

1.6 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 26 05 00.

PART 2 Products

2.1 TRANSFORMERS

.1 Use transformers of one manufacturer throughout project and in accordance with CAN/CSA-C22.2 No. 47, CSA-C802.2-00.

.2 Design

.1 Ventilated: Type ANN

.2 3-phase, 3-winding, 600 V delta primary, 120/208 V grounded 3-winding Wye secondary, 60 Hz.

.3 Voltage taps: four 2½% primary taps (2FCAN, 2FCBN) brought out to a terminal board.

.4 Insulation: Class 220, 150°C average temperature rise.

.5 Basic Impulse Level (BIL): standard.

.6 Hi-pot: standard.

.7 Windings: copper (K factor of 13).

.8 The core and coil shall be isolated from the enclosure to reduce noise and vibration by means of neoprene rubber or isomode vibration dampening effect based on the weight of the core and coil unit.

.9 Finish: in accordance with Section 26 05 00 Common Work Electrical.

.10 Average sound level: standard.

.11 Impedance at 170°C: standard.

.12 Enclosure: NEMA 1

.13 Transformer shall be specifically designed to supply 100% of the 60 Hz fundamental rated current,

.1 33% of the fundamental current as third harmonic;

.2 20% of the fundamental current as fifth harmonic;

.3 14% of the fundamental current as seventh harmonic;

.4 11% of the fundamental current as ninth harmonic and lower proportional percentages of the fundamental current through the 25th harmonic. Mark transformers with a label stating "Suitable for Non-Sinusoidal Current Load with K-Factor not to exceed 13 deg.

.14 The core flux density shall be well below the saturation point to prevent core saturation caused by the harmonic even with a 10% primary overvoltage. The transformer core shall be constructed of grain oriented M6 or better; high grade non-aging silicon steel laminations of the mitre type construction.

.15 The secondary neutral shall be twice the ampacity of the secondary phase conductors and the primary winding conductor shall be of sufficient size to limit the temperature rise to its rated value even with the circulation third harmonic current.

.16 Transformers shall be complete with sprinkler-proof hoods.

.17 Transformers shall be manufactured and tested (production tests) in accordance with CSA C802.2-00 incorporating modifications as specified herein.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results.

.2 Label size: 7.

.3 Nameplate wording to match Single Line Diagram.

PART 3 Execution

3.1 INSTALLATION

.1 Mount dry type transformers on minimum 2" thick concrete housekeeping pad, unless otherwise noted.

.2 Ensure adequate clearance around transformer for ventilation.

.3 Install transformers in level upright position.

.4 Remove shipping supports only after transformer is installed and just before putting into service.

.5 Loosen isolation pad bolts until no compression is visible.

.6 Make primary and secondary connections in accordance with wiring diagram. Conductors shall not enter the transformer through the top of the enclosure

.7 Make flexible conduit connections on both primary and secondary sides of all transformers.

.8 Ground transformer per Canadian Electrical Code.

.9 Energize transformers after installation is complete.

.10 Provide seismic support and restraint for all new transformers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

.2 Section 26 05 14 – Power Cable and Terminations (1001V and Over)

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers, Inc. (IEEE)

.1 ANSI/IEEE 386-95(R2001), Separable Insulated Connector Systems for Power Distribution Systems Above 600 V.

.2 ANSI/IEEE C62.11, Metal-Oxide Surge Arresters for AC Power Circuits (>1kV)

.2 Canadian Standards Association (CSA International)

.1 CAN/CSA-C2.1-06, Single-phase and three-phase liquid-filled distribution transformers.

.2 CAN/CSA-C227.4-06, Three-Phase Pad-Mounted Distribution Transformers with Separable Insulated High-Voltage Connectors.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 01 50 – General Instructions.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, and limitations.

.3 Submit shop drawings and indicate:

.1 Anchoring method and dimensioned foundation template.

.2 Dimensioned cable entry locations.

.4 Identified internal and external component layout on assembly drawing.

.5 Insulating liquid capacity.

.6 Submit primary fuse and secondary breaker time-current characteristics.

.7 Quality Assurance Submittals: submit following in accordance with Section 01 01 50 – General Instructions.

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

.2 Instructions: submit manufacturer's installation instructions.

.8 Closeout Submittals:

.1 Provide operation and maintenance data for pad mounted distribution transformers for incorporation into manual specified in Section 01 01 50 –

General Instructions.

.2 Include insulating liquid maintenance data.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling.

1.5 MAINTENANCE

.1 Provide maintenance materials in accordance with Section 01 01 50 – General Instructions.

Part 2 Products

2.1 EQUIPMENT

.1 Constructed for outdoor installation NEMA 3R, metal-clad single phase, or three phase, dead front pad mounted distribution transformers: to CSA C2.1 or C227.4, respectively. Separable insulated connectors for power distribution systems above 600 V: to ANSI/IEEE 386.

.2 Liquid filled distribution transformer complete with primary and secondary cable compartments and accessories to form complete factory assembled, self contained, steel fabricated unit low profile unit for mounting on concrete pad. The dielectric liquid shall be seed breed environmental friendly type.

.3 High voltage bushings or high voltage bushing wells for connection to distribution system through separable insulated connectors for dead front operation.

.4 Spade type low voltage terminals.

.5 Connectors for primary and secondary cables.

.6 Designed and constructed for loop feed operation.

.7 Two fuse system as defined in CAN/CSA C2.1 and C227.04-06 to be provided and complete with 3 spare BAYONET fuses.

.8 Mechanical interlock systems to prevent access to primary compartment unless primary supply is isolated at source. Separate padlocking for primary compartment door.

.9 Under-oil lightning arresters, 15kV, to ANSI C62.11.

.10 Load break inserts for elbow connectors.

.11 Stays to hold compartment doors in 110 degrees open position.

.12 Barrier shall be provided between secondary voltage and primary voltage compartment.

2.2 TRANSFORMER CHARACTERISTICS

.1 Primary voltage: 12.5 kV, 60 Hz, delta connected, three phase.

.2 Secondary voltage: voltage as indicated on drawing, wye connected, three phase, four wire, neutral grounded.

.3 Capacity: kVA rating as indicated on drawing.

.4 Copper winding.

.5 Type: ONAN.

.6 Temperature Rise: 65 degree C.

.7 Basic impulse level: 95 kV.

.8 Impedance: 4%.

.9 No load losses: standard.

.10 Full load losses: standard.

.11 Average sound level: 55dB.

2.3 VOLTAGE TAPS

.1 Four-2.5% taps, 2-FCAN, 2-FCBN.

2.4 TAP CHANGER

.1 Externally operated off-load tap changer, with provision for padlocking on 3 phase units.

2.5 ACCESSORIES

.1 Liquid temperature thermometer with two sets of contacts.

.2 Liquid level gauge with two sets of contacts.

.3 Pressure relief device.

.4 Internal current limiting primary fuse

.5 25 mm drain valve.

.6 25 mm filler plug.

.7 Voltage selector switch.

2.6 GROUNDING

.1 Copper grounding bus.

.2 Connectors for grounding conductor size 4/0 or as indicated.

2.7 FINISH

.1 Two coats of enamel over one coat of rust resistant primer. Finish exterior of unit in accordance with Section 26 05 00 - Common Work Results for Electrical.

2.8 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Nameplate information label to match existing Institution standard.

2.9 WARNING SIGNS

.1 Provide warning signs in accordance with Section 26 05 00 - Common Work Results for Electrical.

2.10 SOURCE QUALITY CONTROL

.1 Submit to Departmental Representative standard factory test certificates of each transformer and type test of each transformer with high voltage accessories in accordance with CSA-C227.4.

2.11 ACCEPTABLE MANUFACTURERS

.1 Carte International, Pioneer, Cam Tran, Cooper Power, PTI

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.

.2 Transformer to be filled with insulating oil by manufacturer prior to shipment.

3.2 INSPECTION

.1 Check factory made connections of transformer unit for mechanical security and electrical continuity.

.2 Check transformer insulating liquid for correct quantity and specification per manufacturer's instructions.

.3 Check for leakage of insulating liquid.

3.3 INSTALLATION

.1 Provide a structural engineer (registered in APEGBC) to design a pre-cast reinforced concrete pad or cast-in-place reinforced concrete pad, with seismic restraint anchoring. Size the concrete pad to suit transformer shop drawings for

physical footprint and cable entries. Submit detailed shop drawings (signed and sealed by a Professional Engineer registered in the Province of British Columbia) for review.

.2 Ensure concrete pad is fully cured before transformer is installed.

.3 Set and secure transformer unit in place, rigid, plumb and square. Bolt down transformer in accordance with manufacturer's shop drawings.

.4 Make connections.

.5 Connect transformer unit ground bus to system ground.

.6 When field filling of transformer is necessary, the filling shall be done by transformer manufacturer's representative.

.7 Set taps to produce the rated secondary voltage at no load.

.8 Wire one set of contacts on liquid temperature thermometer, liquid level gauge, to sound alarm when unsafe condition reached, wire second set of contacts to trip transformer circuit interrupter.

.9 Ensure care is taken to prevent contamination of liquid and components when field filling transformer.

.10 Use only metal hose when field-filling transformer with oil: do not use rubber hose.

3.4 FIELD QUALITY CONTROL

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

.2 Contractor to include and allow for equipment manufacturer or separate independent testing company to perform on site testing of units and equipments.

.3 Carry out following insulation tests using megger with 20,000 megohm scale and resulting insulation resistance corrected to base of 20 degrees C.

.1 High voltage to ground with secondary grounded for duration of test.

.2 Low voltage to ground with primary grounded for duration of test.

.3 High to low voltage.

.4 Inspect primary and secondary connections for tightness and for signs of overheating.

.5 Inspect and clean bushings and insulators.

.6 Check oil level and temperature indicators.

.7 Set transformer taps to rated voltage as specified.

.8 Inspect for oil leaks and excessive rusting.

.9 Inspect oil level.

.10 Check fuses for correctness of type and size.

.11 Check for grounding and neutral continuity between primary and secondary circuits of transformer.

.12 Record phase and neutral voltages and currents under normal load.

.13 Record tap setting and adjust as directed. Record phase voltage and current with new tap setting.

.14 Failed transformer is to be replaced at no cost and shall be expedite for delivery as soon as possible. Implement temporary solution at no cost.

.15 Obtain inspection certificate of compliance covering field quality control mentioned above from inspection authority and include it with as-built drawings and maintenance manuals.

3.5 CLEANING

.1 Proceed in accordance with Section 01 01 50 – General Instructions.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work

.2 Section 26 05 34 – Conduits, Conduit Fastenings, and Conduit Fittings

.3 Section 26 28 21 – Moulded Case Circuit Breaker

.4 Division 01 – Submittal Procedures

.5 Division 01 – Waste Management and Disposal

1.2 SHOP DRAWINGS

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

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.3 PLANT ASSEMBLY

.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.

1.4 REFERENCES

.1 Canada Standards Association (CSA International).

.1 CSA C22.2 No.29-M1989 (R2000), Panelboards and enclosed Panelboards.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Division 1.

1.6 ENVIRONMENTAL PROTECTION

.1 Refer to Division 1.

PART 2 Products

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.

.2 Provide all switch/fuse type and breaker type distribution panelboards for use in the 600/347V 3PH 4W & 208/120 V, 3PH, 4-W systems. Mains size, switch and fuse sizes, breaker sizes, and number of branch units shall be as shown on the drawings and panel schedule.

.3 Provide CT's, meters and all required accessories for complete interconnection to the existing site power metering network. Allow for all cabling, software and reprogramming requirements for interconnection.

.4 Silver plated copper bus with full size 100% rated neutrals and equipped with pressure type solderless lugs. The copper shall be thoroughly cleaned and pre-plated before the final tin-plating is applied. All bus work shall be suitably supported to withstand a short circuit current of 25kA RMS amperes symmetrical or greater.

.5 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.

.6 Panelboards: mains, main breaker, number of circuits, and number and size of branch circuit breakers as indicated.

.7 Complete circuit directory with typewritten legend showing location and load of each circuit for all new panelboards.

.8 Two keys for each panelboard and key panelboards alike.

.9 Mains: suitable for bolt-on breakers.

.10 All panelboards to have isolated neutral bus.

.11 All panelboards to be seismically rated for minimum of Zone 5 area.

.12 Sized for full width breakers.

.13 All surface mounted panels to be provided with drip-shield and rated for use in sprinklered building.

.14 Provide: sub-feed lugs, and interconnect wiring as required. Note that sub-feed wiring neutrals to be installed through common raceway as hot conductor sub-feed connections.

.15 Trim and door finish: baked grey enamel.

.16 Lockable door.

.17 All surface mounted panelboards to be mounted on 21 mm G1S painted plywood backboards. Paint to be fire retardant grey colour. Back boards to be provided by General Contractor; refer to section 06 01 11 "Rough Carpentry - Short Form" for further details. CSA Approved.

2.2 BREAKERS

.1 Breakers: to Section 26 28 21 – Moulded Case Circuit Breakers.

.2 Main circuit breaker: In existing emergency main panel in building 115 to match existing panel configuration.

In new building, separately mounted on top or bottom of main panel to suit cable entry. When mounted vertically, down position should open breaker. Main circuit breakers that are located in a branch circuit breaker position shall not be used.

.3 Breakers with thermal magnetic tripping in panelboards except as indicated otherwise.

.4 GFEPD breakers for 30 mA equipment protection

.5 GFCI breakers for 5 mA personnel protection.

.6 Manufacturer's tie-locks for critical and code required systems:

1. Fire alarm

2. ULC approved communicators (and security equipment) used for fire alarm communication.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Provide nameplate for each panelboard, size 4 engraved as indicated. Confirm exact wording of nameplate prior to manufacture.

.3 Complete circuit directory with typewritten legend showing location and load of each circuit.

PART 3 Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb true and square, to adjoining surfaces.

.2 Install surface-mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard. mount at height as indicated.

.3 Connect loads to circuits as indicated.

.4 Connect neutral conductors to common neutral bus with respective neutral identified.

.5 Coordinate with the General Contractor for the provision of continuous fire rated wall, ceiling and floor assemblies where panelboards are flush mount in fire separations and fire rated partitions.

.6 Install flush-mount panelboard in wall framing. Report to the General Contractor and to the Departmental Representative during rough-in where wall framing depth does not allow flush mount of electrical tub trim. General Contractor to

provide architectural trim around panel tub, increased depth of framed wall or other increased framing depth work to the approval of the Departmental Representative. Contractor to request written instructions from the Departmental Representative prior to implementation of trim or wall depth increase work

.7 All panelboard feeders to be continuous without splice.

.8 Provide Contractor testing as directed by the Departmental Representative. Insert test result data in O+M manuals.

END OF SECTION

PART 1 General

1.1 SUMMARY

.1 This Section includes Surge Protective Devices (SPD) or Transient Voltage Surge Suppressors (TVSS) for service entrance low-voltage power (347/600 Volts) equipment.

.2 Refer to drawings for general installation information. Follow manufacturer's recommendations for final installation requirements.

1.2 PRODUCT CERTIFICATION

.1 Signed by the surge protection manufacturer certifying that products furnished comply with the specified requirements

.2 Field Test Reports: Written reports of tests undertaken by the supplier to comply with all specified requirements

.3 Maintenance Data: Transient voltage suppression devices to include operation and maintenance instructions specified in Division 26.

.4 Warranties: minimum 2 years.

1.3 DESCRIPTION

.1 These specifications describe the electrical requirements for: Integrated Surge Protection Devices (SPD) for panelboards and switch boards for the:

.1 Main service panels.

1.4 QUALITY ASSURANCE

.1 Product must be made by a company engaged in the manufacture of such devices in the USA or Canada for a minimum of ten years

.2 Source Limitations: Obtain suppression devices from a single manufacturer.

.3 Product Options: specifications indicate system and electrical performance of suppressors and are based on the specific system indicated.

.4 Electrical Components, Devices and Accessories: TVSS compliance to: standards (UL 1449 2nd Edition, UL 1283, ANSI/IEEE C62.41, C62.45 and C62.11, NEMA LS 1-1992, MIL-STD-220AS, and CSA C22.2). All TVSS products to be have been independently tested to verify published surge current ratings. Listed and labelled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 SCOPE OF WORK

.1 Provide a complete Surge Protective Devices (SPD) or Transient Voltage Surge Suppressors (TVSS) for service entrance low-voltage power (347/600 Volts) equipment for the main 600V CDP.

1.6 INSTALLATION

.1 Equipment to be installed as per code and manufacturers recommendations

.2 Surge protective devices to be electrically disconnected during all high potential or MEGGAR testing of conductors or power distribution equipment.

1.7 FIELD QUALITY CONTROL

.1 Testing: Perform the following field quality control testing:

- .1 Before electrical circuitry has been energized, test for compliance with all TVSS manufacturer's requirements.
- .2 Complete start-up checks and voltage verifications according to manufacturer's written instructions.
- .3 Perform visual and mechanical inspection on each unit. Certify with written report in O+M manuals that units are installed per manufacturer's recommendations.

.2 Repair or replace malfunctioning units. Retest after repairs or replacements are made.

1.8 AS-BUIT INFORMATION

.1 All surge protection system information shall be provided on the as-built drawings.

.2 Provide:

- .1 Equipment locations.
- .2 Equipment identification for reference to shop drawings.
- .3 Additional installation detail(s) as required to document the installation.

END OF SECTION

PART 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

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

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Division 1.

1.3 ENVIRONMENTAL PROTECTION

.1 Refer to Division 1.

PART 2 Products

2.1 SWITCHES

.1 20 A, 120 V, single pole, double pole, three-way, four-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 molded housing.
- .4 Suitable for back and side wiring.
- .5 White toggle.

.3 Toggle operated fully rated for fluorescent lamps, and up to 80% of rated capacity of motor loads.

2.2 LED DIMMER SWITCHES

.1 Rating : 1200 VA, 120 V AC, single pole. CSA approved.

.2 Operating Range: 0-10 V

.3 Designed for dimmable LED driver/lamps.

.4 Dimmer to be compatible and as recommended by manufacturer of Type `A' luminaire supplied and installed.

.5 Manually operated with the following features:

- .1 Slide control dimmer, and ON/OFF Switch.
- .2 Building radio/TV interference filter.
- .3 White color.

2.3 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:

- .1 Urea molded 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 riveted grounding contacts.
- .6 White color.

.2 Other receptacles with ampacity and voltage as indicated.

2.4 COVER PLATES

.1 Stainless steel cover plates for wiring devices.

.2 Sheet steel coverplates with turned over edges for surface mounted boxes.

2.5 FLOOR BOXES

.1 Cover:

1. 180° cover opening
2. Two large cable egress doors
3. Listed to UL 514A and UL scrub water compliant
4. Die cast aluminum cover construction
5. ADA compliant
6. Post pour adjustment

.2 Box:

1. 16 gauge galvanized sheet metal and cast iron construction
2. 6 in. solid conductor ground pigtail in each gang
3. 3 in. deep accepts adapter for 2 in. conduit
4. Pre pour adjustment
5. Meets UL 514A requirements and are UL scrub water compliant

.3 Standard of acceptance: Hubbel CFB4G30CI C/W cover and all accessories or approved equal.

PART 3 Execution

3.1 INSTALLATION

.1 Switches:

.1 Install single pole throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height in accordance with Section 26 05 00 – Common Work Results – Electrical.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height in accordance with Section 26 05 00 – Common Work Results - Electrical.

.3 Cover Plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

PART 1 General

1.1 RELATED WORK

.1 Section 26 05 00 – Common Work Results – Electrical.

.2 Section 26 24 17 – Panelboards – Breaker Type.

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Division 1.

1.4 ENVIRONMENTAL PROTECTION

.1 Refer to Division 1.

PART 2 Products

2.1 BREAKERS GENERAL

.1 Bolt-on moulded case circuit breaker, quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.

.2 Common-trip breakers with single handle for multi-pole applications.

.3 Magnetic instantaneous trip elements in circuit breakers, to operate only when the value of current reaches setting.

.4 Circuit breaker interrupting capacity: 25 kA (symmetrical), or as indicated.

2.2 THERMAL MAGNETIC BREAKERS

.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 COUNTERFEIT CIRCUIT BREAKERS

.1 Counterfeit circuit breakers are defined to mean any circuit breaker not authorized by the panel manufacturer.

.2 Submit a letter from the manufacturers authorized technical representative that all breakers supplied within this project are not counterfeit and they are authorized by the panelboard manufacturer for use in each panelboard.

PART 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

.2 Provide lamicoid nameplates as indicated.

END OF SECTION

PART 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

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

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Division 1.

1.3 ENVIRONMENTAL PROTECTION

.1 Refer to Division 1.

PART 2 Products

2.1 DISCONNECT SWITCHES

.1 Non-fusible and fusible disconnect switches in CSA Enclosure 1.

.2 Fuseholder assemblies to CSA C22.2 No. 39.

.3 Provision for padlocking in on and off switch positions by three locks.

.4 Fuses as indicated. Allow for Class J or L for general circuits. Class RK5 for motor or other high inrush current circuits.

.5 Fuseholders in each switch suitable without adaptors, for type of fuse as indicated.

.6 Mechanically interlocked door to prevent opening when handle in ON position.

.7 Quick-make, quick-break action.

.8 ON-OFF switch position indication on switch enclosure cover.

PART 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses where indicated or required.

.2 Install size 2 lamicoid nameplate indicating system name, voltage and phase, or as indicated.

END OF SECTION

PART 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Motor starters, miscellaneous control devices.

1.2 RELATED SECTIONS

.1 Division 01 – Submittal Procedures.

.2 Division 01 – Health and Safety.

.3 Division 01 – Waste Management and Disposal.

.4 Division 01 – Closeout Submittals.

.5 Division 01 – Common Work.

1.3 REFERENCES

.1 CSA C22.1-15, except where specified otherwise.

1.4 SUBMITTALS

.1 Provide submittals in accordance with Division 01 - Submittal Procedures.

.2 Submit product data sheets for sills, bus bars, and compartments. Include product characteristics, physical size, and finish.

.3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence and cleaning procedures.

.4 Submit shop drawings and indicate:

- .1 Outline dimensions.
- .2 Configuration of identified compartments.
- .3 Floor anchoring method and dimensioned foundation template.
- .4 Cable entry and exit locations.
- .5 Dimensioned position and size of bus bars and details of provision for future extension.
- .6 Schematic and wiring diagrams.

.5 Closeout Submittals: provide operation and maintenance data for motor control centre for incorporation into manual specified in Division 01 - Closeout Submittals.

.6 Include data for each type and style of starter.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

1.6 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 01 - Health and Safety Requirements.

1.7 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 26 05 00.

.2 Provide listed spare parts for each different size and type of starter:

- .1 (1) starter heater;
- .2 (1) control transformer;
- .3 (1) pilot lights;
- .4 (1) contacts, stationary;
- .5 (1) contacts, movable;
- .6 (1) contact, auxiliary;
- .7 (1) operating coil;
- .8 (1) fuses.

PART 2 Products

2.1 MOTOR STARTERS

.1 All motor starters supplied under Division 26 shall be of the same manufacturer.

.2 Motor starters are indicated on the mechanical drawings (where/if applicable) by letter types in conjunction with numerical suffixes. The letters indicate the type of starter and the numerals indicate special features which must be incorporated into or placed adjacent to the starters as specified.

.3 The following letter types shall apply:

- .1 Type A- Magnetic in general purpose enclosure;
- .2 Type B- Magnetic in Motor Control Centre, where/if applicable;
- .3 Type C- Manual starter in general purpose enclosure;
- .4 Type D- Manual open type flush mounted in switchbox and fitted with plate to match other switch plates in the area;
- .5 Type E- Manual with special features where applicable;
- .6 Type F- Combination breaker/magnetic starter in an NEMA I enclosure; Overcurrent device rating shall be as noted on Contract Documents. Overcurrent devices to be capable of being locked "OFF" and "ON";
- .7 Type G - Combination un-fused switch/magnetic starter in an NEMA I enclosure;

.8 Type H- Fusible switch in Motor Control Centre, where/if applicable;

.9 Type R-2 (2SP) - Two-speed relay type starter w/o overload heaters. Locate in NEMA 1 enclosure.

.4 The following suffixes shall apply:

.1 Reset only in cover;

.2 Reset and HAND-OFF-AUTOMATIC or LOCAL-OFF-REMOTE switch in cover;

.3 Reset and START-STOP pushbuttons in cover;

.4 Run (red) and Stop (green) PUSH-TO-TEST pilot lights in cover;

.5 Fitted with special features, where/if applicable refer to mechanical drawings;

.6 Reset and ON-OFF selector switch in cover.

.5 All individual starters shall have RUN and STOP pilot lights, with PUSH-TO-TEST feature, and START/STOP pushbuttons or selector switches as required or indicated.

.6 Starters located in finished areas (other than service spaces) shall be of a flush-mounted type with stainless steel cover.

.7 Fit all motor starters supplied under Division 26 with adjustable electronic overload trips in all normally ungrounded lines.

.8 All magnetic starters, including combination starters provided under Division 26 shall be complete with 4 sets of spare auxiliary contacts (2 sets N/C, 2 sets N/O, all sets reversible). Each and every starter shall have a separate control transformer complete with fused secondary protection at 120 volt, 60 Hz AC. Transformer volt-ampere rating will be confirmed with Mechanical Division prior to ordering. Where line over current protection exceeds 15 amperes, provide primary fuses for the control transformers.

.9 Minimum magnetic starter size shall be NEMA Size 1.

.10 Coordinate with the BMS Controls Contractors. Interposing relays required to interface BMS system to the wiring in motor starters shall be provided by BMS Controls Contractor, where/if applicable.

.11 Provide interposing relays for fire alarm shutdown of motors, where/if applicable, refer to mechanical drawings.

2.2 MISCELLANEOUS CONTROL DEVICES

.1 Pushbuttons: Heavy Duty Oil-Tight.

.2 Selector Switches: Heavy Duty Oil-Tight.

.3 Indicating (Pilot) Lights: Transformer Base PUSH-TO-TEST Type, 12 volt LED indicator lamps. Coordinate the pilot light transformer and circuit voltages such that not more than 12 volts are available at the lamp terminals.

.4 Control Circuit Transformers: Confirm the volt-ampere rating of the control transformer with Mechanical Division prior to ordering.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00.

.2 Manual starter designation label, white plate, black letters, Type B, engraved as indicated.

.3 Magnetic starter designation label, white plate, black letters, Type B, engraved as indicated.

PART 3 Execution

3.1 MOTOR STARTERS

.1 Install, and wire adjacent to the starters, all devices, equipment, and enclosures described in the Mechanical Equipment Schedule with applicable special letter types and suffixes.

.2 Furnish and install for every motor in the building, unless otherwise noted, either a manual or magnetic motor starter as indicated in the Motor Schedule.

.3 Check the actual nameplate current rating of all motors installed before ordering the electronic overloads for motor starters.

3.2 MOTOR CONTROL WIRING

.1 All motor control wiring (120V line voltage and 24V low voltage) including conduit as well as supply and installation of control devices will, except where specifically noted on the electrical drawings, in the Motor Schedule, or outlined below, be provided as described in Mechanical Division of the Specification. Except where specifically directed to the contrary, motor control wiring, associated conduits, and control devices do not form a part of Division 26 work.

.2 The motor control work which shall be provided under Division 26 shall include the following:

- .1 All conduit and control wiring specifically noted on the contract drawings and outlined in the different parts of the Specification;
- .2 All control wiring as specified on the mechanical drawings;
- .3 Control wiring related to air handling shutdown during fire alarm, where/if applicable.

3.3 MOTOR POWER WIRING

.1 Connect all motors shown on the drawings or mentioned in this Specification. The locations of motors are approximate only. Check to determine correct locations and install wiring to these points.

.2 Responsibility of Contractor to coordinate all mechanical requirements in accordance with the mechanical equipment schedule included with the mechanical contract documents.

.3 Check motor rotation before mechanically coupling to load.

.4 Except where otherwise directed, connect all motors with flexible conduits. Ground the conduit system with a separate grounding conductor installed in the flexible conduit.

3.4 STARTER VERIFICATION

.1 Field check motor starters supplied prior to commissioning equipment. As a minimum, verify the following:

.1 Check of control circuits;

.2 Verify that overload relay installed is correctly sized for motor used;

.3 Record overload relay size and motor nameplate amperage;

.4 Visual inspection of fuses and contactors;

.5 Ensure all connections are tight.

.2 Measure and record motor amps, under load conditions and compare with full load amps and motor service factor. Report any excessive readings and unbalance. Measure voltage as close to motor terminals as possible while motor is running.

.3 Set all motor circuit protectors to the minimum level which will consistently allow the motor to start under normal starting conditions.

3.5 OVERLOAD RELAYS

.1 For starters provided, select overload relays in accordance with relay and motor manufacturers' recommendations, considering motor service factors, ambient temperature, temperature differences between motor and starter locations. Monitor motor operation during start-up to ensure motor operation is satisfactory and relays provide proper protection. For side inlet fans and other long acceleration time loads, provide special overload relays to suite the start-up condition. Provide manufacturers' curves and data sheets where necessary to provide supporting data for motor protection.

3.6 FIELD QUALITY CONTROL

.1 Operate switches, contactors to verify correct functioning.

.2 Perform starting and stopping sequences of contactors and relays.

.3 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION

PART 1 General

1.1 RELATED WORK

.1 Division 1

.2 Section 26 05 00 – Common Work.

.3 Section 26 05 25 – Seismic Restraints.

1.2 SUMMARY

.1 This specification describes a modular rack mounted uninterruptible power supply system for computer, control and other sensitive electronic equipment applications. It defines the electrical and mechanical characteristics and requirements for a continuous-duty, solid-state, uninterruptible power supply system. The uninterruptible power supply system, hereafter referred to as the UPS, shall provide high-quality AC power. This specification is intended to apply to UPS units of varying sizes as outlined on the drawings.

1.3 SHOP DRAWINGS

.1 Shop drawings to be submitted as outlined herein and contain all items within one complete submission.

.2 Shop drawings to include Manufacturer's specification sheets with photographic depiction of all the system components. Specification and descriptive data to include dimension, weight, appearance, connection provisions, materials, metal gauges and operating specification, characteristics, features and controls.

1.4 APPROVALS

.1 Section 26 05 00 – Common Work.

1.5 OPERATING MANUALS

.1 Operating manuals to be furnished as specified. Operating instructions to consist of the following:

.1 Each manual to be bound in a separate permanent hard cover loose-leaf binder and to contain a title page, table of contents, statement of guarantee including termination date and name of person to be called in event of equipment failure.

.2 Individual factory issued manuals containing all technical information on each piece of equipment. In the event such manuals are not available from the factory, system installer to establish same and compile within the manual to satisfaction of the Engineer.

.2 Each manual to contain a system parts list, a parts list for individual components, detailed schematics and recommended maintenance procedures. Advertising brochures or operational instructions shall not be considered as technical manuals.

1.6 START UP AND COMMISSIONING

.1 The operation of the unit must be properly tested prior to delivery and retested after completion of the installation.

.2 Provide factory test results for review and approval prior to shipment of complete system.

.3 Include in price such start-up and commissioning assistance as will be required by the Installation Contractor to properly start up, adjust and commission the UPS system. Provide all necessary support to the Installation Contractor and the Engineer during the installation phase of the project.

.4 After completion of installation and final acceptance provide instructional sessions to Owner's operational and maintenance staff.

1.7 SOURCE OF SUPPLY

.1 All UPS units specified herein shall be supplied by a single Manufacturer.

PART 2 Products

2.1 PRODUCT MANUFACTURERS

.1 Acceptable Manufacturers:

.1 APC Smart-UPS X 3000VA Rack/Tower LCD

.2 Approved Equal

2.2 UNINTERRUPTABLE POWER SUPPLIES

.1 General:

.1 This specification describes the requirements for a rack mounted, continuous duty, on-line solid state uninterruptible power supply system hereinafter referred to as the UPS. The UPS is to operate in conjunction with the building electrical system to provide uninterruptible power for equipment as indicated on contract drawings.

.2 The UPS system consists of the following major components:

- Pulse width modulation inverter/charger with output power transformer and control circuits.
- Indicators and alarms.
- Static transfer switch.
- Maintenance bypass switch.
- Rack mounted batteries, as needed.

.3 UPS to be continuous type, designed to operate as an on-line system in the following modes:

- Normal - The critical load to be continuously controlled by the inverter. The inverter charger to derive power as needed from the commercial AC source and supplied filtered AC power to the critical load. In addition, simultaneous float charging of the battery to occur.
- Emergency - Upon failure of the commercial AC power critical load continues to be supplied by the inverter, which without any switching,

obtains its power from the storage battery. There is to be no interruption to the critical load upon failure or restoration of the commercial AC source.

- Recharge - Upon restoration of the commercial AC source, the inverter charger to recharge the battery. This is to be an automatic function and causes no interruption to the critical load.
- Static Transfer Mode - If the UPS must be taken out of service for overload, load fault, or internal failures, the static transfer switch shall automatically transfer the load to the alternate source with virtually instantaneous transfer and no noticeable interruption in the output.
- Maintenance Bypass Mode - When the UPS requires maintenance or for other reasons is to be taken out of service, a manual bypass transfers the output to the alternate source parallel and interlocked with the static transfer switch alternate position.

.2 Electrical Characteristics:

.1 Electrical Load Capacity: 2880 VA at 0.8 PF.

.2 The battery to be sized to support the inverter at the kilowatt load specified above at 50% load for at least 30 minutes.

.3 Input and Output Voltage Characteristics: 120 VAC. Input and output frequency to be 60 Hz nominal.

.4 Output voltage regulation to be better than ±2% and frequency regulation 60 Hz, ±0.1% under any of the following conditions:

- Input voltage ±10%.
- Input frequency ±5%.
- No-load to full-load regulation.
- 20% unbalance in output loading.

.5 Under inverter operation from the storage battery (AC power not available) the output voltage to be within 5% of nominal at full-load for specified discharge period; and the frequency to be within ±0.5% of nominal. During this mode of operation, system efficiency to be not less than 85%.

.6 Total harmonic distortion of output waveform to be below 5% under all load conditions. Step loading capabilities to be 15 seconds maximum from zero to full load.

.7 UPS to be capable of sustaining a 125% overload for 1 minute.

.8 The overall system efficiency, input to output, shall be not less than 85% with the battery fully charged and the system supplying full rated kilowatt load.

.9 UPS output neutral to be electrically isolated from the input neutral to provide common mode transient and noise attenuation to the critical load. Integral surge protection to IEEE C6241, Cat. A standards.

.10 UPS output AC neutral to also be electrically connected in normal operation to UPS chassis providing local ground.

.11 All power cables and busses to be copper.

2.3 ENVIRONMENTAL CRITERIA

.1 UPS system shall operate satisfactorily in ambient temperature range of 0 to +40°C, relative humidity of 0 to 95%.

.2 Noise generated by the UPS under any condition of normal operation not to exceed a sound pressure level of 55 dBa measured 1 m from the surface of the UPS.

.3 Integral ventilation fans to be provided as necessary to maintain safe temperatures inside cabinet for room ambient not exceeding 40°C.

2.4 BATTERY SPECIFICATIONS

.1 Batteries to be enclosed in a free-standing metal battery cabinet which shall either match in appearance with the UPS module, or be fully enclosed within the UPS cabinet. Cabinet to be complete with internal battery trays or racks.

.1 Battery type: sealed, maintenance free, lead acid.

.2 Protection time: 10 minutes minimum (battery ambient temperature between 20 and 30°C).

.3 Expected life: 10 years or 200 full discharge cycles at full-load.

.4 Capacity: The battery to be sized to support the inverter at the kilowatt load specified for the protection time indicated above. Provide extended battery bank where required.

.5 Battery circuit breaker: a molded-case breaker to be provided for battery short-circuit protection.

2.5 INDICATORS AND ALARMS

.1 Standard modular control panel to be included in the UPS system and to be equipped with the following metering controls and indicators. All status indicators to have light emitting diodes (LED) for long-life.

.1 Separate digital meters capable of monitoring during normal operations any of the following to be furnished:

- AC input voltage.
- AC input current.
- AC input frequency.
- DC battery voltage.
- DC current.
- Load voltage.
- Load current.
- Load frequency.

.2 Typical status/alarm indication to be displayed as listed below. Provide two (2) form "C" dry contacts and connect “UPS fault” and “UPS Low Battery” alarms to the RTU system, plus additional “UPS Bypass” form “C” dry contact output to the RTU system from the bypass:

.1 AC input – normal.

.2 AC input – failure.

.3 Load on inverter.
.4 Load off - inverter off.
.5 Inverter failure.
.6 On bypass.
.7 Battery discharge.
.8 Sync loss.
.9 Output overload.
.10 Over temperature.
.11 Battery fault (low battery shutdown).
.12 Shutdown imminent.

.3 Audible alarm: to be located in the unit, activated on any UPS alarm. Audible level to be factory set, but may be switched in field to low or off positions. Alarm contact for remote indication to be provided.

2.6 INVERTER/CHARGER

.1 Battery charger to be completely automatic, SCR or semi-conductor controlled with a programmed reference, and capable of restoring the battery to capacity within a maximum of 12 hours after restoration of utility power. Charger power to be obtained from the main inverter charger transformer, without the use of separate transformers. The charger efficiency to be not less than 85%. The charger to be all solid state and to automatically maintain the battery in the fully charged condition whenever the utility power is available. Recharge rate to be current limited on restoration of utility power after discharge.

.2 The Inverter/charger to have a digital synthesized output. The Inverter to be capable of providing specified quality output power while operating from any DC source voltage within the battery operating range. In addition, Inverter to simultaneously float charge the battery.

.3 Adjustable controls: Inverter to have control to manually adjust output voltage ±5% from rated value. Additional adjustments to include but not be limited to inverter current limiting, and meter calibration adjustments.

.4 Inverter to have minimum input power factor of 0.9 with nominal input voltage and while operating at full rated load.

.5 Inverter to have sufficient capacity to support a rated load and recharge the battery to 90% of its full capacity within 10 times the discharge time.

.6 Input and output transformer windings to be designed and manufactured for high efficiency. Windings to be copper. Insulation type to have a minimum temperature rating that is equivalent to highest winding temperature calculated during UPS operation.

.7 Electromagnetic effects to be minimized to ensure that computer systems shall neither adversely affect nor be adversely affected by the UPS.

.8 UPS to have built-in protection against undervoltage, overcurrent, and overvoltage, including low energy lightning surges introduced on the primary AC source, and voltage and current surges on output caused by load transfer between the UPS and an external synchronized source. Where applicable semi conductor fusing is to be provided complete with blown fuse indication.

2.7 STATIC SWITCH AND MAINTENANCE BYPASS

.1 A static switch and bypass shall be provided as an integral part of UPS. Control unit shall contain transfer circuit that senses status of inverter logic signals and alarm conditions to provide an uninterrupted transfer of load to alternate source without exceeding transient limits specified herein when a malfunction occurs in the UPS.

.2 Static switch shall be accessible for ease of maintenance and shall be completely isolated during manual bypass operation with no interruption to the critical load.

.3 Static switch shall be a naturally committed, high-speed static transfer device. The static switch shall operate when inverter logic signals one of the following:

.1 UPS failure.

.2 Critical bus overvoltage or undervoltage.

.3 Battery protection period expired (DC undervoltage).

.4 Inverter overload period expired.

.4 The manual bypass shall operate to parallel the static transfer switch (static transfer switch in bypass mode) before breaking the bypass feed to and output from the inverter. This will enable uninterrupted load transfer to the manual bypass while providing full isolation for the UPS and static switch.

.5 Bypass shall be rated 3000 VA with selectable automatic or manual transfer; unit shall provide 10% voltage regulation from up to 30% supply voltage variations, and transient surge suppression of up to 20 kA total peak surge current.

2.8 MECHANICAL DESIGN

.1 Parts Replacement: UPS to be designed to permit ready access to modules and assemblies. Parts, test points, and terminals to be placed so they are accessible for circuit checking, adjustment, and maintenance.

PART 3 Execution

3.1 INSTALLATION

.1 Install UPS equipment where indicated in the schedule or as noted on the drawings and make plug-in or wired-in connection as directed.

END OF SECTION

PART 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Submit shop drawings for all fixtures including complete photometric data. Photometric data must be produced by a recognized independent testing laboratory.

.3 Details of fixtures listed in specifications, may include features considered exclusive to one manufacturer. It is not the intent of this specification to limit the submission of fixtures to one manufacturer and other manufacturers may submit bids on equal equipment.

.4 All fixtures shall be delivered to the site completely assembled and in original cartons. Ensure the availability of a dry and protected storage space before delivery of fixtures.

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Division 1.

1.3 ENVIRONMENTAL PROTECTION

.1 Refer to Division 1.

PART 2 Products

2.1 LUMINAIRES

.1 General Description: refer to luminaire schedule on drawings for details.

PART 3 Execution

3.1 INSTALLATION

.1 Install Luminaires as indicated.

.2 Provide seismic restraints for all luminaires in accordance with Section 26 05 25 – Seismic Restraints.

.3 Connect to lighting circuits and switches as indicated.

.4 Protect all luminaires from construction dust and debris.

.5 Clean all lighting reflectors, lenses and other lighting surfaces at time of final cleaning.

END OF SECTION

PART 1 General

1.1 REFERENCE STANDARDS

.1 Do unit equipment for emergency lighting work in accordance with CSA C22.2 No. 141-M11985(R1992) except where specified otherwise.

1.2 PRODUCT DATA

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

1.3 GUARANTEE

.1 Provide a written guarantee, signed and issued in the name of Her Majesty, the Queen in right of Canada, stating that the battery for emergency lighting is guaranteed against defects in material and workmanship for a period of ten years, with a no-charge replacement during the first lustrum and a pro-rate charge on the second lustrum, from the date of the Final Certificate of Completion.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Division 1.

1.5 ENVIRONMENTAL PROTECTION

.1 Refer to Division 1.

PART 2 Products

2.1 BATTERY PACK

.1 Supply voltage: 120 V ac. Cord and 15P Plug.

.2 Output voltage: 12 V dc.

.3 Output wattage: As shown on the drawings

.4 Operating time: 120 minutes for battery pack #1 (electrical room), 30 min. for all other battery packs.

.5 Battery: lead acid, sealed, maintenance free, 10 year.

.6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected, modular constructed.

.7 Solid state transfer.

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

.9 Signal lights: solid state, life expectancy 100,000 h minimum, for `AC Power ON' and `High Charge'.

.10 Lamp heads: integral on unit adjustable mounting, swivel type, 7W L.E.D. type.

.11 Cabinet:
- .1 20 gauge steel.
- .2 Shelf mounted to wall.

.12 Finish: factory standard.

.13 Auxiliary equipment:
- .1 Lamp disconnect switch.
- .2 Test switch.
- .3 Time delay relay.
- .4 DC output terminal block inside cabinet.
- .5 Power cord and plug for AC connection.
- .6 Shelf.

2.2 REMOTE HEADS

.1 Flush mounted: On finished ceilings or walls as indicated.

.2 Surface mounted: On underside of Open Webbed Steel Joists as indicated.

.3 Surface heads mounted on an adjustable swivel base, 12V, 2 x 6W L.E.D. Lamps.

2.3 RELAY CABINET

.1 Dimensions:
- .1 As per the manufacturer recommendations per each output wattage.

.2 Steel EEMAC-1 enclosure, grey.

.3 Continuous piano hinged, latched cover.

.4 Plywood mounting backboard inside.

.5 Relays: 120 V coil, 15 Amp contacts, Plug-in type with mounting base.

2.4 WIRING

.1 Conduit: EMT type in accordance with Section 26 05 34 – Conduits, Conduit Fastenings, and Conduit Fittings.

.2 Conductors: RW90 type in accordance with Section 26 05 21 – Wires and Cables (0-1000V), sized as indicated and in accordance with manufacturer's recommendations.

PART 3 Execution

3.1 INSTALLATION GENERAL

.1 Install unit equipment and remote mounted heads as indicated.

.2 Connect exit signs to unit equipment.

.3 Direct heads as indicated.

.4 Install Relay Cabinets as indicated.

.5 Test operations of all battery packs and relay cabinets. Submit test reports indicating time battery pack switched to battery, time battery fully discharged and time battery packs fully charged after restoration of the line voltage.

.6 Provide Lamicoid Nameplates for Relay Cabinets as indicated.

END OF SECTION

PART 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

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

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Division 1.

1.3 ENVIRONMENTAL PROTECTION

.1 Refer to Division 1.

PART 2 Products

2.1 EXIT SIGNS GENERAL

.1 197 mm high, 305 mm wide Running Man in accordance with CSA C22.2 #141 and in compliance with 2010 NBC.

.2 Universal mounting.

.3 Wall, end, or ceiling mounted as indicated.

.4 Single face or double faced as indicated.

.5 Complete with 3 pictogram faceplates; Running Man, Left Running Man with Directional Arrow, and Right Running Man with Directional Arrow.

.6 120V, 1.9W LED light source.

.7 12VDC, 0.9W DC Emergency LED light source.

.8 Designed for 50,000 hours continuous use.

.9 Housing shall be constructed of rugged extruded aluminum. White powder coated finish.

PART 3 Execution

3.1 INSTALLATION

.1 Install Exit Signs as indicated.

.2 Connect to 120V lighting circuit and D.C. Emergency Battery Pack as indicated.

.3 Where directional arrows are shown on the drawings, provide same on the exit signs pointing left, or right as indicated.

.4 All Exit Sign wiring to be in separate conduit.

END OF SECTION

PART 1 General

1.1 RELATED WORK

.1 Refer to Section 26 05 00 – Common Work Results.

.2 Refer to Section 26 24 17 – Panel Boards – Breaker Type.

.3 Refer to Section 26 28 21 – Moulded Case Circuit Breakers

.4 Refer to Section 26 12 16 – Dry Type Transformers up to 600 V Primary

.5 Refer to Section 26 12 19 – Pad Mounted Liquid Filled Medium Voltage Transformers

.6 Refer to Section 33 65 71 – Site Work

1.2 DESCRIPTION

.1 This section describes the requirements for furnishing a protective device coordination study for power distribution gear.

.2 Include in the quotation all costs for preparation of a complete System Coordination Study in accordance with the IEEE Standard 242, 'Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems', the IEEE Standard 1584-2002, 'IEEE Guide for Performing Arc-Flash Hazard Calculations', and CSA Z462-2015, 'Workplace Electrical Safety'.

.3 The study shall be prepared by an Engineering or Technical Service firm that regularly performs these types of power systems studies and analysis. The study shall be performed or reviewed and sealed by a licensed Professional Engineer, registered to practice in the Province of British Columbia.

PART 2 Products – not used

PART 3 Execution

3.1 STUDIES

.1 The coordination study shall include all relevant distribution and protective devices within the following scope:

.1 'Upstream' devices to the utility level, including the curves of the utility transformer's protective device; or, where no such device exists, the next upstream device in the Utility's system; this includes the main emergency breaker, generator breaker and main breaker in building 115.

.2 The transformer damage curve, in order that a complete coordination of the system is accomplished;

.3 'Downstream' devices to include the DCP main breaker, pump breakers for each 600V motor larger than 10 HP (including motor curves).

.2 A short circuit study shall be performed for the following busses within the following scope:

.1 Main utility transformer secondary terminals;

.2 Existing CDP's bus (emergency and normal power in building 115);

.3 Generator feed bus and ATS

.4 New CDP bus

.5 Motor terminals and;

.6 347/600V and 120/208V panelboards

.3 An arc flash study shall be performed for the following busses and with the following scope:

.1 Same equipment busses as short circuit study, plus the line side of the all CDP's main overcurrent protection device (main breaker's up the stream);

.2 The arc flash study shall include production of detailed arc flash warning labels for each equipment bus, these labels are to be prepared as detailed in CSA Z462 Annex Q.4;

.3 The labels produced shall be prepared for the 'worst-case' arc flash hazard likely to occur in the facility;

.4 The study provider shall examine arc flash hazard when the facility is running on utility and stand-by generator power, and with and without the pumps running. The scenario which yields the highest incident energy shall be used as the basis for producing the equipment labels;

.5 All scenarios shall be run with As-Built breaker setting and feeder information entered into study model.

.4 The work of the aforementioned studies shall include:

.1 Liaison with the local utility for information on primary fuse and other protective devices, transformer data and system and substation capacities which affect the coordination of this system for both primary and any stand-by feeders;

.2 Liaison with distribution equipment and switchgear manufacturer to obtain actual trip curves of proposed protective devices for the new equipment;

.3 Recommendations shall be included, listing all deficiencies within the scope of the study and proposing methods of correction for each deficiency;

.4 Short circuit study shall be produced based on the highest available fault current available from the utility provider;

.5 Arc flash study shall be produced based on the actual (present-day) fault current available from the utility provider and operating on standby generator with and without motors running; the worst-case results from these operating scenarios shall be used to produce equipment arc flash labels.

.5 The coordination study report shall include the following:

.1 Each time-current graph shall be printed in colour. The selected colours or hatching pattern will allow the end-user to easily discriminate between different device curves, especially on complicated graphs where devices overlap.

.2 The time-current curves shall be drawn on special log graphs with time coordinate range of 0.01 to 1,000 seconds and current coordinate ranges of 4 orders. The entire distribution system shall be subdivided into portions so that the curve for each device clearly shows its relationship to associated upstream and downstream devices. The coordination study should separate the emergency power from the normal power distributions. Each graph for a portion of the system shall include/ indicate the following:

.1 The portion of the distribution system represented by the devices on the graph shall be represented by a single-line diagram, drawn in the corner of the time-current coordination graph.

.2 Each device curve shall end at the 3 phase symmetrical fault level calculated for that bus, based on the results of the short circuit study.

.3 Cable, bus, or conductor damage curves shall be shown where appropriate. All transformer inrush, damage and overload curves shall be shown.

.4 Motor starting curves and protective devices shall be shown for all motors larger than 10 HP within the scope of the study.

.5 Include ground fault protection coordination within the scope of the study.

.3 On the graphs, or on the same page as the graph, all protective device curves within the scope of the graph shall be shown with the following information:

.1 Relay curves with text indicating, Manufacturer, Type, Current Transformer size, Tap or Pickup setting, Time Dial settings, and curve type;

.2 Fuse curves with average melting curve for low voltage fuses and minimum melt and total clearing for high voltage fuses with text indicating, Manufacturer, Type, Ampacity, Voltage, and Speed;

.3 Static-Trip breaker curves with text indicating; Breaker and Trip Unit Manufacturer and type, Current Transformer and Sensor Type, and all trip unit settings.

.4 Thermal-Magnetic Breaker curves with text indicating, Breaker type, Trip rating, and instantaneous trip settings.

.6 Include tables within the study that clearly list all protective devices within the scope of the study and all associated information. These tables are to be based on settings established and noted in the coordination curves. The tables shall be logically arranged and grouped to effectively present the following information:

.1 Relays, including Manufacturer, type, curve, CT, and all protective settings;

.2 Transformers, including size, type, configuration, voltage, and impedance;

.3 Fuses, including Manufacturer, type, ampacity, voltage, speed;

.4 Static Trip Units, including Manufacturer, type, CT, sensor or plug, all protective settings;

.5 Thermal-Magnetic Trip Units, including Manufacturer, rating, and instantaneous setting;

.6 Motor Protectors (overloads), include Manufacturer, type, rating, all protective settings;

.7 All protective devices shall be listed with clear descriptive text to identify their place within the distribution system;

.8 All protective devices shall have a reference to the time-current graph where they are shown;

.9 The tables shall list all recommended settings of all protective devices within the scope of the study. This will allow the end-user to identify and plan for required changes to protective device settings, and to determine which settings have been implemented within this contract.

.7 The work of the short circuit study shall include:

.1 Evaluation and documentation of three phase and single-line-to-ground short circuit fault levels at all evaluated distribution busses, motor control centre and panel board locations within the scope listed above;

.2 The output of the short circuit study shall be a printed tabulation of asymmetrical and symmetrical RMS short circuit current values, including X/R ratios;

.3 All significant sources and impedances shall be evaluated, including but not limited to, power utility and Stand-by emergency sources, motors, cables, transformers, reactors, and any other devices impacting upon the available short circuit.

.8 The device evaluation study shall include:

.1 All pertinent interrupting devices within the scope of the job shall be listed with its interrupting rating or its series interrupting rating as applicable;

.2 All devices upstream the new main breaker feeding this building (main emergency CDP power, main breaker feeding the emergency CDP, Generator bus and ATS and utility transformers.

.3 A cross reference in table form shall be provided whether the protective devices at each bus are appropriate for the available fault current at each bus.

.9 The arc flash study shall include:

.1 For all busses within the scope, bus separation distances and enclosure dimensions must be gathered, arc flash currents derived, and current interruption times defined;

.2 A cross reference in table form shall be provided for the arc flash currents, incident fault energies, flash protection boundaries, and protection classification;

.3 Adhesive labels shall be produced and affixed to all electrical equipment as previously noted;

.4 An electronic PDF document of the field markings for all switchgear within the scope of the arc flash study will be issued electronically, as well as an MS Excel ® file containing all data submitted within the PDF document. This will allow the Departmental Representative to have spare or replacement adhesive warning signs printed and attached on all equipment, as per the CEC 2015, CSA Z462-2015 and ANSI Z535.4-2002 'Product Safety Signs and Labels'.

.10 A final Engineering report shall be completed including all graphs, tables, findings, and recommendations listed above. Provide one copy in colour in electronic format (pdf file). Also included shall be the following items:

.1 Review the ground fault protection to ensure proper ground fault protection of the system.

.2 Review the application of protective devices and CT configurations and list omissions in proper protection of electrical apparatus.

.3 A clear and concise listing of deficiencies found upon completion of the protection and coordination studies.

.4 For each deficiency, an associated recommended solution, including an 'Order of Magnitude' budget pricing (not including design and/ or drawings).

.11 Submission for the Departmental Representative approval will verify the ratings and settings of all protective devices. Approval will not eliminate the responsibility of Division 26 to provide proper coordination of the breaker and relay settings for all equipment supplied.

.12 A preliminary report shall be prepared and submitted to the Departmental Representative for review, as part of the shop drawing submittal process provided for the service entrance equipment. This initial report shall include all proposed equipment characteristics, protection devices, etc., and shall use estimated feeder lengths.

.13 The preliminary report shall be updated at the end of construction to account for any and all changes made during the course of the project. Feeder lengths, equipment modifications, actual overcurrent protective device settings, etc., shall be incorporated into the final report.

.14 Delivery of the final report shall be made a minimum of four (4) weeks prior to request for substantial completion. After review and comment by the Departmental Representative, the Contractor shall furnish the arc flash warning labels and affix to the equipment, prior to final inspection.

.15 Prior to final inspection, the Contractor shall arrange for the distribution equipment, Manufacturer's Representative to visit site to check all settings and ensure they are in accordance with coordination study results/ values.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Mechanical: Divisions 23 and 25

1.2 REQUIREMENTS

.1 Provide a complete system of wiring to motors and other mechanical equipment such as heaters and hot water tanks and mechanical controls as specified herein and as shown on the drawings.

.2 Unless specifically noted otherwise, wire and leave in operation all electrically operated equipment supplied under this contract or relocated or re-wired as part of the scope. Examine the drawings and shop drawings of all Divisions for the extent of electrically operated equipment supplied under other divisions.

.3 Unless specifically noted otherwise, supply all disconnects, relays, starters, etc., necessary of the operation of equipment. Check all starters, relay coils and thermal elements to ensure that they provide the necessary protection for motors and other equipment.

.4 Do not operate mechanical equipment unless approval is obtained from the trade providing the equipment.

.5 Examine drawings and shop drawings of other Divisions to obtain exact location of mechanical equipment shown on the drawings. Where necessary, obtain information for conduit locations from other trades' drawings and shop drawings.

.6 Assist in placing in operation all mechanical equipment having electrical connections.

.7 Provide single or three phase starters with fused 120V control transformers and overload relays where indicated.

.8 Provide all power wiring for all motors.

.9 Provide power wiring for heating ventilating and air conditioning equipment. Provide terminations in starters and MCC for control wiring so that starter control circuits may be extended. Where 120V power is required for any mechanical equipment, wiring to equipment terminal is the work of this Division.

.10 Refer to Mechanical Equipment Schedule on the drawings for more details.

.11 Mechanical equipment control work which shall be provided under Division 26 shall include the following:

.1 All conduit and 120V control wiring and any other control wiring specifically noted on the drawings or outlined in the different parts of the Specifications.

.2 Conduit and 120V control wiring for baseboard heaters, unit heaters and force flow heater thermostats.

.3 All control wiring as specified in the Mechanical Equipment Schedule.

.4 Where applicable, control wiring related to shut down on any mechanical equipment during fire alarm.

PART 2 Products

2.1 3-PHASE DISCONNECT SWITCHES

.1 Industrial type 'A', having quick make, quick break visible blade mechanism, cover interlocks and padlocking switch in the closed or open position. Use EEMAC 4 enclosures outdoors, and EEMAC 1 indoors, switches to be H rated, heavy duty type.

2.2 120V, 1-PHASE DISCONNECT SWITCHES

.1 Manual disconnect switch hp rated without overload relay.

2.3 208V, 1-PHASE DISCONNECT SWITCHES

.1 Manual disconnect switch hp rated without overload relay -2 poles.

PART 3 Execution

3.1 INSTALLATION

.1 Provide disconnect switches adjacent to all equipment unless the specifically noted otherwise.

.2 Provide automatic starters complete with magnetic contactor for equipment shutdown by the fire alarm systems when activated as indicated on the drawings and described here in.

.3 Provide all wiring between all force flow and unit heaters and their thermostats if the T-stats are 120V. Install wiring between all mechanical components to provide a functional system.

.4 Do control wiring as indicated on the drawings and the Mechanical Equipment Schedule.

END OF SECTION

PART 1 General

1.1 RELATED WORK

.1 Section 26 05 00 – Common Work Results – Electrical.

.2 Section 26 05 28 – Grounding Secondary.

.3 Section 26 05 31 – Junction and Pull Boxes.

.4 Section 26 05 32 – Outlet Boxes and Conduit Boxes.

.5 Section 26 05 34 – Conduits, Fastenings and Fittings.

1.2 STANDARDS AND CODES

.1 Comply with latest issues and all addendums of the following standards:

- .1 TIA/EIA, 568-C series standards – Commercial Building Telecommunications Standards.
- .2 ANSI/TIA, 607-B – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
- .3 NECA/BICSI 568-2006 – Standard for Installing Commercial Building Telecommunications Cabling.
- .4 Canadian Electrical Code including all BC amendments and bulletins.
- .5 National Building Code.

1.3 CONTRACTOR QUALIFICATIONS

.1 The cabling contractor shall be a certified systems vendor of Category 6 components, and/or cabling, and use only technicians fully trained and qualified on installation and testing of the components installed.

.2 All staff performing any type of work contained in this Section shall be certified in the installation, termination and testing of all aspects of Category 6 UTP cabling and components.

1.4 SHOP DRAWINGS

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

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Division 1.

1.6 ENVIRONMENTAL PROTECTION

.1 Refer to Division 1.

PART 2 Products

2.1 LAN CABINET

.1 Standard complete EIA 482.6 mm (19") enclosed rack cabinet. Black.

.2 Wall mounted on Plywood mounting backboard.

.3 Double-hinged steel cabinet, louvered steel front door. Cabinet to hinge from rear mounting enclosure allowing access to front and back of rack mounted equipment. Hinged from either side. Lockable door. Provide 2 keys keyed the same. Keyed separately from Security Cabinet.

.4 Louvered sides, solid top and bottom, welded steel construction.

.5 Four adjustable rails.

.6 Height: 16 Rack Units.

.7 Overall Depth: 559 mm, Usable Depth: 508 mm.

.8 Provide one 482.6 mm (19") rack mounted Power bar, equipped with 6 outlets, surge suppressor, and on/off switch.

.9 Provide 482.6 mm (19") rack mounted Horizontal Wire Managers as indicated. Hinged door with oblong openings on topo and bottom. 1 unit or 2 unit and quantity as indicated.

2.2 OUTSIDE PLANT TELEPHONE CABLE

.1 Polyethylene insulated cables.

.2 24 Gauge, pairs as indicated.

.3 Gel filled.

.4 Medium density black polyethylene jacket, UV resistant.

.5 Solid annealed copper twisted-pair conductors.

.6 Colour coded dual expanded polyolefin insulation.

.7 Colour coded binders.

.8 Non-hygroscopic dielectric tape.

.9 Corrugated copolymer 0.2 mm coated aluminum tape.

.10 Similar to PE 89 cable.

.11 Distance measurements factory-stamped on the outer jacket.

.12 Suitable for outdoor underground-duct applications.

.13 Category 3 rated.

2.3 NETWORK SWITCH

.1 New switch to be AVAYA, ERS 4850GTS-PWR+, complete with second field replaceable power supply and fiber card. The switch is a CSC standard and NO other alternates will be accepted.

2.4 SERVICE ENTRANCE PROTECTION BLOCKS

.1 Telephone outside plant surge protection, for customer owned outside plant cables.

.2 CSA approved, BIX in BIX out, hinged enclosure, door covering all connections.

.3 Connection to ground bar as indicated.

.4 Five-pin plug-in protection modules. Provide protection modules for all pairs of entrance cable.

.5 Protection modules ULC approved, balanced and symmetrical.

2.5 INSIDE MULTI-PAIR TELEPHONE CABLE

.1 Pairs as indicated, twisted, solid copper core, 100 ohm, 24 AWG, Category 3, FT4 rated.

.2 Transmission requirements shall conform to or exceed all applicable section of the TIA/EIA 568 current specifications and addendums.

2.6 OUTSIDE PLANT FIBRE OPTIC CABLE

.1 Multi-mode.

.2 62.5 micron core, 125 micron cladding, number of fibres strands as indicated. Tight-buffered 900 micron, or loose-tube construction, fan-out kit as required.

.3 Outdoor type, suitable for installation in underground conduits and pull boxes.

.4 Water-blocked construction.

.5 Medium density polyethylene jacket, all dielectric.

.6 Minimum short-term tensile load strength: 1,400 N.

.7 Laser-optimized, 10 Gigabit Ethernet Distance 150 m @ 850 nm, 300 m @ 1310 nm.

.8 Gigabit Ethernet Distance: 750 m @ 850 nm, 600 m @ 1310 nm.

.9 Maximum attenuation (dB/km) 3.0 @ 850 nm, 1.0 @ 1310 nm.

.10 Minimum laser bandwidth: (MHz-km) 950 @ 850 nm, 500 @ 1310 nm.

.11 Minimum LED bandwidth: (MHz-km) 700 @ 850 nm, 500 @ 1310 nm.

.12 Compliance: TIA/EIA 568-B.3.

2.7 CATEGORY 6 UTP HORIZONTAL CABLE

.1 Four (4) pair, unshielded, twisted, solid copper core, 100 ohm, 24 AWG, Category 6, FT4 rated.

.2 Category 6 cable for both voice and data horizontal cabling. Blue color for data cables and White color for voice cables.

.3 Transmission requirements shall conform to or exceed all applicable sections of the TIA/EIA 568-B current specifications and addendums for Category 6 cable and components.

.4 Electromagnetic radiation: cables shall comply with Class A limits of FCC Part 15, Subpart J for computing devices.

.5 Nearby sources of radio and electrical interference such as radio transmitters, HVAC, arc welders, motors, intercom or radar installations shall be evaluated for any possible effects.

2.8 CATEGORY 6 PATCH CORDS

.1 Modular Patch Cords:

- .1 Mechanical: All UTP Patch Cords shall be fabricated with stranded conductors.
- .2 Transmission: All UTP Patch cords shall meet the same transmission performance requirements as stated for Category 6 Horizontal UTP.
- .3 Wired "straight through".

.2 4-pair, 24 AWG, 8P/8W, T569A (ISDN) wired, RJ45 plug at each end, blue color outer jacket.

.3 Provide the following required lengths and quantities:

- .1 3.0 metre – 6 total.
- .2 2.0 metres – 12 total.
- .3 1.0 metre – 12 total.
- .4 600 m m – 12 total.
- .5 300 mm – 12 total.

2.9 FIBER PATCH CORDS

.1 Provide fiber patch cords for the new LAN cabinet new building 107 and existing LAN cabinet in building 104. Confirm connectors style onsite with existing equipment in building 104.

.2 The patch cords shall be compliant with TIA-568-C.

.3 Multimode riser-rated simplex or duplex zip cord multimode cable. Standard 50/125 µm and 62.5/125 µm orange jacket cable.

.4 The patch cords shall meet an optical return loss equal to or better than -20dB per mated pair for PC polish, equal to or better than -50dB for UPC polish, or -60dB for APC polish.

.5 Insertion loss shall not exceed 0.4dB per mated pair for both multimode and single-mode. The patch cords shall be available in 1, 2, 3, 5, and 10 meter lengths.

2.10 IDC CONNECTORS

.1 Wall-mounted Insulation Displacement Type (IDC) BIX termination connector strips.

.2 Category 6 for all horizontal cabling to set run, wall outlets. 6 x 4-pair connection strips for all horizontal runs.

.3 Category 3 for Outside Plant cabling. 5 x 5-pair connection strips for all Outside Plant Cables.

2.11 FIBRE OPTIC PATCH PANELS

.1 Suitable for number of ports as required for Outside Plant Fibre strands to be terminated.

.2 Modular with 6 port adaptor plates and blanks as required.

.3 Rack mounted in LAN Cabinet.

.4 LC type connectors complete with dust covers.

.5 Hinged cleared plastic cover.

2.12 DATA PATCH PANELS

.1 Modular Patch Panel, Category 6, black.

.2 24 Port (4 x 6), Female 8P/8W, RJ45.

.3 Suitable for mounting in 482.6 mm (19 inch) LAN Cabinet.

.4 Patch Panels for all horizontal cabling.

2.13 MODULAR VOICE AND DATA JACKS

.1 For installation on stainless steel face plates.

.2 Non-keyed, 4 pair, 8P/8W modular jacks, Category 6, T568A (ISDN) wiring.

.3 Snap-in type connectors.

.4 Color code for jacks:

.1 Voice – Black.

.2 Data – White.

.5 Arrange voice and data jacks in identical sequence at every outlet, with data jacks on top and voice on the bottom.

2.14 CATEGORY 6 UTP CONNECTORS

.1 Applies to both voice and data terminations.

.2 All UTP connectors at each horizontal cable run shall meet the following specifications:

.1 Data horizontal cable runs shall use 8P/8W female RJ45 components at both ends.

.2 Voice horizontal cable runs shall use 8P/8W female RJ45 components at the faceplate end and direct IDC termination in the LAN Room.

.3 Cables shall be wired straight through, no crossover is allowed. Pin 1 at one end is connected to Pin 1 at the other end of the cables.

.4 Components:

.1 Configured to support 8 position EIA/TIA, ISDN cabling, 1000Base T and Token Ring standards.

.2 Meet or exceed technical criteria outlines in TIA/EIA-568, "Transmission Performance Specifications for 4-Pair, 100 ohm, Category 6 Cabling".

.3 Insulation Displacement Type (IDC), modular, non-keyed, utilizing BIX block type connectors.

.5 Connectors at outlet end; install in appropriate stainless steel coverplate.

2.15 CABLE LABELS

.1 Label all new voice and data cables.

.2 Bold face laser quality printed labels, black print on white background.

.3 Self-adhesive, one piece label and clear cover wrapped around cable.

.4 Wording on labels to be approved by Departmental Representative prior to manufacture.

2.16 OUTSIDE PLANT CABLE LABELS

.1 In accordance with Section 26 05 00.

.2 LABELS:

1. Stainless steel, type 304, 0.737 mm thickness.
2. Round, approximately 38mm diameter.
3. Hole at one end of label.
4. Loop in label hole in addition to tie-wrap fastener on cable. Extra loop required to ensure label hangs freely. Stainless steel ring.
5. Remove sharp edges.
6. Cable identification laser-etched on label.
7. Submit samples of etched label complete with holes, lop and tie-wraps for approval by Departmental Representative.
8. Tie-wraps:
    1. Stainless steel (316) with locking device in head
    2. At least 4.5mm width for fastening to cables.
9. Text 3 mm height minimum. Maximize text size to aid readability.

PART 3 Execution

3.1 OUTSIDE PLANT CABLE INSTALLATION

.1 Install outside plant cable in existing or new underground ductbank system and new conduits within building as indicated.

.2 All outside plant cables installed inside new or existing underground pull boxes shall be looped around sides of pull boxes and fastened to side mounting rails using stainless steel tie-wraps. Do no install cables in bottom of pull boxes.

.3 Terminate all pairs on BIX connector strips of service entrance cable protection block.

.4 Ground protection block to building ground as indicated.

3.2 OUTSIDE PLANT TELEPHONE CABLE TESTING

.1 Provide wiremap test on all Category 3 Outside Plant cables.

.2 Test each cable on a pair-to-pair basis ensuring continuity and eliminating the possibilities of shorts or reversals.

.3 Use testing equipment based on TDR (Time Domain Reflectometry) technology.

3.3 FIBRE OPTIC CABLE TESTING

.1 Perform both insertion loss tests and Optical Cable Delay Reflectometer (OTDR) tests on all fibres to verify performance of cable.

.2 Perform testing as clarified and referenced in TIA TSA-140 "Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fibre Cabling Systems".

.3 Provide launch fibres at both ends of cable under test.

.4 Ensure each component/event loss does not exceed values in TIA/EIA 568-B Standards.

.5 Certify link for polarity, insertion loss, optic return loss, and length.

.6 Provide trace of OTDR testing.

.7 Provide test results in electronic format.

.8 Provide paper copy of all test results for incorporation into Maintenance Manuals.

3.4 CATEGORY 6 UTP HORIZONTAL CABLE INSTALLATION

.1 Install each cable in one continuous run from the BIX IDC Connector to the jack on the faceplate. Breaks or spliced not allowed.

.2 No single cable run shall exceed 90 metres in length, measure from the terminations on the BIX Connector to each RJ45 faceplate jack. Ensure the distance is not exceeded before installing the cabling system.

.3 Locate all cables:

.1 At least 130 mm from power lines carrying 2 kVA or less.

.2 At least 300 mm from power lines carrying 2 kVA to 5 kVA.

.3 At least 600 mm from power lines carrying more than 5 kVA.

.4 At least 300 mm from fluorescent fixtures.

.4 Ensure that all clearances between the installed cables and any type of electrical equipment, lines, and lighting are met and/or exceeded such that EMI is well within acceptable industry specifications.

.5 Should the Contractor encounter cable runs that cannot be installed to meet required clearance specifications, then the Contractor shall install fully satisfactory shielding.

.6 Cable terminations:

.1 Terminate data cables with 8P/8W female RJ45 components at both ends.

.2 Terminate voice cables with 8P/8W female RJ45 components at faceplate end, direct IDC termination in the Telephone Cabinet.

.7 Install all UTP cables according to the standards for a Category 6 installation in CSA-T529.

.8 Cable bends shall not be less than the minimum radius specified by the manufacturer for the particular cable in use and shall be made without strain or stress to the cable.

.9 All cables shall be installed in conduit raceway system unless otherwise indicated on contract drawings.

.10 All cables shall be clearly labeled at both ends.

.11 Use no more than 25 lbs of force to install the voice and data cabling in raceways.

3.5 UTP CABLE TERMINATIONS

.1 All terminations to the UTP cable shall be properly connected using industry-standard Insulation Displacement Connection conventions and procedures to 8P/8W, T568A connector and in full compliance with the manufacturer's installation specifications and instructions.

.2 Maintain the cable twist up to the connection point at both ends of the cables. Remove a maximum of 12 mm of the cable jacket measured from the connection point.

.3 Terminate all four horizontal cable pairs at the RJ45 jack, patch panel and BIX connector strip.

.4 Label each voice jack and voice connector strip as indicated using bold face laser quality labels. Label voice jacks as indicated.

3.6 UTP CABLE LABEL INSTALLATION

.1 Install label on each end of cable.

.2 Install label not less than 150 mm from termination end of cable.

.3 All labels to be clearly visible and readable after final termination of cables without having to move or rotate cables.

3.7 CATEGORY 6 UTP CABLE TESTING

.1 Testing, General:

.1 Perform a basic link test to verify and ensure full functional capabilities.

.2 Test each cable on a pair-to-pair basis ensuring continuity and eliminating the possibilities of shorts or reversals.

.3 Use testing equipment based on TDR (Time Domain Reflectometry) technology.

.4 Test each cable to ensure compliance with transmission requirements outlined in the specification.

.5 Test all cables.

.2 Test all cables with a Level II-E tester for conformance with basic link performance as described in EIA/TIA-568 standards.

.3 The test results information for each link shall be recorded in the memory of the field tester upon completion of the test.

.4 The test results records saved by the tester shall be transferred to a windows-based database utility that allows for the maintenance, inspection, and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered, i.e. "As saved in the tester" at the end of each test and that these results cannot be modified at a later time.

.5 Documentation of tests shall be given in report form and will, at a minimum, contain the following data:

OPERATOR: DATE:
LOCATION: CABLE TYPE:

CABLE # TESTER, MAKE AND MODEL

TEST RESULTS (PAIRS):
PINS 1, 2 / PINS 3, 6 / PINS 4, 5 / PINS 7, 8
LENGTH:
ATTENUATION:
IMPEDENCE:
WIRE MAP:
NEXT (PAIR-TO-PAIR):
PSNEXT:
RETURN LOSS:
ELFEXT (PAIR-TO-PAIR):
PSELFEXT:
PROPAGATION DELAY:
DELAY SKEW:

.6 No marginal passes or conditional passes will be accepted.

.7 Provide paper copy of all test results for incorporation into Maintenance Manuals specified in Division 1.

3.8 CATEGORY 6 UTP AND FIBRE OPTIC CABLE DOCUMENTATION AND CERTIFICATOIN

.1 Provide record drawings upon completion:

- .1 Indicate all changes.
- .2 Indicate cable ID's adjacent to outlets.
- .3 Indicate conduit runs, pull boxes and conduit sizes on record drawings.

.2 Provide a certificate document issued by the cable/component manufacturer, guaranteeing transmission capabilities of the cabling system to support 1000 Mbps applications for a period of 25 years.

.3 Installation technicians shall be certified through the manufacturer's certification program. Technicians shall provide evidence of their training certification, or Contractor shall supply documentation verifying their current participation in the manufacturer's certification program.

.4 Manufacturer's Certification:

- .1 The manufacturer's certification shall guarantee that design and installation on the part of the Certified Contractor will not negate or void any portion of the certified system.
- .2 In the event that the Contractor is no longer in business, the full certification remains valid and will be cover by the manufacturer.

.5 The installed structured cabling system shall be covered by a warranty which includes, as a minimum:

- .1 25 Year Coverage.
- .2 Warranty against defects in material and workmanship from the date of the interim acceptance of installation.
- .3 Repair or replacement of a failed component, covering parts and labour, at no charge to the Departmental Representative.
- .4 Single point of contact for all warranty service.

.6 Upon request at no additional cost, provide a manufacturer's technical representative to conduct an on-site visit to ensure complete technical compliance.

END OF SECTION

PART 1 General

1.1 RELATED WORK

.1 Section 26 05 00 – Common Work Results – Electrical.

.2 Section 26 05 28 – Grounding Secondary.

.3 Section 26 05 31 – Junction and Pull Boxes.

.4 Section 26 05 32 – Outlet Boxes and Conduit Boxes.

.5 Section 26 05 34 – Conduits, Fastenings and Fittings.

1.2 STANDARDS AND CODES

.1 CS-03-1996 – Telecommunications Apparatus Compliance Specification, Issue 8.

.2 CSA C22.1-2012 – Canadian Electrical Code, Part 1.

1.3 SHOP DRAWINGS

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

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for public address system for incorporation into manual specified in Division 1.

.2 Maintenance Handover Report:

.1 Provide a list of all equipment itemizing the locations, quantity, model number, serial number and revision level of all installed equipment.

.2 The list of equipment is to be incorporated into a Maintenance Handover Report.

.3 Provide a separate Maintenance Handover Report for the Public Address System.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Division 1.

1.6 ENVIRONMENTAL PROTECTION

.1 Refer to Division 1.

PART 2 Products

2.1 ZONE PAGING MODULE

.1 "BOGEN PCMZPM" to match existing and compatible with existing "BOGEN PCM200" Public Address Zone Paging System equipment.

.2 Three zone paging module.

2.2 TELEPHONE PAGING AMPLIFIERS

.1 "BOGEN TPU1100B" to match existing and compatible with existing "BOGEN PCM200" Public Address Zone Paging System equipment located in building 106.

.2 Rating: 100 Watt.

.3 Inputs for 600-ohm balanced telephone line, LO-Z balanced microphone, and background music.

.4 Integral automatic level control (ALC) circuit for controlling pages made by persons with varying voice levels and paging techniques.

.5 Page from telephone and/or microphone.

.6 Separate controls for page volume, music volume, night ringer, music mute, and Aphex Aural Exciter.

.7 Bass and treble controls.

.8 Built-in night ringer activated by contact closure or by 90V ring signal.

.9 Balanced or unbalanced 16-ohm, 25V, 25VCT, and 70V outputs.

.10 VOX sensitivity level control to eliminate back-ground noise when paging from telephone.

.11 Thermal and electronic overload protection.

.12 Peak level indicator lights.

.13 120V AC, 60Hz power source.

.14 CSA Approved.

2.3 CEILING SPEAKERS

.1 Nominal 200 mm dual cone type speaker.

.2 6 ounce permanent magnet.

.3 5-watt multi tap transformer for use on 25-volt and 70-volt constant voltage type distribution systems.

2.4 SURFACE MOUNTED CEILING SPEAKERS

.1 Surface box to suit speaker. Cold rolled steel. Color to match speaker.

.2 Nominal 200 mm dual cone type speaker.

.3 6 ounce permanent magnet.

.4 5-watt multi tap transformer for use on 25-volt and 70-volt constant voltage type distribution systems.

2.5 WALL MOUNTED HORN SPEAKERS

.1 Weatherproof.

.2 6 ounce permanent magnet.

.3 5-watt multi tap transformer for use on 25-volt and 70-volt constant voltage type distribution systems.

2.6 OUTSIDE PLANT PUBLIC ADDRESS (PA) CABLE

.1 Polyethylene insulated cables.

.2 24 Gauge, pairs as indicated.

.3 Category 3 rated.

.4 Water blocked suitable for outdoor underground-duct applications.

.5 Medium density black polyethylene jacket, UV resistant.

.6 Solid annealed copper twisted-pair conductors.

.7 Colour coded dual expanded polyolefin insulation.

.8 Colour coded binders.

.9 Non-hygroscopic dielectric tape.

.10 Corrugated copolymer 0.2 mm coated aluminum tape.

.11 Similar to PE 89 cable.

.12 Distance measurements factory-stamped on the outer jacket.

2.7 INSIDE MULTI-PAIR PUBLIC ADDRESS (PA) CABLE

.1 Pairs as indicated, twisted, solid copper core, 100 ohm, 24 AWG, Category 3, FT4 rated.

.2 Transmission requirements shall conform to or exceed all applicable sections of the TIA/EIA 568 current specifications and addendums.

2.8 SERVICE ENTRANCE PROTECTION BLOCKS

.1 Telephone outside plant surge protection, for customer owned outside plant cables.

.2 CSA approved, BIX in BIX out, hinged enclosure, door covering all connections.

.3 Connection to ground bar as indicated.

.4 Five-pin plug-in protection modules. Provide protection modules for all pairs of entrance cable.

.5 Protection modules ULC approved, balanced and symmetrical.

2.9 SPEAKER WIRE AND CABLE

.1 2 Conductor, 18 gauge, shielded, FT-4 rated.

2.10 OUTSIDE PLANT CABLE LABELS

.1 To match existing outside plant cable labels.

.2 38 mm Diameter, 0.737mm Thick, Type 304 Stainless Steel with cable identification laser-etched on nameplate.

.3 Minimum text size: 3mm high.

.4 Tie-wrap fasteners to be 4.5 mm wide Type 316 Stainless Steel with locked device head.

.5 Nameplates to have stainless steel ring through hole in nameplate and stainless steel tie-wrap fastens to this ring to allow nameplate to hang freely from tie-wrap.

.6 Cable label to have a unique identification number and shall indicate Type of Cable, Use of Cable, Building Origin of Cable and Building Termination of Cable.

.7 Wording on all nameplates to be approved by Departmental Representative prior to manufacture.

PART 3 Execution

3.1 INSTALLATION (General)

.1 Install equipment in accordance with manufacturer's recommendations, instructions, and as indicated.

.2 Provide all components for a fully operational system.

.3 Connect all Public Address Speakers.

.4 All speaker cabling to be in conduit.

.5 Connect to existing "BOGEN PCM2000" Zone Paging System" and PBX Telephone System in Administration Building.

.6 Program existing "BOGEN PCM2000" Zone Paging System to incorporate new Zone Paging Module and Amplifiers for new Maintenance Building.

3.2 OUTSIDE PLANT CABLE INSTALLATION

.1 Install outside plant cable in existing or new underground ductbank system and new conduits within building as indicated.

.2 All outside plant cables installed inside new or existing underground pull boxes shall be looped around sides of pull boxes and fastened to side mounting rails using stainless steel tie-wraps. Do no install cables in bottom of pull boxes.

.3 Terminate all pairs on BIX connector strips of service entrance cable protection block.

.4 Ground protection block to building ground as indicated.

.5 Install outside plant cable label on cable within each pull box or manhole in which the cable passes through and at each end of the cable.

3.3 OUTSIDE PLANT PUBLIC ADDRESS (PA) CABLE TESTING

.1 Provide wiremap test on all Category 3 Outside Plant cables.

.2 Test each cable on a pair-to-pair basis ensuring continuity and eliminating the possibilities of shorts or reversals.

.3 Use testing equipment based on TDR (Time Domain Reflectometry) technology.

3.4 TESTING

.1 Conduct intelligibility tests.

.2 Test operation of Telephone Interface, Paging, All-Call Operation of new Zone Modules and Amplifiers.

.3 Commission system and provide written test reports, include commissioning reports in operation and maintenance manuals.

3.5 DOCUMENTATION

.1 Submit all test reports to Departmental Representative.

.2 Submit Maintenance Handover Report for all installed equipment.

END OF SECTION

PART 1 General

1.1 RELATED WORK

.1 Section 26 05 00 – Common Work Results – Electrical.

.2 Section 26 05 28 – Grounding Secondary.

.3 Section 26 05 31 – Junction and Pull Boxes.

.4 Section 26 05 32 – Outlet Boxes and Conduit Boxes.

.5 Section 26 05 34 – Conduits, Fastenings and Fittings.

1.2 STANDARDS AND CODES

.1 Comply with latest issues and all addendums of the following standards:

- .1 IA/EIA, 568-C series standards – Commercial Building Telecommunications Standards.
- .2 ANSI/TIA, 607-B – Generic Telecommunications Bonding and Ground (Earthing) for Customer Premises.
- .3 NECA/BICSI 568-2001 – Standard for Installing Commercial Building Telecommunications Cabling.
- .4 Canadian Electrical Code including all BC amendments and bulletins.
- .5 National Building Code.

1.3 SHOP DRAWINGS

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

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Division 1.

1.5 ENVIRONMENTAL PROTECTION

.1 Refer to Division 1.

PART 2 Products

2.1 SECURITY CABINET

.1 Standard complete EIA 482.6 mm (19") enclosed rack cabinet.

.2 Wall mounted on Plywood mounting backboard.

.3 Double-hinged, 3 Section cabinet. Back-pan section, middle section and front door. Middle section of cabinet to hinge from back-pan section allowing access to front and back of rack mounted equipment. Hinged from either side. Lockable door. Provide 2 keys keyed the same. Keyed separately from LAN Cabinet.

.4 Louvered front door, 16 Gauge steel construction. Black textured powder coated finish. Keyed lockable.

.5 Louvered sides, solid top and bottom. 16 Gauge steel construction. Black textured powder coated finish.

.6 Four adjustable rails.

.7 Height: 21 Rack Units.

.8 Overall Height: 1111 mm

.9 Overall Depth: 668 mm, Usable Depth: 508 mm.

2.2 RACK MOUNTED POWER BAR

.1 482.6 mm (19") rack mounted Power bar.

.2 6 x 5-15R CSA receptacles.

.3 Surge suppressor and on/off switch.

.4 CSA 5-15P, Plug and Cord.

2.3 RACK MOUNTED UPS

.1 Refer to Section 26 33 53 – Uninterruptible Power Supply.

2.4 RACK MOUNTED HORIZONTAL WIRE MANAGERS

.1 482.6 mm (19") rack mounted Horizontal Wire Managers.

.2 Hinged latched door.

.3 Oblong opening on top and bottom.

.4 16 Gauge steel construction. Black textured powder coated finish.

2.5 DIN RAIL MOUNTED TERMINAL BLOCKS PANELS

.1 DIN Rails:

- .1 35 mm, Type 3 DIN mounting rails.
- .2 Compatible with terminal blocks.
- .3 Length suitable for mounting in Security Cabinet mounting rails.

.2 Terminal Blocks:

- .1 Push-in, compression clamp.
- .2 Switchable lever disconnect.
- .3 DIN 3 Type, rail mounting.
- .4 10 mm block, wire size; 24 – 12 AWG stranded or solid.

.5 Rating: 300 V, 10 A.

.6 Numbered plastic inserts of same manufacture of terminal blocks.

.7 End stops on each end of each group of blocks as required.

.8 CSA Approved.

2.6 OUTSIDE PLANT SHIELDED SECURITY CABLE

.1 Polyethylene insulated cables.

.2 24 Gauge, pairs as indicated.

.3 Gel filled.

.4 Medium density black polyethylene jacket, UV resistant.

.5 Solid annealed copper individually foil shielded twisted-pair conductors.

.6 Colour coded dual expanded polyolefin insulation.

.7 Colour coded binders.

.8 Non-hygroscopic dielectric tape.

.9 Corrugated copolymer 0.2 mm coated aluminum tape.

.10 Similar to PE 89 cable.

.11 Distance measurements factory-stamped on the outer jacket.

.12 Suitable for outdoor underground-duct applications.

.13 Category 3 rated.

2.7 SERVICE ENTRANCE PROTECTION BLOCKS

.1 Telephone outside plant surge protection, for customer owned outside plant cables.

.2 CSA approved, BIX in BIX out, hinged enclosure, door covering all connections.

.3 Connection to ground bar as indicated.

.4 Five-pin plug-in protection modules. Provide protection modules for all pairs of entrance cable.

.5 Protection modules ULC approved, balanced and symmetrical.

2.8 OUTSIDE PLANT FIBRE OPTIC CABLE

.1 Multi-mode.

.2 62.5 micron core, 125 micron cladding, number of fibres strands as indicated. Tight-buffered 900 micron, or loose-tube construction, fan-out kit as required.

.3 Outdoor type, suitable for installation in underground conduits and pull boxes.

.4 Water-blocked construction.

.5 Medium density polyethylene jacket, all dielectric.

.6 Minimum short-term tensile load strength: 1,400 N.

.7 Laser-optimized, 10 Gigabit Ethernet Distance 150 m @ 850 nm, 300 m @ 1310 nm.

.8 Gigabit Ethernet Distance: 750 m @ 850 nm, 600 m @ 1310 nm.

.9 Maximum attenuation (dB/km) 3.0 @ 850 nm, 1.0 @ 1310 nm.

.10 Minimum laser bandwidth: (MHz-km) 950 @ 850 nm, 500 @ 1310 nm.

.11 Minimum LED bandwidth: (MHz-km) 700 @ 850 nm, 500 @ 1310 nm.

.12 Compliance: TIA/EIA 568-B.3.

2.9 FIBRE OPTIC PATCH PANELS

.1 Suitable for number of ports as required for Outside Plant Fibre strands to be terminated.

.2 Modular with 6 port adaptor plates and blanks as required.

.3 Rack mounted in Security Cabinet.

.4 LC type connectors complete with dust covers.

.5 Hinged cleared plastic cover.

2.10 OUTSIDE PLANT CABLE LABELS

.1 To match existing outside plant cable labels.

.2 38 mm Diameter, 0.737mm Thick, Type 304 Stainless Steel with cable identification laser-etched on nameplate.

.3 Minimum text size: 3mm high.

.4 Tie-wrap fasteners to be 4.5 mm wide Type 316 Stainless Steel with locked device head.

.5 Nameplates to have stainless steel ring through hole in nameplate and stainless steel tie-wrap fastens to this ring to allow nameplate to hang freely from tie-wrap.

.6 Cable label to have a unique identification number and shall indicate Type of Cable, Use of Cable, Building Origin of Cable and Building Termination of Cable.

.7 Wording on all nameplates to be approved by Departmental Representative prior to manufacture.

PART 3 Execution

3.1 OUTSIDE PLANT CABLE INSTALLATION

.1 Install outside plant cable in existing or new underground ductbank system and new conduits within building as indicated.

.2 All outside plant cables installed inside new or existing underground pull boxes shall be looped around sides of pull boxes and fastened to side mounting rails using stainless steel tie-wraps. Do no install cables in bottom of pull boxes.

.3 Terminate all pairs on BIX connector strips of service entrance cable protection block.

.4 Ground protection block to building ground as indicated.

3.2 OUTSIDE PLANT SECURITY CABLE TESTING

.1 Provide wiremap test on all Category 3 Outside Plant cables.

.2 Test each cable on a pair-to-pair basis ensuring continuity and eliminating the possibilities of shorts or reversals.

.3 Use testing equipment based on TDR (Time Domain Reflectometry) technology.

3.3 FIBRE OPTIC CABLE TESTING

.1 Perform both insertion loss tests and Optical Cable Delay Reflectometer (OTDR) tests on all fibres to verify performance of cable.

.2 Perform testing as clarified and referenced in TIA TSA-140 "Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fibre Cabling Systems".

.3 Provide launch fibres at both ends of cable under test.

.4 Ensure each component/event loss does not exceed values in TIA/EIA 568-B Standards.

.5 Certify link for polarity, insertion loss, optic return loss, and length.

.6 Provide trace of OTDR testing.

.7 Provide test results in electronic format.

.8 Provide paper copy of all test results for incorporation into Maintenance Manuals.

3.4 FIBRE OPTIC CABLE DOCUMENTATION AND CERTIFICATOIN

.1 Provide a certificate document issued by the cable/component manufacturer, guaranteeing transmission capabilities of the cabling system to support 1000 Mbps applications for a period of 25 years.

.2 Installation technicians shall be certified through the manufacturer's certification program. Technicians shall provide evidence of their training certification, or Contractor shall supply documentation verifying their current participation in the manufacturer's certification program.

.3 Manufacturer's Certification:

.1 The manufacturer's certification shall guarantee that design and installation on the part of the Certified Contractor will not negate or void any portion of the certified system.

.2 In the event that the Contractor is no longer in business, the full certification remains valid and will be cover by the manufacturer.

.4 The installed structured cabling system shall be covered by a warranty which includes, as a minimum:

.1 25 Year Coverage.

.2 Warranty against defects in material and workmanship from the date of the interim acceptance of installation.

.3 Repair or replacement of a failed component, covering parts and labour, at no charge to the Departmental Representative.

.4 Single point of contact for all warranty service.

.5 Upon request at no additional cost, provide a manufacturer's technical representative to conduct an on-site visit to ensure complete technical compliance.

END OF SECTION

PART 1 General

1.1 GLOSSARY

.1 AGC - Automatic Gain Control

.2 ATP - Acceptance Testing Procedure/Plan

.3 BSCS - Building Security & Communication Systems

.4 CCD - Charged Couple Device

.5 CCTV - Closed Circuit Television

.6 CEC - Canadian Electrical Code

.7 CER - Common Equipment Room

.8 CSA - Canadian Standards Association

.9 CSC - Correctional Service of Canada

.10 DCS - Door Control System/subsystem

.11 EIA - Electronic Industries Association

.12 ES - Electronic Systems

.13 FAAS - Facility Alarm Annunciation System

.14 FAT - Factory Acceptance Test

.15 FDR - Final Design Report

.16 GFE - Government Furnished Equipment

.17 GUI - Graphical User Interface

.18 HMI - Human Machine Interface

.19 I/O - Input/Output

.20 KVM - Keyboard/Video/Mouse

.21 LAN - Local Area Network

.22 LCIS - Limited Call Intercom System

.23 LCP - Local Control Post

.24 MCCP - Main Communications Control Post

.25 MM - Multi-mode

.26 MTBF - Mean Time before Failure

.27 OFC - Optical Fiber Cable

.28 PC - Personal Computer

.29 PDC - Power Distribution Centre

.30 PDR - Preliminary Design Report

.31 PE - Principal Entrance

.32 PLC - Programmable Logic Controller

.33 PIU - Perimeter Intrusion Unit

.34 PWC - Public Works Canada (PWGSC's predecessor)

.35 PWGSC - Public Works & Government Services Canada

.36 PTT - Push-to-Talk

.37 RU - Rack Units (1.75" vertical space in an EIA-310E standard equipment cabinet)

.38 SAC - System Administration and Control

.39 SCP - Secure Control Post

.40 SOW - Statement of Work

.41 SM - Single-mode

.42 SPEC - Specification

.43 STD - Standard

.44 T&E - Telecommunications and Electronics

.45 TES - Telecommunications Equipment Space

.46 UPS - Uninterruptible Power Supply

.47 VAC - Volts, Alternating Current

.48 VDC - Volts, Direct Current

1.2 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.3 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 47 15 – Sustainable Requirements.

.3 Section 01 74 19 – Waste Management and Disposal.

.4 Section 26 05 31 – Splitters, Junction, Pull Boxes and Cabinets.

.5 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Place materials defined as hazardous or toxic waste in designated containers.

1.5 PRODUCT DATA

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

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Place materials defined as hazardous or toxic waste in designated containers.

1.7 REQUIREMENTS

.1 Provide a new security system for the secured space. Provide a new central intrusion panel that will be configured as the head-end for new building 107 zones on site.

1.8 SHOP DRAWINGS

.1 Submit shop drawings and product data in accordance with Section 26 05 00:

.1 Shop drawings which are submitted incomplete will be returned to Contractor without review.

.2 Shop drawings to include a complete material list with manufacturer, style, model number and quantity. Wire and cable to be included in material list.

.3 Shop drawings to include manufacturer's specification sheets with photographic depiction of all system components. Specification and descriptive data to include dimension, weight, appearance, connection provisions, materials, metal gauges and operating specification, characteristics, features and controls.

.4 Shop drawings to include the following diagrams:

.5 Elevations to indicate component layouts, cable routing and component functions.

.6 System room plan drawings depicting backboards and cable routing.

.7 Layout drawings for all splice boxes.

.8 Cable details, including type and electrical characteristics.

.9 Complete contractor drawings of all custom made components indicating all materials, gauges, finishes and wiring diagrams.

.10 Complete system wire and cable designation schedule indicating origin, terminus, origin terminal identification, terminus terminal identification, cable function, cable type and cable designation, at each demarcation point.

.11 Under no circumstances will wiring schematics or typical wiring details be considered as circuit diagrams.

.2 Shop drawings to include a bill of material quantities.

1.9 OPERATING & MAINTENANCE DATA

.1 In accordance with Section 26 05 00.

1.10 SYSTEM DESCRIPTION

.1 A complete list of material and spare parts shall be provided to CSC and the Departmental Representative prior to installation.

1.11 WARRANTY/SERVICE

.1 System warranty to cover one-year parts and labour from date of substantial performance. Manufacturers extended warranties on equipment shall apply if typically longer than one year.

.2 System supplier to include a guarantee that service will be provided on the system within 24 hours of call origination during the warranty period.

.3 During the warranty period the system installer at his expense will repair and replace all such defective work and other work to the new system, which fails or becomes defective during the term of warranty, provided that such failure is not caused by the improper usage or physical damage.

1.12 TRAINING

.1 Provide complete and comprehensive training and demonstration sessions for the CSC.

.2 Instruct personnel in operation, adjustment, and maintenance of equipment and systems, using provided operation and maintenance data as the basis for instruction.

.3 Include for 3 hours of system training for the users, divided into 2 sessions – 2hour session up front after installation and a 1hour sessions 30 days or more afterwards.

.4 System contractor to return 90 days after training sessions have been complete and system in use for follow up sessions and Q&A session. Allow for 1 additional 1 hour session.

PART 2 Products

2.1 SECURITY SYSTEM

.1 The protected space shall be provided with a complete security system. Intrusion protection shall be provided by way of door contact switches, and motion sensors as required. The intrusion alarm system is designed to detect unauthorized entry into protected spaces. The system shall conform to the requirements of this document.

.2 The intrusion alarm panel is to be connected to the annunciator panel in building 104 as indicated on the drawings.

.3 The security system may be broken into separate partitions (areas).

.4 The security control panel shall have a sufficient number of zone inputs so that each device shall be connected to a single zone (double doors may be grouped as a single zone).

.5 Home-run all devices to the alarm panel - do not gang or group devices unless otherwise authorized by the Departmental Representative.

.6 The system shall have the capacity to provide one access code per person for the full occupancy of the protected space.

.7 When partitioned, the intrusion alarm system will have as a minimum the following devices:

- .1 Individual LCD keypads
- .2 Door contacts
- .3 Passive infrared motion detectors

.8 The panel shall be non-proprietary (i.e. – available to all alarm contractors).

.9 The panel power supply shall be a minimum 37VA. It shall be hard-wired to a dedicated, non-switched source (i.e. no plug-in type transformers) and the circuit # be clearly identified on both the electrical panel directory and on the alarm panel.

.10 Battery back-up shall be gel-cell type, minimum 7 amp/hour. Battery installation date shall be marked on the battery and panel cover.

.11 All devices (including the panel) shall be supervised with tamper switches and end of line resistors.

.12 EOL devices shall be installed at the device – not in the panel.

.13 A copy of the zone descriptors shall be left inside the alarm panel.

2.2 PROGRAMMING

.1 The Contractor shall be responsible for all programming of the security system. This includes all user codes and all zone definitions.

.2 The panel shall be programmed in an industry standard format (i.e. - SIA or CID format.)

.3 The new security panel is to connect to the new annunciator in the Duty Office console in Building 104.

.4 The Contractor shall program the following:

- .1 Restoral to follow zone closure
- .2 User code required to bypass zones
- .3 Daily test transmission (early morning – not on the hour)
- .4 Bell time-out shall be set at 4 minutes
- .5 Home-away enabled
- .6 All panels shall be programmed to auto-arm at 23:00 daily

.5 The Contractor shall not install a contractor's lockout enable and shall not program Forced Arming or Auto-Disarming without prior approval from the CSC.

.6 The Contractor shall not access the system either physically or by modem without the CSC's approval.

2.3 KEYPAD

.1 No global keypads - each partition will have its own keypad

.2 All keypads shall be LCD alpha (full English) type (unless otherwise specified)

.3 List all zones on the keypad in a clear and legible manner

.4 All keypad panic buttons shall be disabled

.5 All keypads to be set up for "quick Arming" ("X–0")

.6 All keypads to be installed at 1.150m to the middle of the device above finished floor.

2.4 ALARM ANNUNCIATION

.1 The system shall annunciate at the 24/7 manned Duty Office in Building

2.5 MOTION DETECTORS

.1 Motion detectors shall only be passive infrared type.

.2 All motion detectors shall be field-adjusted as per manufacturer's specifications for full coverage pattern of the protected spaces.

.3 All motion detectors shall have LED's disabled after initial testing is done.

2.6 DOOR CONTACTS

.1 Door contacts to be able to communicate with:

.1 Security System

.2 All door contacts shall be installed at the top of the door, opposite the hinge side of the door.

.3 All door contacts must be "wide gap" type. Acceptable standard: "Bosch ISN-CSM35"

.4 All door and window contacts must be concealed unless otherwise directed by the Departmental Representative. If installed in wood or similar material, allow for expansion. Fill all voids with RTV silicone or equivalent.

2.7 DOCUMENTATION

.1 The Contractor shall return the following documentation to the Departmental Representative:

.1 As-built drawings showing location of all devices, controls, splice points, demarcation connection, panels and keypads. All zones shall be clearly identified on the drawings. Electrical panel circuit breaker shall be clearly identified and noted on both the panel cover and as-built drawings.

.2 An installation manual.

.3 A hard-copy printout of the panel download.

.4 Device verification sign-off sheets.

.5 Manufacturer's cut sheets for all devices.

.6 Electrical inspection permit and report.

.7 Training session attendance sheet.

2.8 TRAINING

.1 The Contractor shall allow for a minimum two (2) hour training session on site at the occupants' convenience. Contractor shall provide the CSC with a training attendance sign-off sheet. This sheet shall identify the site, time and date as well as a listing of all those in attendance.

PART 3 Execution

3.1 INSTALLATION

.1 All wiring shall be in conduit.

.2 The security control panel shall be located in room 116 in new building 107.

.3 All cable and equipment supplied, and all installation methods used, shall be as specified by the equipment manufacturer.

.4 All systems shall be wired using cable acceptable to the authority having jurisdiction for the building.

.5 A proposed wiring layout shall be submitted to for approval before start of work.

.6 No splices shall be permitted in the wiring except where a connection is made to a device. All connections shall be made using "B" clips, stakons or approved equivalent (no marrettes).

.7 All wiring shall be concealed unless otherwise authorized by the Departmental Representative.

.8 All cables shall be permanently identified and listed on as-built drawings as follows:

- .1 Cable number
- .2 Source
- .3 Destination

.9 Electrical panel circuit number shall be clearly identified on all system panels.

.10 All work shall be installed in a neat and workmanlike manner. The Contractor is responsible for cleanup and disposal of all garbage and debris caused as a result of their work.

END OF SECTION

PART 1 General

.1 AGC - Automatic Gain Control

.2 ATP - Acceptance Testing Procedure/Plan

.3 BSCS - Building Security & Communication Systems

.4 CCD - Charged Couple Device

.5 CCTV - Closed Circuit Television

.6 CEC - Canadian Electrical Code

.7 CER - Common Equipment Room

.8 CSA - Canadian Standards Association

.9 CSC - Correctional Service of Canada

.10 DCS - Door Control System/subsystem

.11 EIA - Electronic Industries Association

.12 ES - Electronic Systems

.13 FAAS - Facility Alarm Annunciation System

.14 FAT - Factory Acceptance Test

.15 FDR - Final Design Report

.16 GFE - Government Furnished Equipment

.17 GUI - Graphical User Interface

.18 HMI - Human Machine Interface

.19 I/O - Input/Output

.20 KVM - Keyboard/Video/Mouse

.21 LAN - Local Area Network

.22 LCIS - Limited Call Intercom System

.23 LCP - Local Control Post

.24 MCCP - Main Communications Control Post

.25 MM - Multi-mode

.26 MTBF - Mean Time before Failure

.27 OFC - Optical Fiber Cable

.28 PC - Personal Computer

.29 PDC - Power Distribution Centre

.30 PDR - Preliminary Design Report

.31 PE - Principal Entrance

.32 PLC - Programmable Logic Controller

.33 PIU - Perimeter Intrusion Unit

.34 PWC - Public Works Canada (PWGSC's predecessor)

.35 PWGSC - Public Works & Government Services Canada

.36 PTT - Push-to-Talk

.37 RU - Rack Units (1.75" vertical space in an EIA-310E standard equipment cabinet)

.38 SAC - System Administration and Control

.39 SCP - Secure Control Post

.40 SOW - Statement of Work

.41 SM - Single-mode

.42 SPEC - Specification

.43 STD - Standard

.44 T&E - Telecommunications and Electronics

.45 TES - Telecommunications Equipment Space

.46 UPS - Uninterruptible Power Supply

.47 VAC - Volts, Alternating Current

.48 VDC - Volts, Direct Current

1.2 RELATED SECTIONS

.1 Division 1

.2 Section 01 74 19 – Waste Management and Disposal

.3 Section 26 05 31 – Splitters, Junction, Pull Boxes and Cabinets

.4 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings

.5 Section 27 10 05 – Structured Cabling for Communications Systems

.6 Section 28 16 02 – FLASH - Personal Portable Alarm System

1.3 REFERENCES

.1 Canadian Standards Association (CSA)

.1 Install in accordance with CSA C22.1 Current Edition, except where specified otherwise

.2 Install overhead and underground systems in accordance with CSA C22.3 No.1-M1979 except where specified otherwise

.2 Electronic Industries Association

.1 EIA-310E Standard for Racks, Panels and Associated Equipment

1.4 SYSTEM DESCRIPTION

.1 The Portable Alarm Location System (PALS) shall work in conjunction with the PPA system. It shall be used to allow CSC staff to monitor the location and origin of the alarms generated by the PPA system. The system is comprised of but not limited to the following components:

.1 Wireless Receivers

.2 Control Equipment

.3 Interface with Data Logging

.2 CSC Furnished Equipment:

.1 All materials required for a complete and working system are to be provided by this contract

1.5 SCOPE OF WORK

.1 Supply and install new PALS receivers as indicated.

.2 Update the FLASH and FLARE computers to incorporate the new receivers.

.3 Update the site plan the existing site plan on the system to incorporate the new building.

.4 Recalibrate the FLARE system within the area shown on the plans, including all exterior areas and inside the new maintenance building “07”.

.5 Contractor to submit shop drawings form Senstar Corporation for all wiring to new receiver’s c/w the integration schematics with the existing FLASH and FLARE systems.

.6 The PAL system shall be supplied and installed as shown on the drawings.

.7 Provide a completed system with all necessary components, programming, commissioning, patch cables, and interface devices as required and regardless of mention to provide a complete functioning system.

.8 Provide all required software updates and telephone technical support for no less than five years from the date of substantial completion.

.9 Carry the cost of Senstar Corp. to re-program and re-calibrate the existing system with the new equipment for fully operational system.

.10 All cables must be installed in conduit. The installation and provision of conduit will be provided by Division 26, coordinate requirements with the Division 26 subcontractor prior to rough-in installation.

.11 Provide specific colour different from the rest of the facility's colour coding to clearly identify the cable as for use with the PAL System.

.12 Provide a list of recommended spare parts and service manuals for maintenance of the PAL system. List shall include recommended quantity, manufacturer, model number, and unit landed cost.

1.6 SUBMITTALS

.1 General: Submit three copies of each hard and electronic copies of all documents in accordance with Division 1.

.2 Operational Manuals: Submit five printed copies and one electronic copy on disc.

.3 Training Plan and Course Materials provided by the contractor.

.4 Operations & Maintenance Manual provided by the contractor.

.5 SHOP DRAWINGS

.6 Submit shop drawings in accordance with Division 1, Section 01 33 00 - Submittal Procedures.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Divert unused metal and wiring materials from landfill to metal recycling facility as designated by the Designated Departmental Representative.

.4 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 All system hardware and software components shall be produced by manufacturers regularly engaged in the production of Correctional equipment to the ISO 9001 standards. Units of the same type of equipment shall be products of a single manufacturer. All material and equipment shall be new and currently in production. Each major component of equipment shall have the manufacturer's name and address, and the model and serial number in a conspicuous place.

.2 Acceptable Manufacturers:

.1 Senstar no substitutions.

2.2 CONTROLLERS, RECEIVERS

.1 Receivers

.1 The receivers shall be provided by Senstar Corporation and shall match existing, or the newest model of the existing receivers.

2.3 CARRYING CASES

.1 The Contractor shall supply PPA transmitter carrying cases for belt or harness mounting as determined by the CSC representative. The carrying case shall be able to be mounted either horizontal or vertical position.

2.4 RECEIVERS

.1 The receiver shall have the required sensitivity and selectivity to receive an alarm signal from all areas of a facility without interference from other institution RF communication equipment. It will send the alarm signal to the decoder for processing.

.2 The receivers shall comply with the requirements stated in ES/SPEC-0600 & ES/STD-0601.

2.5 DECODERS

.1 The decoder shall process all coded signals from the PPA transmitters and activate the corresponding displays and annunciators. It shall be capable of decoding a minimum of 500 different PPA transmitters as well as store and decode a minimum of 10 alarms within 10.0 seconds. The decoder shall have the capability to be interfaced with an RS-232C protocol to output the received alarm ID number, time and date to the Facility Alarm Annunciation System Integration Unit (FIU). If another standard communications protocol is proposed to be used, approval is required by the Design Authority and the Contractor shall provide all technical and interconnection information.

The decoder shall also be able to receive alarm acknowledge and reset functions from the FIU to cancel an alarm.

If no FIU is available, the decoder shall be able to interface directly to a standalone data logger. The decoder shall display alarm identification in easy readable LEDs. It shall contain the following:

.1 An audible annunciator

.2 An alphanumeric display

.3 Acknowledge and reset buttons to extinguish the alarm indicator and the audible annunciator

2.6 OUTDOOR ANTENNA

.1 The Contractor shall supply and install the outdoor antenna array with associated hardware. The Design Authority shall approve the proposed antenna location.

2.7 WIRE AND CABLE

.1 Wiring shall comply with the requirements stated in ES/SPEC-0602 & ES/STD-0602.

PART 3 Execution

3.1 DOCUMENTATION PRE-REQUISITES

.1 Installation shall not commence until Design Reports have been submitted by the manufacturer and Contractor, and reviewed by the CSC Technical Authority.

.2 Acceptance testing shall not commence until project-specific Acceptance Testing Procedures (ATP) have been submitted by Contractor and reviewed by the CSC Technical Authority.

.3 Operator and Maintenance Technician Training shall not commence until project-specific Training course outlines and trainee handouts have been submitted by Contractor and reviewed by the CSC Technical Authority.

.4 System substantial performance and commencement of the warranty period shall not commence until acceptable ATPs have been completed and signed off by both Contractor and CSC Technical Authority, and Operator training is complete. Substantial performance may nevertheless be granted in the presence of noted deficiencies at the discretion of the Departmental Representative.

.5 Final completion will not be granted until system is in full operation, third party written tests submitted and verified by the Departmental Representative, all noted deficiencies have been cleared and all documentation deliverables have been received by the Departmental Representative in the quantities specified within the contract documents.

3.2 DETAILED DESIGN DEVELOPMENT

.1 Upon Contract Award, prepare and submit a Manufacturer's Design Report to the CSC Technical Authority and the Departmental Representative.

.2 Upon CSC acceptance of the Report, proceed with procurement, manufacture and staging of products compliant with the Report. Prepare subsystem configurations using licensed software. Prepare and submit ATP, training course outlines and materials and operating manual to CSC Technical Authority and the Departmental Representative.

3.3 GENERAL INSTALLATION PROVISIONS

.1 Inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in and acceptable manner.

.2 Verify the accuracy of all dimensions, allowances, and clearances on site prior to commencing with any work that may be affected by those dimensions, allowances, and clearances.

.3 Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in the Contract Documents.

.4 Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.

.5 Supervise construction activities to ensure that no part of the Work, completed or in progress is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

.6 Precautions shall be taken to guard against electrostatic and electromagnetic susceptibility and interference.

.7 Provide adequate ventilation for all heat radiating equipment.

.8 Install equipment so as to provide maximum safety to the operating and maintenance personnel.

3.4 METHOD OF WORK

.1 Work to be performed by fully competent technicians in a thorough manner.

.2 All workmanship to be of the highest quality and meet recognized standards of craftsmanship.

.3 Areas of installation deemed not acceptable by the Departmental Representative to be reworked at the Contractor's expense, additional charges to the contract will not be accepted.

3.5 PROTECTION OF EXISTING PROPERTY

.1 Be responsible for protecting all existing property including floors, walls, ceilings, furniture, and furnishings from damage, dust and other construction related

activities. Provide all necessary dust covers and protective pads required for performance of the Work.

.2 Remove all debris and protective coverings at the end of each work period. Leave premises in condition found at start of work in each room or area of work.

.3 Except for scheduled activities, do not inconvenience user due to construction operations.

3.6 INSTALLATION

.1 Provide complete PAL system as indicated on the drawings and specified herein and in accordance with manufacturer's instructions.

.2 All material furnished shall be new and conform to the applicable requirements of the Underwriters Laboratories of Canada and the National Standards Institute.

.3 Unless otherwise noted, all wiring is to be installed in conduit or wireways.

.4 Do not exceed manufacturer's maximum cable pulling force specifications.

.5 Maintain not less than minimum bending radius for fiber and copper conductors.

.6 If more or larger conduit is required than exists or is indicated on the drawings, allow for such additional conduit in contract price.

.7 All system equipment to be contained within equipment cabinets. If more or larger equipment cabinets are required than exist or are indicated on the drawings, allow for such additional equipment racks and cabinets in contract price.

.8 All system equipment and field devices to be held securely in place. Fastenings and supports shall be selected to provide a safety factor of three.

.9 All system equipment equipped with plug in power connectors to be connected to a dedicated receptacle. Do not use tap connectors for plugging in multiple plugs into a single receptacle.

.10 All cable within equipment cabinets to be neatly bundled, labelled, and properly secured.

.11 Wires shall not be nicked, have strands removed, or have frayed strands when removing insulation or terminating.

.12 Enclosures:

.1 Install at locations and heights indicated on the Contract Documents;

.2 Use green insulated #10 AWG bond conductors for bonding enclosures. Use green insulated #6 AWG bond conductors for bonding racks and cabinets. Use grounding bushing, solderless lug, clamp, or cup washer and screw;

.3 Protect bond conductors from mechanical injury;

.4 Install bond conductors such that neither bond conductors nor data cables interfere with one another in regard to future servicing of patch panel rear connections;

.5 Anchor or stabilize racks per code requirements and the local Authority Having Jurisdiction.

3.7 IDENTIFICATION AND LABELLING

.1 An identification and labelling scheme for all cabling and all devices shall be provided to CSC and or the Departmental Representative for review and comment prior to proceeding with the Work. The CSC shall reserve the right to change the labelling scheme to suit any numbering deviation as a result of field or as installed conditions. Any additional work associated with these changes shall be included in the contract and shall not be considered as an additional cost to the contract.

.2 Color identification of wiring:

.1 Identify wiring by continuous insulation color;

.2 Where multi-conductor cables are used, use the same color-coding system for identification of wiring throughout;

.3 Maintain uniform phasing and color-coding throughout system;

.4 Colour indicated in the Identification section of Section 26 05 00 – Common Work Results - Electrical.

.3 Name identification of wiring:

.1 Identify wiring at all equipment locations, pull boxes, junction boxes and outlet boxes;

.2 Develop a uniform identification scheme for use throughout the system;

.3 Record wire name identification on all applicable drawings and provide wiring tables within the Operating and Maintenance manuals;

.4 Mechanically printed labels only;

.5 Colour indicated in the Identification section of Section 27 10 05 – Structured Cabling for Communications Systems.

.4 Use one of the following marking materials:

.1 Heat shrink sleeves;

.2 Clear plastic tape wrap-on strips with designated labelling section;

.3 Slip-on identification bead markers or sleeves.

3.8 TESTING AND ADJUSTING

.1 Test all runs upon completion of permanent terminations, using instrumentation acceptable to the Departmental Representative. Before commencing testing, submit sample test data sheets and information with respect to test instrumentation to be used.

.2 Testing

.1 Acceptable Test Instruments:

.1 Copper: Fluke DSP-4000
Microtest Omni scanner

.3 Test system components in presence of the Departmental Representative to ensure correct operation of system. On completion of tests, submit to the Departmental Representative a certificate listing components tested.

.4 Testing & adjusting to verify the full and proper operation of each system component and integrated function.

.5 Except where otherwise specified, arrange and pay for testing & adjusting of system.

.6 If test results do not conform to applicable requirements, repair, replace, adjust, or balance equipment and systems. Repeat testing as necessary until acceptable results are achieved.

.7 Log and tabulate test results on appropriate test report forms and as specified.

.8 Submit forms to the Departmental Representative prior to use.

.9 Submit copy of completed test report forms to the Departmental Representative immediately after tests are performed for review.

.10 Insert a copy of completed test report forms in each copy of the Operating and Maintenance manuals.

END OF SECTION

PART 1 General

.1 AGC - Automatic Gain Control

.2 ATP - Acceptance Testing Procedure/Plan

.3 BSCS - Building Security & Communication Systems

.4 CCD - Charged Couple Device

.5 CCTV - Closed Circuit Television

.6 CEC - Canadian Electrical Code

.7 CER - Common Equipment Room

.8 CSA - Canadian Standards Association

.9 CSC - Correctional Service of Canada

.10 DCS - Door Control System/subsystem

.11 EIA - Electronic Industries Association

.12 ES - Electronic Systems

.13 FAAS - Facility Alarm Annunciation System

.14 FAT - Factory Acceptance Test

.15 FDR - Final Design Report

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.17 GUI - Graphical User Interface

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.24 MCCP - Main Communications Control Post

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.28 PC - Personal Computer

.29 PDC - Power Distribution Centre

.30 PDR - Preliminary Design Report

.31 PE - Principal Entrance

.32 PLC - Programmable Logic Controller

.33 PIU - Perimeter Intrusion Unit

.34 PWC - Public Works Canada (PWGSC's predecessor)

.35 PWGSC - Public Works & Government Services Canada

.36 PTT - Push-to-Talk

.37 RU - Rack Units (1.75" vertical space in an EIA-310E standard equipment cabinet)

.38 SAC - System Administration and Control

.39 SCP - Secure Control Post

.40 SOW - Statement of Work

.41 SM - Single-mode

.42 SPEC - Specification

.43 STD - Standard

.44 T&E - Telecommunications and Electronics

.45 TES - Telecommunications Equipment Space

.46 UPS - Uninterruptible Power Supply

.47 VAC - Volts, Alternating Current

.48 VDC - Volts, Direct Current

1.2 RELATED SECTIONS

.1 Division 1

.2 Section 01 74 19 – Waste Management and Disposal.

.3 Section 26 05 00 – Common Work Results - Electrical

.4 Section 26 05 31 – Splitters, Junction, Pull Boxes and Cabinets.

.5 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

.6 Section 28 16 02 – Flash - Personal Portable Alarm System.

1.3 REFERENCES

.1 Canadian Standards Association (CSA)

.1 Install in accordance with CSA C22.1 Current Edition, except where specified otherwise

.2 Comply with CSA Electrical Bulletins and local by laws

.3 Install overhead and underground systems in accordance with CSA C22.3 No.1-M1979 except where specified otherwise

.2 Electronic Industries Association

.1 EIA-310E Standard for Racks, Panels and Associated Equipment

1.4 SYSTEM DESCRIPTION

.1 The Portable Alarm Location System (PALS) shall work in conjunction with the PPA system. It shall be used to allow CSC staff to monitor the location and origin of the alarms generated by the PPA system. The system is comprised of but not limited to the following components:

.1 Wireless Receivers

.2 Control Equipment

.3 Interface with Data Logging

.2 CSC Furnished Equipment:

.1 All materials required for a complete and working system are to be provided by this contract

1.5 SCOPE OF WORK

.1 Update existing Flare software to include the new PALS.

.2 The PAL system shall be supplied and installed as shown on the drawings.

.3 Provide a completed system with all necessary components, programming, commissioning, patch cables, and interface devices as required and regardless of mention to provide a complete functioning system.

.4 Provide all required software updates and telephone technical support for no less than five years from the date of substantial completion.

.5 Carry the cost of Senstar Corp. to re-program and re-calibrate the existing system with the new equipment for fully operational system.

.6 All cables must be installed in conduit. The installation and provision of conduit will be provided by Division 26, coordinate requirements with the Division 26 subcontractor prior to rough-in installation.

.7 Provide specific colour different from the rest of the facility's colour coding to clearly identify the cable as for use with the PAL System.

.8 Provide a list of recommended spare parts and service manuals for maintenance of the PAL system. List shall include recommended quantity, manufacturer, model number, and unit landed cost.

1.6 SUBMITTALS

.1 General: Submit three copies of each hard and electronic copies of all documents in accordance with Division 1.

.2 Operational Manuals: Submit five copies.

.3 Training Plan and Course Materials provided by the contractor.

.4 Operations & Maintenance Manual provided by the contractor.

1.7 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Division 1, Section 01 33 00 - Submittal Procedures.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Divert unused metal and wiring materials from landfill to metal recycling facility as designated by the Designated Departmental Representative.

.4 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 All system hardware and software components shall be produced by manufacturers regularly engaged in the production of Correctional equipment to the ISO 9001 standards. Units of the same type of equipment shall be products

of a single manufacturer. All material and equipment shall be new and currently in production. Each major component of equipment shall have the manufacturer's name and address, and the model and serial number in a conspicuous place.

.2 Acceptable Manufacturers:

.1 Senstar no substitutions.

2.2 CONTROLLERS, RECEIVERS

.1 The receivers shall comply with the requirements stated in ES/SPEC-0602 & ES/STD-0602.

.2 The RF receivers shall have the option of being powered from an AC source (115VAC, 50/60 Hz) 3. The RF receivers shall have the option of being powered via Power-overEthernet (PoE).

.3 Each RF receiver shall be capable when operating under AC of including individual integral battery backup. When fully charged, the backup batteries shall provide a minimum of 4 continuous hours of operation following the loss of AC power.

2.3 RF Requirements

.1 The LSECS shall operate in licensed bands as to avoid potential interference from a third-party.

.2 The LSECS shall support the International Public Safety band, 420 to 470 MHz

.3 It shall be possible to configure the LSECS to operate at any of a number of frequencies within the approved band in order to avoid RF interference from pre-existing RF sources on or near a particular site.

.4 The option shall exist for an external antenna to be used in order to increase the coverage area.

.5 The RF signal shall not be blocked by common building materials, smoke, the human body, or heavy clothing.

2.4 Personal Protection Device Functionality

.1 The PPD shall include a button that, when pressed, activates an alarm transmission

.2 Optionally, the PPD shall be capable of generating an alarm if the PPD is taken from the user. This tamper function shall require the use of an optional device, such as lanyard with a pull-pin, which causes an alarm to be generated when it is removed from the PPD.

.3 Man-down feature:

.1 The PPD shall have an optional man-down capability, whereby the PPD automatically transmits a duress alarm when it tilts beyond a user-specified angle for a user-selectable period.

.2 The PPD shall use an internal accelerometer to detect tilt conditions.

.3 The man-down function shall include the following user-programmable features:

.1 Tilt angle

.2 Audible warning of pending alarm

.3 Silent mode (no audible warning)

.4 Time delay before warning of pending alarm

.5 Warning duration

.6 Retransmission at user-defined intervals

.4 Each PPD shall be configurable by the system administrator to report a specific identification code, without a return to the factory. This will enable any PPD to be used as a replacement for another PPD that is damaged or otherwise needs to be replaced.

.5 Optionally, each PPD with a pull-pin option shall be capable of being configured by the system administrator to transmit repeatedly after a duress call is initiated by pull-pin activation. In this way, a PPD can be tracked and located if the person carrying it does not remain in one location.

2.5 WIRE AND CABLE

.1 Wiring shall comply with the requirements stated in ES/SPEC-0602 & ES/STD-0602.

PART 3 Execution

3.1 SITE ASSESSMENT

.1 Before installation begins, the Installation Contractor shall provide a report to the Departmental Representative documenting any site conditions that may prevent the system from operating satisfactorily.

3.2 SYSTEM INSTALLATION

.1 General: The system shall be installed in accordance with the manufacturer's recommended procedures as defined in the manufacturer's documentation.

3.3 SYSTEM CALIBRATION

.1 The Installation Contractor shall calibrate the system in accordance with the manufacturer's recommended procedures as defined in the manufacturer's documentation.

.2 The Installation Contractor shall submit to the Departmental Representative the configuration settings for the system

3.4 DOCUMENTATION PRE-REQUISITES

.1 I Installation shall not commence until Design Reports have been submitted by the manufacturer and Contractor, and reviewed by the CSC Technical Authority.

.2 Acceptance testing shall not commence until project-specific Acceptance Testing Procedures (ATP) have been submitted by Contractor and reviewed by the CSC Technical Authority.

.3 Operator and Maintenance Technician Training shall not commence until project-specific Training course outlines and trainee handouts have been submitted by Contractor and reviewed by the CSC Technical Authority.

.4 System substantial performance and commencement of the warranty period shall not commence until acceptable ATPs have been completed and signed off by both Contractor and CSC Technical Authority, and Operator training is complete. Substantial performance may nevertheless be granted in the presence of noted deficiencies at the discretion of the Departmental Representative.

.5 Final completion will not be granted until system is in full operation, third party written tests submitted and verified by the Departmental Representative, all noted deficiencies have been cleared and all documentation deliverables have been received by the Departmental Representative in the quantities specified within the contract documents.

3.5 DETAILED DESIGN DEVELOPMENT

.1 Upon Contract Award, prepare and submit a Manufacturer's Design Report to the CSC Technical Authority and the Departmental Representative.

.2 Upon CSC acceptance of the Report, proceed with procurement, manufacture and staging of products compliant with the Report. Prepare subsystem configurations using licensed software. Prepare and submit ATP, training course outlines and materials and operating manual to CSC Technical Authority and the Departmental Representative.

3.6 GENERAL INSTALLATION PROVISIONS

.1 Inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in and acceptable manner.

.2 Verify the accuracy of all dimensions, allowances, and clearances on site prior to commencing with any work that may be affected by those dimensions, allowances, and clearances.

.3 Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in the Contract Documents.

.4 Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.

.5 Supervise construction activities to ensure that no part of the Work, completed or in progress is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

.6 Precautions shall be taken to guard against electrostatic and electromagnetic susceptibility and interference.

.7 Provide adequate ventilation for all heat radiating equipment.

.8 Install equipment so as to provide maximum safety to the operating and maintenance personnel.

3.7 METHOD OF WORK

.1 Work to be performed by fully competent technicians in a thorough manner.

.2 All workmanship to be of the highest quality and meet recognized standards of craftsmanship.

.3 Areas of installation deemed not acceptable by the Departmental Representative to be reworked at the Contractor's expense, additional charges to the contract will not be accepted.

3.8 PROTECTION OF EXISTING PROPERTY

.1 Be responsible for protecting all existing property including floors, walls, ceilings, furniture, and furnishings from damage, dust and other construction related activities. Provide all necessary dust covers and protective pads required for performance of the Work.

.2 Remove all debris and protective coverings at the end of each work period. Leave premises in condition found at start of work in each room or area of work.

.3 Except for scheduled activities, do not inconvenience user due to construction operations.

3.9 INSTALLATION

.1 Provide complete PAL system as indicated on the drawings and specified herein and in accordance with manufacturer's instructions.

.2 All material furnished shall be new and conform to the applicable requirements of the Underwriters Laboratories of Canada and the National Standards Institute.

.3 Unless otherwise noted, all wiring is to be installed in conduit or wireways.

.4 Do not exceed manufacturer's maximum cable pulling force specifications.

.5 Maintain not less than minimum bending radius for fiber and copper conductors.

.6 If more or larger conduit is required than exists or is indicated on the drawings, allow for such additional conduit in contract price.

.7 All system equipment to be contained within equipment cabinets. If more or larger equipment cabinets are required than exist or are indicated on the drawings, allow for such additional equipment racks and cabinets in contract price.

.8 All system equipment and field devices to be held securely in place. Fastenings and supports shall be selected to provide a safety factor of three.

.9 All system equipment equipped with plug in power connectors to be connected to a dedicated receptacle. Do not use tap connectors for plugging in multiple plugs into a single receptacle.

.10 All cable within equipment cabinets to be neatly bundled, labelled, and properly secured.

.11 Wires shall not be nicked, have strands removed, or have frayed strands when removing insulation or terminating.

.12 Enclosures:

- .1 Install at locations and heights indicated on the Contract Documents;
- .2 Use green insulated #10 AWG bond conductors for bonding enclosures. Use green insulated #6 AWG bond conductors for bonding racks and cabinets. Use grounding bushing, solderless lug, clamp, or cup washer and screw;
- .3 Protect bond conductors from mechanical injury;
- .4 Install bond conductors such that neither bond conductors nor data cables interfere with one another in regards to future servicing of patch panel rear connections;
- .5 Anchor or stabilize racks per code requirements and the local Authority Having Jurisdiction.

3.10 IDENTIFICATION AND LABELLING

.1 An identification and labelling scheme for all cabling and all devices shall be provided to CSC and or the Departmental Representative for review and comment prior to proceeding with the Work. The CSC shall reserve the right to change the labelling scheme to suit any numbering deviation as a result of field or as installed conditions. Any additional work associated with these changes shall be included in the contract and shall not be considered as an additional cost to the contract.

.2 Color identification of wiring:

- .1 Identify wiring by continuous insulation color;

.2 Where multi-conductor cables are used, use the same color-coding system for identification of wiring throughout;

.3 Maintain uniform phasing and color-coding throughout system;

.4 Colour indicated in the Identification section of Section 26 05 00 – Common Work Results - Electrical.

.3 Name identification of wiring:

.1 Identify wiring at all equipment locations, pull boxes, junction boxes and outlet boxes;

.2 Develop a uniform identification scheme for use throughout the system;

.3 Record wire name identification on all applicable drawings and provide wiring tables within the Operating and Maintenance manuals;

.4 Mechanically printed labels only;

.5 Colour indicated in the Identification section of Section 26 05 00 – Common Work Results - Electrical.

.4 Use one of the following marking materials:

.1 Heat shrink sleeves;

.2 Clear plastic tape wrap-on strips with designated labelling section;

.3 Slip-on identification bead markers or sleeves.

3.11 TESTING AND ADJUSTING

.1 Test all runs upon completion of permanent terminations, using instrumentation acceptable to the Departmental Representative. Before commencing testing, submit sample test data sheets and information with respect to test instrumentation to be used.

.2 Testing

.1 Acceptable Test Instruments:

.1 Copper: Fluke DSP-4000
Microtest Omni scanner

.3 Test system components in presence of the Departmental Representative to ensure correct operation of system. On completion of tests, submit to the Departmental Representative a certificate listing components tested.

.4 Testing & adjusting to verify the full and proper operation of each system component and integrated function.

.5 Except where otherwise specified, arrange and pay for testing & adjusting of system.

.6 If test results do not conform to applicable requirements, repair, replace, adjust, or balance equipment and systems. Repeat testing as necessary until acceptable results are achieved.

.7 Log and tabulate test results on appropriate test report forms and as specified.

.8 Submit forms to the Departmental Representative prior to use.

.9 Submit copy of completed test report forms to the Departmental Representative immediately after tests are performed for review.

.10 Insert a copy of completed test report forms in each copy of the Operating and Maintenance manuals.

END OF SECTION

PART 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 REFERENCES

.1 CAN/ULC-S524, Standard for the Installation of Fire Alarm Systems

.2 CAN/ULC-S525, Audible Signal Device for Fire Alarm Systems

.3 CAN/ULC-S526, Visual Signal Devices for Fire Alarm Systems

.4 CAN/ULC-S527, Control Units

.5 CAN/ULC-S528, Manual Pull Station for Fire Alarm Systems

.6 CAN/ULC-S529, Smoke Detectors for Fire Alarm Systems

.7 CAN/ULC-S530, Heat Actuated Fire Detectors for Fire Alarm Systems

.8 CAN/ULC-S531, Standard for Smoke Alarms

.9 CAN/ULC-S536, Inspection and Testing of Fire Alarm Systems

.10 CAN/ULC-S537, Verification of Fire Alarm Systems

.11 NBCC- National Building Code of Canada

.12 NFCC- National Fire Code of Canada

.13 TB OSH – Treasury Board of Canada, Occupational Safety and Health Manual – Chapter 3-03, Standard for Fire Protection Electronic Data Processing Equipment.

.14 TB OSH – Treasury Board of Canada, Occupational Safety and Health Manual – Chapter 3-04, Standard for Fire Alarm Systems.

.15 All references to the latest edition of these standards.

.16 Where the standards listed above reference other standards, those requirements shall also apply.

1.3 SYSTEM DESCRIPTION

.1 Fully supervised, microprocessor-based, fire alarm system, utilizing digital techniques for data control and digital, and multiplexing techniques for data transmission.

.2 System to carry out fire alarm and protection functions; including receiving alarm signals; initiating single-stage alarm; supervising components and wiring; actuating annunciators and auxiliary functions; initiating trouble signals and signaling to fire department.

.3 Zoned, coded, single stage.

.4 Modular in design to allow for future expansion.

.5 Operation of system shall not require personnel with special computer skills.

.6 System to include:

.1 Central Control Unit in separate enclosure with power supply, stand-by batteries, central processor with microprocessor and logic interface, main system memory, input-output interfaces for alarm receiving, annunciation/display, and program control/signalling.

.2 All panel modules and add-on cards, connections, software and programming as required. Provide 25% spare capacity in control panel cabinet for future cards/modules.

.3 Power supplies.

.4 Initiating/input circuits.

.5 Output circuits.

.6 Auxiliary circuits.

.7 Wiring.

.8 Manual and automatic initiating devices.

.9 Ancillary devices.

.10 Spare relay outputs to initiate device shutdown on alarm.

.11 Audible and visual signaling devices.

.12 End-of-line devices.

.13 Annunciators.

.14 Event log memory chip.

.15 Historic event recorder.

.7 New Fire Alarm central control unit (FACP) to be integrated with the existing site master control panel located in the Administration Building 106. Provide required software and hardware at the new building as well as at the existing central control for a fully functional system. Upon completion of the work, re-verify all affected controllers, devices, appurtenances, etc., as required.

.8 The fire alarm system within the building shall be capable of operating as a single stage system.

.9 The fire alarm system within the building shall operate independently and also transmit information to the fire alarm network. Upon failure of the data communication link to the fire alarm network, the fire alarm system within the building shall remain operational and a trouble signal will be imitated on the fire alarm network and be annunciated at the Main System Annunciator and the Network Annunciator Workstation.

.10 Provide fiber optic cabling in new and existing underground ducts for system(s) integration.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

.1 System:

.1 To TB OSH Chapter 3-04.

.2 Subject to Fire Commissioner of Canada (FC) approval.

.3 Subject to Correctional Service Canada Fire Authority (CSCFA) approval

.4 Subject to FC inspection for final acceptance.

.5 Subject to CSCFA inspection for final acceptance

.2 System components: listed by ULC and comply with applicable provisions of National Building Code, and meet requirements of local authority having jurisdiction.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with the requirements of this section, Section 26 05 00.

.2 Include:

.1 Overall system riser identifying control equipment, initiating zones, signaling circuits; devices and end-of-line devices (as applicable).

.2 Details for all products and devices used to produce a working system. Include all initiating and annunciating devices, end-of-line devices, panels, ancillary devices, and other devices required to produce a complete working fire alarm system.

.1 Identify all options and features that will be present with equipment as installed, including but not limited to: operating ranges, colors, voltage, phase, dimensions, enclosure ratings, materials or protective features.

.3 Step-by-step operating sequence, (cross-referenced to logic flow diagram if required for clarification).

1.6 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for fire alarm system for incorporation into manual specified in Section 01 01 50- Closeout Submittals.

.2 Include:

.1 Instructions for complete fire alarm system to permit effective operation and maintenance.

.2 Technical data - illustrated parts lists with parts catalogue numbers.

.3 Copy of approved shop drawings with corrections completed and marks removed except review stamps.

.4 List of recommended spare parts for system.

PART 2 Products

2.1 MATERIALS

.1 Equipment and devices: ULC listed and labeled and supplied by single manufacturer.

.2 Power supply: to CAN/ULC-S524.

.3 Audible signal devices: to ULC-S525.

.4 Visual signal devices: to CAN/ULC-S526.

.5 Control unit: to CAN/ULC-S527.

.6 Manual pull stations: to CAN/ULC-S528.

.7 Thermal detectors: to CAN/ULC-S530.

.8 Smoke detectors: to CAN/ULC-S529.

.9 Smoke alarms: to CAN/ULC-S531.

2.2 ACCEPTABLE MANUFACTURERS

.1 Standard of Acceptance:

.1 Mircom FleX-Net® #FX-2003-xxxx series, site standard of installation, NO substitutions. Upon contract award, record information, shop drawings and installed system information will be provided to the Contractor for compliance and integration purposes, and prior to component procurement.

2.3 SYSTEM OPERATION: SINGLE STAGE – SIGNALS ONLY

.1 Actuation of any alarm initiating device on this stage to:

.1 Cause electronic latch to lock-in alarm state at building central control unit.

.2 Indicate zone of alarm at building central control unit, building annunciator, main system annunciator in building 104 and at network annunciator workstation in building 107.

.3 Cause audible/visual signalling devices to sound in alarm tone (temporal T3 pattern) in all of the facility and the building central control unit.

.4 Cause fire doors and smoke control doors, if normally held open, to close automatically.

.5 Cause air conditioning and ventilation fans to shut down or to function to provide required control of smoke movement.

.6 Cause elevators to return to floor of egress, or to alternate floor, as required.

.7 Cause additional ancillary device shutdowns to occur.

.2 Signals shall be capable of being silenced in staff supervisory stations and control rooms.

.3 Acknowledging alarm: indicated at central control unit.

.4 Possible to silence signals by "alarm silence" switch at central control unit, after a sixty (60) second period of operation.

.5 Subsequent alarm, received after previous alarm has been silenced, to re-activate signals.

.6 Actuation of any supervisory device to:

.1 Cause electronic latch to lock-in supervisory state at central control unit (and data gathering panels/transponders where installed).

.2 Indicate respective supervisory zone at building central control unit, building annunciators, main system annunciator in building 104 and at network annunciator workstation in building 107.

.3 Cause audible signal at central control unit to sound.

.4 Activate common supervisory sequence.

.7 Resetting alarm or supervisory device will not return system indications/functions back to normal until control unit is reset.

.8 Trouble on system to:

.1 Indicate circuit in trouble at building central control unit, building annunciators, main system annunciator in building 104 and at network annunciator workstation in building 107.

.2 Activate "system trouble" indication, buzzer and common trouble sequence. Acknowledging trouble condition to silence audible indication; visual indication to remain until trouble is cleared and system is back to normal.

.3 Troubles on system: suppressed during course of alarm.

.4 Trouble condition on any circuit in system not to initiate alarm conditions.

.9 Provide the capability to connect to the fire department upon activation of alarms via the central control unit in building 106.

.10 Configure system so that no audible alerts for any alarm, trouble or supervisory condition occurs at the network annunciator workstation in building 107. Provide the capability to enable the audible alerts.

2.4 CONTROL PANEL

.1 Central control unit (CCU)(FACP).

.1 Suitable for DCLA, DCLB and DCLC communication style: to CAN/ULC-S524.

.2 Features specified are minimum requirements for microprocessor-based system with digital data control and digital multiplexing techniques for data transmission.

.3 Minimum capacity of 2000 addressable monitoring and control IDNet and up to 500 addressable control/signal points. Points may be divided between two (2) communication channels in distributed system, each channel operating independently of other. Faults on one communication channel not to affect operation of other channel.

.4 Maintain 25% spare device capacity in each SLC loop.

.5 System to provide for priority reporting levels, with fire alarm points assigned highest priority, supervisory and monitoring lower priority, and third priority for troubles. Possible to assign control priorities to control points in system to guarantee operation or allow emergency override as required.

.6 Integral power supply, battery charger and standby batteries.

.7 Basic life safety software: retained in nonvolatile Erasable Programmable Read-Only-Memory (EPROM). Extra memory chips: easily field-installed. Random-Access-Memory (RAM) chips in panel to facilitate password-protected field editing of simple software functions (e.g. zone labels, priorities) and changing of system operation software.

.8 Circuitry to continuously monitor communications and data processing cycles of microprocessor. Upon failure, audible and visual trouble indication to activate.

.9 Communication between CCU and remote CCUs to be supervised, DCLB or DCLA as indicated. Should communications fail between CCU and remote units, audible and visual trouble to be indicated at CCU. Data communication to be binary DC, baseband, time-division multiplex, half-duplex. Each data channel: capable of communicating up to distance of 3,000 m.

.1 Communication between nodes in networked system to be supervised, DCLB or DCLA as indicated. Should communications fail between any 2 nodes, other nodes on loop to continue to communicate with each other and programmed functions on communicating nodes to continue operating.

.10 Support up to two (2) RS-232-C I/O ports. CCU output: parallel ASCII with adjustable baud rates to allow interface of any commercially available printer, terminal or PC.

.11 Equipped with software routines to provide Event-Initiated-Programs (EIP); change is status of one or more monitor points, may be programmed to operate any or all of system's control points.

.12 Software and hardware to maintain time of day, day of week, day of month, month and year.

.13 Software to operate variable sensitivity addressable smoke detectors and annunciate their status and sensitivity settings at control panel.

.14 All All control panels to be lockable, keyed alike.

.15 All control panels to be the same model, including the hub node.

.16 Each control panel shall be sized to accommodate all present devices plus an additional 50% future devices.

.17 Overall system shall be capable of adding at least 15 additional control panels.

2.5 POWER SUPPLIES

.1 120 V, 60 Hz as primary source of power for system.

.2 Voltage regulated, current limited distributed system power.

.3 Primary power failure or power loss (less than 102 V) will activate common trouble sequence.

.4 Panel load calculation to be submitted with shop drawing submittal.

.5 Interface with battery charger and battery to provide uninterruptible transfer of power to standby source during primary power failure or loss.

.6 During normal operating conditions fault in battery charging circuit, short or open in battery leads to activate common trouble sequence and standby power trouble indicator.

.7 Standby batteries: sealed, maintenance free. Minimum expected lifespan of four (4) years. Sized in accordance with NBC.

.8 Continuous supervision of wiring for external initiating and alarm circuits to be maintained during power failure.

.9 Provide batteries for all fire alarm panels.

2.6 INITIATING/INPUT CIRCUITS

.1 Receiving circuits for alarm initiating devices such as manual pull stations, smoke detectors, heat detectors and water flow switches, wired in DCLB configuration to central control unit.

.2 Alarm receiving circuits (active and spare): compatible with smoke detectors and open contact devices.

.3 Actuation of alarm initiating device: cause system to operate as specified in "System Operation".

.4 Receiving circuits for supervisory, N/O devices. Devices: wired in DCLB configuration to central control unit.

.5 Actuation of supervisory initiating device: cause system to operate as specified in "System Operation".

2.7 ALARM OUTPUT CIRCUITS

.1 Alarm output circuit: connected to signals, wired in class A configuration to central control unit.

.1 Signal circuits' operation to follow system programming; capable of sounding audible/visual devices at 20 spm and in a temporal pattern T3. Each signal circuit: rated at 4A or 2A?, 24VDC; fuse-protected from overloading/overcurrent.

.2 Manual alarm silence, automatic alarm silence and alarm silence inhibit to be provided by system's common control.

2.8 AUXILIARY CIRCUITS

.1 Auxiliary contacts for control functions.

.2 Alarm and supervisory, trouble on system to cause operation of programmed auxiliary output circuits where shown or specified.

.3 Two sets of separate contacts for elevator capture (to main floor of egress and to alternate floor of egress).

.4 Upon resetting system, auxiliary contacts to return to normal or to operate as pre-programmed.

.5 Fans: stagger-started upon system reset; timing circuit to separate starting of each fan or set of fans connected to auxiliary contact on system.

.1 Timing circuit: controlled by CCU.

.6 Auxiliary circuits: rated at 4A or 2A?, 24VDC or 120 VAC, fuse-protected.

2.9 WIRING

.1 Twisted copper conductors installed in conduit.

.2 Minimum wire gauges:

.1 120VAC wiring, #12AWG Cu minimum, installed in conduit.

.2 To initiating circuits: #18 AWG Cu minimum, ULC listed, and in accordance with manufacturer's requirements.

.3 To signal circuits: #16AWG Cu minimum for horn/strobe circuits, ULC listed, #14 AWG for bell circuits, and in accordance with manufacturer's requirements.

.4 To control circuits: #14AWG minimum, ULC listed, and in accordance with manufacturer's requirements.

.3 Size all signaling and control circuits for maximum 5% voltage drop at last signaling/ control device on each circuit.

.4 Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or back-boxes, except where conduit entry is specified by the manufacturer.

.5 Fiber optic cable:

.1 Suitable for outdoor buried conduit use and suitable to be pulled into buried conduits.

.2 Indoor/outdoor rated.

.3 Min. 6-strand, 50µm, multi-mode, OM3, all dielectric, plenum-rated, gel free, UV resistant, water-blocking.

.4 Patch cable to connect to fire alarm panels from fiber termination enclosure: 50µm, OM3.

2.10 FIBER OPTIC TERMINATION

.1 Wall-mounted steel enclosure with modular bulkhead fiber termination modules, bend radius spools, fiber routing kit.

.2 Size enclosure to match number of terminated fibers. Terminate all fibers in each cable.

.3 Connect fibers to bulkhead fittings.

.4 Match existing site fire alarm system fiber connectors, use LC duplex type.

.5 Provide locks on enclosures, all keyed alike to existing site standard. Obtain existing site master key from the Departmental Representative prior to procurement.

2.11 MANUAL ALARM STATIONS

.1 Addressable manual pull station: Pull lever, semi-flush wall mounted type, single action, single stage, electronics to communicate station's status to addressable module/transponder over two (2) wires and to supply power to station. Bilingual English & French signage. Station address to be set and labeled on station in field. Mircom #MS-401AP series

2.12 AUTOMATIC ALARM INITIALING DEVICES

.1 Addressible optical sensor, smoke detector:

.1 Advanced protocol intelligent smoke sensor: Mircom #MIX-2251AP series.

.2 Addressible air duct, smoke detector:

.1 Intelligent non-relay, photoelectric duct smoke sensor: Mircom #DNR-A/ MIX-2251-BR-A/ DST5 assembly.

.3 Addressible thermal, fire detector.

.1 Advanced protocol intelligent thermal sensor, 135 deg. F. fixed with self-restoring rate of rise: Mircom #MIX-5251RAP-A series.

.2 Advanced protocol intelligent thermal sensor, 190 deg. F. fixed temperature: Mircom #5251HAP-A series.

.4 Electronics to communicate detector's status to addressable module/transponder.

.5 Plug in type with fixed base.

.6 Wire-in base assembly with integral red alarm LED.

.7 Detector address to be set and labeled on detector in field.

2.13 SMOKE DETECTOR COVER

.1 ULC approved steel cage covers (wire guards) for mechanical protection of smoke and heat detectors.

.2 Minimum 12 gauge, open mesh sides, factory painted, complete with manufacturer approved mounting tabs.

.3 Tamper proof machine screws as per manufacturer instructions, where requested by the Departmental Representative.

.4 Install in accordance with manufacturer instructions.

.5 Provide steel cage covers for detection devices located in warehouse OWSJ, open ceiling spaces and within service rooms where potentially subject to damage. Finished office, closed ceiling spaces may not require steel cage covers.

2.14 AUDIBLE SIGNAL DEVICES

.1 Horns: 90dBa, red color, 24VDC. Field adjustable volume control. Mircom #HRA-B & #HRKA-B series.

.2 Weather resistant spacers and seals as required and where shown.

.3 Signal devices shall have independent operation of the audible outputs of the device when using a two-wire circuit.

2.15 VISUAL ALARM SIGNAL DEVICES

.1 Strobe type: flashing, white, 24VDC. Mircom #SRHA-B & #SRHKA-B series.

.2 Synchronize operation of visual signals.

.3 Field selectable brightness settings (lux/cd).

.4 Designed for surface mounting on walls (or as indicated).

.5 Designed to protect against mechanical damage and vandalism

.6 Signal devices shall have independent operation of the visual outputs of the device when using a two-wire circuit.

2.16 AUDIBLE AND VISUAL SIGNAL DEVICE COVERS

.1 Red cover with "FIRE" identification.

.2 Designed to protect against mechanical damage and vandalism.

.3 Minimum 3.175mm clear polycarbonate construction, slotted for audible devices.

.4 Weather resistant spacers and seals as required and where shown.

.5 Provide signal device covers for all inmate accessible areas.

2.17 END-OF-LINE DEVICES

.1 Required for Class B (non-coded) fire alarm circuits.

.2 End-of-line devices to control supervisory current in alarm circuits and/or signaling circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

.3 Install EOL devices in separate box with labels indicating zone. Where coded devices (addressable) are installed with a single device per zone, the EOL may be installed in the initiating device box.

2.18 REMOTE ANNUNCIATORS

.1 LED Alphanumeric type, with designation cards to indicate zones.

.2 Display:

.1 Alarms and troubles for alarm initiating circuits.

.2 Supervisory alarms and troubles for supervisory initiating circuits.

.3 Common system trouble.

.3 Trouble buzzer.

.4 Acknowledging trouble at main panel to silence trouble buzzers in system.

.5 Supervised, with LED test button and alarms acknowledge button.

2.19 ANCILLARY DEVICES

.1 Relay output to initiate fan and mechanical equipment shutdown.

.2 Relay output to initiate elevator to land on the alternate floor as per the detector base relay on each lobby.

.3 Relay output to initiate power door operators release where required.

PART 3 Execution

3.1 GENERAL

.1 All construction waste to be handled in accordance with the requirements of Section 01 74 19 - Waste Management and Disposal.

.2 All materials delivered and stored on site shall be protected from theft,

mechanical and environmental damage (temperature, moisture, dust and other contaminants).

.3 Prior to completion of the project, manufacturer of the Fire Alarm system shall update all existing remote annunciators, graphical display units and existing Fireworks station to reflect addition of the building and associated devices.

3.2 INSTALLATION

.1 Install systems in accordance with CAN/ULC-S524 [and TB OSH Chapter 3-04].

.2 Install central control unit and connect to ac power supply, [ac] [dc] standby power.

.3 Install manual alarm stations and connect to alarm circuit wiring.

.4 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1m 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.

.5 Connect alarm circuits to main control panel.

.6 Locate and install horns and visual signal devices and connect to signaling circuits. Synchronize audible/visual devices.

.7 Connect signaling circuits to main control panel.

.8 Install end-of-line devices at end of alarm and signaling circuits (as required).

.9 Install remote annunciator panels and connect to annunciator circuit wiring.

.10 Install door releasing devices.

.11 Install remote relay units to control fan shut down.

.12 Sprinkler system: wire alarm and supervisory switches and connect to control panel.

.13 Room detection system.

.14 Install detectors. Make necessary connections between room detection panel and main fire alarm panel.

.15 Locate and install detectors under raised floor. Fasten to steel brackets approximately 300 mm above sub-floor level to clear cables and conduits.

.16 Connect fire suppression systems to control panel.

.17 Splices are not permitted.

.18 Provide necessary raceways, cable and wiring to make interconnections to

terminal boxes, annunciator equipment and CCU, as required by equipment manufacturer.

.19 Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.

.20 Identify circuits and other related wiring at central control unit, annunciators, and terminal boxes.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and CAN/ULC-S537. Coordinate with tests and inspections by Commissioning Agent specified in Section 01 91 00 Commissioning. Provide verification reports.

.2 Fire Alarm system:

.1 Test all zones, signal, alarm, ancillary and annunciation devices which have been installed.

.2 Test such device and alarm circuit to ensure manual stations, thermal and smoke detectors, and sprinkler system devices transmit alarm to control panel and actuate alarm states and operate ancillary devices.

.3 Test each signal device and each signal circuit; including auxiliary inputs and trouble signals.

.4 When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

.5 Check annunciator panels to ensure zones are shown and actuated correctly. Ensure that each smoke detector and zone is properly annunciated.

.6 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of systems.

.7 Tests to be carried out by the Contractor or Contractor(s) agent.

.8 Tests to include witness of fan shutdown, activation of lighting circuits on alarm, magnetic door holder operation, preaction/clean agent system operation and all other ancillary devices.

.9 Tabulated, Contractor stamped, signed and dated test results are to be submitted to the Departmental Representative for review and approval, and included in the O&M manual.

.10 Addressable circuits system style DCLA:

.1 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals on each side of single open-circuit fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

.2 Test each conductor on all DCLA addressable links for capability

of providing 3 or more subsequent alarm signals during ground-fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

.3 Provide final EPROM program for system incorporating program changes made during construction.

3.4 VERIFICATION

.1 Verify all zones, signal, and alarm, which have been installed or modified in any fashion. Verification to CAN/ULC S537. Include verification costs in tender price.

.2 Test each device and alarm circuit to ensure manual stations, thermal and smoke detectors transmit alarm to control panel and actuate first stage alarm, general alarm and ancillary devices.

.3 Test each signal device and each signal circuit. Test to include sound level readings in each room and synchronization test with the strobes and shall be recorded in the test report.

.4 Check the Fire Alarm CCU display to ensure zones are shown and actuated correctly. Ensure that each smoke detector is properly annunciated.

.5 Simulate grounds and breaks on alarm and signaling devices and circuits to ensure proper operation of trouble signals.

.6 Contractor to perform sound level test for each room as per CSA/ULC 537-13.

.7 Test to be carried out in the presence of a Departmental Representative where applicable.

.8 Verification to include the operation at the existing central station connections.

.9 Verification to include a witness of the ventilation system (and other ancillary shutdowns) shutdown on fire alarm.

.10 The Contractor will be responsible for corrective deficiencies in the Contractor's work that are reported by the verification agent.

.11 Fire Alarm verifier to certify one plan drawing. Certification to be included on fire alarm verification report.

.12 Verification shall include verifying all new and added devices and graphics on the new and existing Fire alarm units.

.13 Contractor to carry the cost of the verification in the bid price.

.14 Submit all verification reports to the Departmental Representative.

.15 The qualified Fire Alarm verification agency shall be independent of the installing company.

.16 The Electrical Division Contractor and fire alarm system manufacturer's representative shall be present at all times during the verification procedure

.17 Provide a minimum of ten workings days written notice ahead of the verification process to the Departmental Representative.

3.5 DEMONSTRATION AND TRAINING

.1 Provide on-site lectures and demonstration by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

.2 Allow for three (3) separate training sessions, three (3) hours for each.

.3 Provide a formal training agenda for review.

3.6 RECORD DRAWINGS

.1 Record all wiring, terminations/splicing, pipe runs and junction box locations on the asbuilt drawings. Include wire gauge, conduit size and junction box size.

.2 Record drawings to show ladder diagram of operation detailing input signals to programmed output function for programmed systems.

.3 Record drawings to show fire alarm zoning, device addresses and the location of each field device of the fire alarm system including fault isolation modules, ancillary devices and control panels.

.4 Include room and corridor numbers (Specific area identification)

.5 Show all line voltage branched circuit connections including ancillary connections. Include panel identification, circuit number and over-current protection.

.6 Identify each drawing in lower right hand corner in letters at least 12mm high as follows: "RECORD DRAWINGS: THIS DRAWINGS HAS BEEN REVISED TO SHOW ELECTRICAL SYSTEMS AS INSTALLED" (Signature of Journeyman Contractor) (Completion Date).

.7 Submit completed record drawing with Operating & Maintenance manuals to the Departmental Representative for approval and make corrections as directed.

END OF SECTION

Part 1 General

1.1 PRICE AND PAYMENT PROCEDURES

.1 The site consists of a mixture of native soil and rock. The extent of buried rock is not known. Rock removal may be required for the installation of underground ductbanks, underground pullboxes, concrete pads, grounding electrodes and conductors, and similar infrastructure.

.2 Measurement for Payment will be calculated from cross sections taken in area over excavation and measured in bank cubic metres. Measurement of rock volume will be as measured in situ prior to removal and approved by the Departmental Representative.

.3 Payment will be made on the basis of the Price per Unit Bid for Rock Removal in the Bid and Acceptance Form.

.4 There are a number of possible methods used for rock removal. Provide a single Unit Price to cover all possible methods of rock removal, for methods related to excavation for underground ductbanks, pullboxes, and concrete pads.

.5 Separate Unit Price for rock removal resulting from coring for ground rods.

1.2 SECURITY

.1 The facility is a Correctional Institution and security is a concern. Follow all institutional security protocols if explosives are required on the site.

1.3 REFERENCES

.1 Definitions:

.1 Rock: any solid material in excess of 0.25 m^3 and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m^3 bucket. Frozen material not classified as rock.

.2 PPV: peak particle velocity.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit submittals in accordance with Section 01 01 50 – General Instructions.

.2 Blasting Submittals: submit for approval, written proposal of operations for removal of rock by blasting to Departmental Representative.

.1 Indicate proposed method of carrying out work, types and quantities of explosives to be used, blast protection measures for items such as flying rock, vibration, dust and noise control. Include details on protective measures, time of blasting and other pertinent details.

.2 Maintain complete and accurate record of drilling and blasting operations.

.3 Qualification Statements:

.1 Retain licensed explosives expert to program and supervise blasting work,

.2 Submit documentation verifying explosives expert's qualifications.

1.5 QUALITY ASSURANCE

.1 Blasting and Vibration Control:

.1 Reduce ground vibrations to avoid damage to structures or remaining rock mass.

Part 2 Products

2.1 MATERIALS

.1 Not used.

Part 3 Execution

3.1 ROCK REMOVAL

.1 Perform excavation in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Co-ordinate this Section with Section 01 35 33 - Health and Safety Requirements.

.3 Remove rock to alignments, profiles, and cross sections as required.

.4 Do blasting operations in accordance with local and provincial codes and requirements of authority having jurisdiction.

.5 Use rock removal procedures to produce uniform and stable excavation surfaces. Minimize overbreak, and to avoid damage to adjacent structures.

.6 Cut trenches to widths as indicated.

.7 Remove boulders and fragments which may slide or roll into excavated areas.

.8 Correct unauthorized rock removal at no extra cost, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.2 CLEANING

.1 Clean in accordance with Section 01 01 50 – General Instructions.

.2 Rock Disposal:

.1 Dispose of removed rock off site.

.2 Do not dispose removed rock into landfill. Send material to appropriate quarry as approved by Departmental Representative

.3 Restore all surfaces including but not limited to roadways, sidewalks, landscaping to original condition if damaged.

3.3 PROTECTION

.1 Prevent damage to surroundings and injury to persons. Erect fencing, post guards, sound warnings and display signs when blasting to take place.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 General requirements for excavating and backfilling procedures for installation of underground duct, ductbanks and manholes.

1.2 RELATED SECTIONS

.1 Section 33 65 73 – Concrete Encased Ductbanks and Manholes

1.3 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

- .1 ASTM C117- 04, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
- .2 ASTM C136- 06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .3 ASTM D422- 63 (2007), Standard Test Method for Particle-Size Analysis of Soils.
- .4 ASTM D698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m ;).
- .5 ASTM D4318-10, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 Canadian Standards Association (CSA International)

- .1 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
  - .1 CSA-A3001-08, Cementitious Materials for Use in Concrete.
- .2 CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.4 Worksafe B.C. Health and Safety Act

.5 Canadian Council of the Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines

.6 BC Ministry of Environment (BC MoE), pursuant to the *Environmental Management Act* (EMA, SBC 2003 Chapter 53, current to June 22, 2011).

- .1 The Contaminated Site Regulation (CSR, BC Reg. 375/96, O.C. 1480/96 and M271/2004, including amendments up to BC Reg. 97/2011, May 31, 2011).
- .2 Hazardous Waste Regulation (HWR, BC Reg.63/88, O.C. 268/88, including amendments up to BC Reg. 63/2009, April 1, 2009), which includes standards for total concentrations of select substances as well as leachate quality standards.
- .3 Standards Triggering Contaminated Soil Relocation Agreements (CSRA, Schedule 7).

.7 Transportation of Dangerous Goods Regulations.

1.4 DEFINITIONS

.1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.

.1 Rock: any sound or solid mass material in excess of 0.5 cubic metres, of such hardness and texture that it cannot be effectively loosened or broken down by mechanical ripping equipment with a minimum drawbar pull of 360 kN and/or by means of heavy duty excavation equipment. Frozen material is not classified as rock.

.2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.

.2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.

.3 Topsoil:

.1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

.2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.

.4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.

.5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

.6 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.

.7 Unsuitable materials:

.1 Weak, chemically contaminated, and compressible materials.

.2 Frost susceptible materials:

.1 Fine grained soils with plasticity index higher than 10 when tested to ASTM D4318, and classified as CL, CH, CL-ML, ML, and SM with material fine than 0.02 mm exceeding 15%.

.2 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.

.8 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

.9 Classification of soils:

.1 Native Soils (Clayey silt and clay) classified as "Not Exceeding CSR Schedule 7, Column 2 Standards": Soil with concentrations of substances less than Contaminated Sites Regulation (CSR) Schedule 7, Column 2 standards or any other standard in the CSR.

.2 Soil classified as "Waste": Soil containing concentrations of substances greater than CSR Schedule 7, Column 2 standards or any other standard in the CSR, but not classified as "Hazardous Waste" under the Hazardous Waste Regulation (HWR). Soil must be disposed of at a permitted waste facility.

.3 Soil classified as "Hazardous Waste": Soil contains substance concentrations that would cause it to be classified as Hazardous Waste under the HWR. Soil must be disposed of at a permitted hazardous waste facility.

1.5 QUALITY ASSURANCE

.1 Qualification Statement: submit proof of insurance coverage for professional liability.

.2 Submit design and supporting data at least 2 weeks prior to beginning Work.

.3 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of British Columbia, Canada.

.4 Keep design and supporting data on site.

.5 Engage services of qualified professional engineer who is registered or licensed in Province of British Columbia, Canada in which Work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for Work.

.6 Health and Safety Requirements:

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling and for disposal.

.2 Arrange and pay for testing of excavated soil to divert soils to appropriate facilities.

.3 Divert excess aggregate materials from landfill to local quarry, recycling facility for reuse.

1.7 EXISTING CONDITIONS

.1 Examine topographic survey and existing conditions information included with Contract Documents.

.2 Buried services:

.1 Before commencing work verify and establish location of buried services on and adjacent to site.

.2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.

.3 Remove obsolete buried services within 2 m of structure: cap cut-offs.

.4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.5 Prior to beginning excavation Work, notify the Departmental Representative and authorities having jurisdiction and establish location and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during Work.

.6 Confirm locations of buried utilities by careful test excavations, ground penetrating radar scans, soil hydrovac methods or other approved method.

.7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.

.8 Where utility lines or structures exist in area of excavation, obtain direction of the Departmental Representative before removing and/or re-routing.

.9 Record location of maintained, re-routed and abandoned underground lines.

.3 Existing buildings and surface features:

.1 Conduct, with the Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, pavement, survey bench marks and monuments which may be affected by Work.

.2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by the Departmental Representative.

.3 Where required for excavation, cut roots or branches as directed by the Departmental Representative.

Part 2 Products

2.1 MATERIALS

.1 Type 1 (bedding and pipe cushion), Type 2 (Granular Sub-base), Type 3 (select subgrade material) and Type 4 (Granular Base) fill: properties to Section 31 05 16 - Aggregate Materials and the following requirements:

.1 Crushed, pit run or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C136 and

ASTM C117. Sieve sizes to CAN/CGSB-8.2.

.3 Table:

Sieve Designation	**% Passing**			
	Type 1	**Type 2**	**Type 3**	**Type 4**
75 mm	-	100	100	-
50 mm	-	-	70-100	-
37.5 mm	-	60-100	-	-
25 mm	100	-	50-100	-
19 mm	90-100	35-80	-	100
12.5 mm	65-85	-	-	75-100
9.5 mm	50-75	26-60	-	60-90
4.75 mm	25-50	20-40	22-100	40-70
2.36 mm	10-35	15-30	10-85	27-55
1.18 mm	6-26	10-20	-	16-42
0.600 mm	3-17	5-15	-	8-30
0.300 mm	-	-	-	5-20
0.075 mm	0-5	0-5	2-8	2-8

.2 Type 2 Fill (Granular Sub-base): Properties as follows:

.1 Los Angeles degradation: to ASTM C 131. Max % Loss by mass: 40.

.2 Particles smaller than 0.02 mm: to ASTM D 422, Maximum 3%.

.3 Soaked CBR: to ASTM D 1883, Min 40 when compacted to 95% of ASTM D 698.

.3 Type 3 Fill (Select Subgrade Material): well-graded granular material, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials meeting the requirements in the above table.

.1 Recovered rock from the work by blasting, trenching or other approved method may be used if crushed and graded to meet requirements of Type 3.

.4 Type 4 Fill (Granular Base): Properties as follows:

.1 Los Angeles degradation: to ASTM C 131. Max. % loss by weight: 45.

.5 Crushed particles: at least 60% of particles by mass within each of following sieve designation ranges to have at least one freshly fractured face. Material to be divided into ranges using methods of ASTM C 136.

.6 Unshrinkable fill: proportioned and mixed to provide:

.1 Maximum compressive strength of 0.5MPa at 28 days.

.2 Maximum cement content of 25 kg/m; with 40% by volume fly ash replacement

.3 Minimum strength of 0.07 MPa at 24 h.

.4 Concrete aggregates: to CSA A23.1/A23.2.

.5 Cement: Type 10 Portland Cement.

.6 Slump: 160 to 200mm.

Part 3 Execution

3.1 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

.2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.2 PREPARATION/PROTECTION

.1 Protect existing features in accordance with the applicable local regulations.

.2 Keep excavations clean, free of standing water, and loose soil.

.3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to the Departmental Representative's approval.

.4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.

.5 Protect buried services that are required to remain undisturbed.

3.3 SOILS CLASSIFIED AS "WASTE"

.1 All Soils at site are classified as "Waste" unless excavation reveals hazardous waste (HW) soils. Obtain directions from the Departmental Representative for testing and disposal of hazardous waste (HW) soils.

.2 Include the following in the Environmental Protection Plan:

.1 How excavation, handling, and disposal of the soils will be carried. Include location of disposal facility.

.3 Set up environmental and engineering controls as specified and required as per applicable regulations.

.4 Remove top soil, existing fill material if any and excavate the areas.

.5 Handle, load and transport "waste" soils as per the applicable federal, provincial and municipal regulations.

.6 Dispose as follows.

.1 "Waste": Dispose of at a permitted waste facility.

.7 Backfill excavated areas as specified and indicated.

3.4 STRIPPING OF TOPSOIL

.1 Strip topsoil where required.

.2 Strip topsoil to existing fill materials and native soil.

.1 Do not mix topsoil with existing fill or native soil.

.3 Stockpile on site within the Limit of Construction of each stage of work.

.1 Stockpile height not to exceed 2 m and should be protected from erosion.

.4 Dispose of unused topsoil off site.

3.5 STOCKPILING

.1 Stockpile fill materials on site within the Limit of Construction.

.1 Stockpile granular materials in manner to prevent segregation. Maximum stockpile height is 2.5 metres.

.2 Protect fill materials from contamination.

.3 Protect fill materials from wet weather conditions, precipitation, and excessive moisture.

.4 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

3.6 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

.1 Engage services of qualified professional engineer who is registered or licensed in the Province of British Columbia, Canada to design and inspect cofferdams, shoring, bracing and underpinning required for Work.

.2 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance Health and Safety Act for the Province of British Columbia, Canada.

.3 Construct temporary Works to depths, heights and locations as required under the directions of qualified professional engineer responsible for such temporary Works.

.4 During backfill operation:

.1 Unless otherwise indicated or directed by the Departmental Representative, remove sheeting and shoring from excavations.

.2 Do not remove bracing until backfilling has reached respective levels of

such bracing.

.3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500 mm above toe of sheeting.

.5 When sheeting is required to remain in place, cut off tops at elevations as indicated.

.6 Upon completion of substructure construction:

.1 Remove cofferdams, shoring and bracing.

.2 Remove excess materials from site.

3.7 DEWATERING AND HEAVE PREVENTION

.1 Keep excavations free of water while Work is in progress.

.2 Avoid excavation below groundwater table if quick condition or heave is likely to occur.

.3 Protect open excavations against flooding and damage due to surface run-off.

.4 Dispose of water to approved collection areas and in manner not detrimental to public and private property, or portion of Work completed or under construction.

.1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

.5 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas.

3.8 EXCAVATION

.1 Excavate to lines, grades, elevations and dimensions as indicated.

.2 The existing utilities information (type, location, size, elevations) provided on the existing condition drawings included in the contract documents has not been verified. In order to address this issue the following procedure will be followed:

.1 Excavate and expose all utilities within the excavation limits as indicated. Determine the extent of excavation based on site safety requirements, construction methods and schedule.

.2 Prior to carrying out further work in the excavation, jointly with the Departmental Representative inspect the excavation and identify known and unknown exposed utilities. Based upon the results of the inspection, the Departmental Representative will issue appropriate instructions. Comply with instructions and proceed with the work.

.3 For all connections of new utilities to existing utilities, expose the connection points to existing utilities for verification by the Departmental Representative. Based on the results of the verification, the Departmental Representative will issue appropriate instructions. Comply with the instructions.

.3 Excavation must not cause bearing capacity failure and settlement of adjacent

foundations.

.4 For trench excavation, unless otherwise authorized by the Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

.5 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by the Departmental Representative.

.6 Restrict vehicle operations directly adjacent to open excavation and trenches.

.7 Dispose of excavated material off site as per the requirements of applicable regulations as follows:

.1 Soil classified as "Waste": Soil containing concentrations of substances greater than CSR Schedule 7, Column 2 standards or any other standard in the CSR, but not classified as "Hazardous Waste" under the Hazardous Waste Regulation (HWR). Soil must be disposed of at a permitted waste facility.

.8 Do not obstruct flow of surface drainage or natural watercourses.

.9 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.10 Notify the Departmental Representative when bottom of excavation is reached.

.11 Obtain the Departmental Representative's approval of completed excavation.

.12 Remove unsuitable material from bottom including those that extend below required elevations to extent and depth as directed by the Departmental Representative.

.13 Correct unauthorized over-excavation as follows at no additional cost to the contract:

.1 Fill under bearing surfaces excluding building foundations and footings placed on bedrock with Type 1 fill compacted to not less than 100% Standard Proctor maximum dry density.

.2 Fill under other areas with Type 3 fill compacted to not less than 95% of Standard Proctor maximum dry density.

.14 Hand trim, make firm and remove loose material and debris from excavations.

.1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

.2 Clean out rock seams and fill with concrete mortar or grout to approval of the Departmental Representative.

3.9 FILL TYPES AND COMPACTION

.1 For fill types and compactions for utility trenches, utility structures (manholes/pull

boxes) road structures and building and retaining wall foundations, see contract drawings.

3.10 BEDDING AND SURROUND OF UNDERGROUND SERVICES

.1 Place and compact granular material for bedding and surround of underground services as indicated.

.2 Place bedding and surround material in unfrozen condition.

3.11 BACKFILLING

.1 Do not proceed with backfilling operations until completion of following:

- .1 The Departmental Representative has inspected and approved installations.
- .2 The Departmental Representative has inspected and approved of construction below finish grade.
- .3 Inspection, testing, approval, and recording location of underground utilities.
- .4 Removal of concrete formwork.
- .5 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.

.2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.3 Do not use backfill material which is frozen or contains ice, snow or debris.

.4 Place backfill material in uniform layers not exceeding 300 mm loose thickness up to grades indicated. Compact each layer before placing succeeding layer.

.5 Backfilling around installations:

- .1 Place bedding and surround material as specified elsewhere.
- .2 Do not backfill around or over cast-in-place concrete within 48 hours after placing of concrete.
- .3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 500 mm.
- .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
  - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from the Departmental Representative.

.6 Place unshrinkable fill in areas as indicated.

.7 Consolidate and level unshrinkable fill with internal vibrators.

.8 Install drainage filter system in backfill as indicated.

3.12 RESTORATION

.1 Upon completion of Work, remove waste materials and debris, trim slopes, and correct defects as directed by the Departmental Representative.

.2 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation as indicated.

.3 Clean and reinstate areas affected by Work as directed by the Departmental Representative.

.4 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.

.5 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

PART 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Excavation and backfill Division 31

.3 Section 26 05 00 – Common Work - Electrical

.4 Section 26 05 28 – Grounding

.5 Section 26 05 21 – Wire and Cables

.6 Section 26 05 34 – Conduits, Tray, Wireways, Outlet Boxes & Fittings

1.2 SUSTAINABLE REQUIREMENTS

.1 Materials and products in accordance with Division 01 Sustainable Requirements: Construction.

.2 Do verification requirements in accordance with Division 01 Sustainable Requirements: Contractor's Verification.

1.3 REGULATORY REQUIREMENTS

.1 Coordinate and meet requirements of power supply authority. Ensure availability of power when required.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 - Construction/Demolition Waste Management and Disposal and with the Waste Reduction Workplan.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Place materials defined as hazardous or toxic waste in designated containers.

1.5 SCOPE OF WORK

.1 Provide a complete system of underground conduits for the distribution of electric power, communication, electronic safety and security systems from the existing Generator Building electrical room 115, building 104, building 106 and Administration Building Communication Room 103 to the new building.

.2 Provide new pull boxes and identifications as shown on the drawings.

.3 Provide electrical services to miscellaneous equipment as shown on the drawing and described herein.

.4 Provide all utility work as per CEC 22.1-15 and to the approval of the Departmental Representative.

.5 Provide underground conduits, protection and encasements as indicated on drawings.

.6 Conduit for Power and Communications is drawn diagrammatically. Conduit to be routed in an orderly manner and where practical, shall maintain a minimum of 3m clear of existing vegetation as indicated on Landscape drawings.

.7 Underground conduit and duct bank routing location to be clearly documented on the 'Record Drawings' with setback dimensions from key fixed points.

PART 2 Products

2.1 PVC DUCTS

.1 Main power and communication ducting to CSA C22.2 No. 211.1 M1984, Rigid type DB2 PVC conduit. Concrete encased with cable marker above.

.2 Concrete encased ducting where indicated to CSA C22.2 No. 211.1 M1984.

.3 PVC underground telecommunication cable ducting: to CSA B196.3-1975.

.4 Plastic underground power cable ducting: to CSA B196.1-1972.

2.2 PVC DUCT FITTINGS

.1 Rigid PVC solvent welded type couplings, bell end fittings, plugs, caps, adapters as required to provide a complete installation.

.2 Expansion joints as required.

.3 Rigid PVC 5 degree angle couplings as required.

2.3 CABLE PULLING EQUIPMENT

.1 6 mm stranded nylon pull rope tensile strength 5 kN.

2.4 CABLE MARKERS

.1 Yellow PVC, sized to suit full width of trench marked "DANGER - BURIED ELECTRICAL SERVICE", install 300mm below finished grade "above the buried cables" refer to trenching detail on the drawing for more details.

2.5 DUCT SPACERS

.1 Provide approved PVC duct spacers to maintain horizontal and vertical separation.

2.6 PULLBOXES FOR SUB DISTRIBUTION

.1 Provide 1220mmx 1220mm x 1100mm deep concrete sub distribution pull box designed for AASHTO HS20 live load, provide 390 x 310mm knockouts cores with 190mm diameter sump and 4 galvanized steel cable channels on all sides.

.2 Provide double hatched galvanized steel cover with recessed locking hasp.

.3 Bead welded ID and number of the pull box in nominal 150mm high upper scale letters as indicated.

2.7 CONCRETE ENCASEMENTS

.1 Concrete mixture to use screened 13 mm maximum water washed gravel. Concrete shall have 176 kg/cm2 (2500 psi) compressive strength at twenty-eight (28) days. Bends and offsets shall be minimum 900 mm radius. Suitable factory made spacers, of cast concrete or plastic, shall be installed at 1200 mm maximum intervals, to maintain a clear spacing as shown between ducts for the concrete. Stain top of concrete duct by mixing red staining agents into top 25mm of the concrete.

.2 Ducts and spacers shall be securely braced to prevent duct from floating when concrete is placed.

.3 Care shall be taken to ensure that joints are watertight and concrete is vibrated between and under ducts. Water leaks through the duct bank shall be treated and duct bank repaired in a satisfactory manner.

.4 Ducts shall be terminated with bell-end fittings.

.5 Provide drainage openings at lowest point of duct run and tie into site drainage system.

PART 3 Execution

3.1 DUCT INSTALLATION

.1 Install duct as indicated and to manufacturer's instructions.

.2 Clean inside of ducts before laying.

.3 Ensure full, even support every 1.2 m throughout duct length.

.4 Slope ducts to indicated inverts with 1 to 200 minimum slope.

.5 Provide drainage from lowest point of duct run and drain all ducts into the site drainage system.

.6 During construction, cap ends of ducts to prevent entrance of foreign materials.

.7 Pull through each duct a mandrel not less than 300 mm long and of a diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Pull stiff bristle brush through each duct immediately before pulling-in cables.

.8 In each duct install pull rope continuous throughout each duct run with 3 m spare rope at each end.

.9 In no case shall the concrete envelope of duct banks be laid within 150 mm of any water, sewer or gas distribution pipes unless approved by Departmental Representative.

.10 A 300 mm minimum separation of well tamped material, must be maintained between different direct buried services.

.11 Care shall be taken not to alter or remove, without consent of the department representative or authority, any structure crossing or running parallel to the excavation.

.12 Provide concrete reinforcement to any bends or off-sets for underground ductwork systems where direct burial of ducts are permitted.

.13 Provide duct drains for utility ducts as required by the Utility standards.

3.2 EXISTING UNDERGROUND SERVICES

.1 Confirm all existing undergoing services and exact routes onsite before digging, coordinate with the Departmental Representative and other trades for locating all underground conduits before performing any underground work.

.2 Protect all existing services encountered. Before starting the trenching, locate and expose any utility lines crossing the duct route and ensure that these lines are not damaged in the course of trenching operations. Allow for the use of GPR, hand dig, hydro-vacuum as required to locate the underground conduits without causing any damage. The Contractor is responsible for all damage caused by negligence.

.3 Provide temporary bridges for the passage of traffic over any trenches where necessary. Provide temporary crossings at walkways in order to maintain all existing access ways and provide barriers, signs and lights as required.

.4 Provide all sizes and burying depth for all conduits on the as built drawings, measurements shall be referenced from a solid structure (i.e. building) to the location of the buried conduits.

3.3 EXCAVATION AND BACKFILLING

.1 Coordinate all excavation, sand levelling and bedding ready for the electrical installation. Level all trenches for underground conduit and duct lines with a 75mm layer of screened sand.

.2 Conduit not encased in concrete to be bedded in screened sand and covered by a second 150mm layer of compacted screened sand. Provide warning tape above the buried sections of conduit or cable.

.3 Supervise all backfilling of electrical services and underground conduit runs.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDE

.1 A complete ductbank and manhole infrastructure for 15kV primary power. Include excavation, trenching and backfilling to Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Coordinate the installation of ductbank with all existing civil and electrical site utilities and site works.

1.2 RELATED SECTIONS

.1 Section 31 23 33.01 - Excavating, Trenching and Backfilling

1.3 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A82/A82M-05a, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

.2 ASTM A185/A185M-05a, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

.3 ASTM C139-05, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.

.4 ASTM C 478/C478M-06, Standard Specification for Precast Reinforced Concrete Manhole Sections.

.5 ASTM D1056-00, Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

.2 Canadian Standards Association (CSA International)

.1 CAN/CSA-A3000-03(R2005), Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.1 CSA-A3001-03, Cementitious Materials for Use in Concrete.

.2 CSA A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.3 CAN/CSA-G30.18-M92(R2002), Billet-Steel Bars for Concrete Reinforcement.

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Shop Drawings:

.1 Submit shop drawings for precast manholes or pull boxes.

.3 Quality assurance submittals:

.1 Test reports: submit certified test reports for specified materials from approved independent testing laboratories, indicating compliance 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.

.4 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures, etc.

Part 2 Products

2.1 PVC DUCTS

.1 PVC ducts, type DB-2, encased in reinforced concrete.

2.2 PVC DUCT FITTINGS

.1 Rigid PVC opaque solvent welded, translucent pushfit type couplings, bell end fittings, plugs, caps, adaptors as required to complete installation.

.2 Expansion joints.

.3 Rigid PVC 5 degree angle couplings.

2.3 DRAINAGE

.1 Storm sewer connection: cast iron service saddle consisting of oil resistant gasket, stainless steel clamp and oil resistant O ring.

.2 Sump pit: 300 x 300 x 125 mm.

2.4 CABLE PULLING EQUIPMENT

.1 Pulling iron: galvanized steel rods, size and shape as indicated.

.2 Pull rope: 6 mm stranded nylon, tensile strength 5 kN, continuous throughout each duct run with 3 m spare rope at each end.

2.5 MARKERS

.1 Concrete type cable markers: 600 x 600 x 100 mm, with words: "Cable", "Joint", "Conduit" impressed in top surface, with arrows to indicate change in direction of duct runs.

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 GENERAL

.1 Install underground duct banks including formwork, excavation, trenching and backfilling to Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Build duct bank on undisturbed soil or on well compacted granular fill not less than 150 mm thick, compacted to 95% of maximum proctor dry density.

.3 Open trench completely in area of work before ducts are laid and ensure that no obstructions will necessitate change in grade of ducts.

.4 Prior to laying ducts, construct "mud slab" not less than 75 mm thick.

.5 Install ducts at elevations and with slope as indicated and minimum slope of 1 to 400.

.6 Install base spacers at maximum intervals of 1.5 m levelled to grades indicated for bottom layer of ducts.

.7 Lay PVC ducts with configuration and reinforcing as indicated with preformed interlocking, rigid plastic intermediate spacers to maintain spacing between ducts at not less than 75 mm horizontally and vertically.

.1 Stagger joints in adjacent layers at least 150 mm and make joints watertight.

.2 Encase duct bank with 75mm thick concrete cover.

.3 Use galvanized steel conduit for sections extending above finished grade level.

.8 Make transpositions, offsets and changes in direction using 5 degree bend sections, do not exceed a total of 20 degree with duct offset.

.9 Use bell ends at duct terminations in pull boxes, manholes or buildings.

.10 Use conduit to duct adapters when connecting to conduits.

.11 Terminate duct runs with duct coupling set flush with end of concrete envelope when dead ending duct bank for future extension.

.12 Cut, ream and taper end of ducts in field in accordance with manufacturer's recommendations, so that duct ends are fully equal to factory-made ends.

.13 Allow concrete to attain 50% of its specified strength before backfilling.

.14 Use anchors, ties and trench jacks as required to secure ducts and prevent moving during placing of concrete.

.1 Tie ducts to spacers with twine or other non-metallic material.

.2 Remove weights or wood braces before concrete has set and fill voids.

.15 Clean ducts before laying:

.1 Cap ends of ducts during construction and after installation to prevent entrance of foreign materials.

.16 Duct cleaning:

.1 Pull 300 mm long x diameter 6 mm less than internal diameter of duct wooden mandrel through each duct, immediately after placing of concrete.

.2 Then pull stiff bristle brush through duct; avoid disturbing or damaging ducts where concrete has not set completely.

.3 Pull stiff bristle brush through each duct immediately before pulling-in cables.

.17 Install four 3 m lengths of 10M reinforcing rods, one in each corner of duct bank when connecting duct to manholes or buildings.

.1 Wire rods to 10M dowels at manhole or building and support from duct spacers.

.2 Protect existing cables and equipment when breaking into existing manholes.

.3 Place concrete down sides of duct bank filling space under and around ducts.

.4 Rod concrete with flat bar between vertical rows filling voids.

.18 Install pull rope continuous throughout each duct run with 3 m spare rope at each end.

3.3 DUCTBANK

.1 Ductbank shall be encased with 30MPa concrete as shown in drawings.

3.4 MARKERS

.1 Mark location of duct runs under hard surfaced areas not terminating in manhole with railway spike driven flush in edge of pavement, directly over run.

.1 Place concrete duct marker at ends of such duct runs.

.2 Construct markers and install flush with grade.

.2 Mark ducts every 30 m along straight runs and changes in direction.

.3 Where markers are removed to permit installation of additional duct, reinstall existing markers.

.4 Lay concrete markers flat and centered over duct with top 25 mm above earth surface.

.5 Provide drawings showing locations of markers.

3.5 FIELD QUALITY CONTROL

.1 Site Tests/Inspections:

.1 Inspection of duct will be carried out by Engineer prior to backfilling.

.2 Placement of concrete and duct cleanout to be done when Engineer present.

3.6 CLEANING

.1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

CORRECTIONAL SERVICE OF CANADA
TECHNICAL SERVICES BRANCH
ELECTRONICS SYSTEMS
MAINTENANCE HANDOVER REPORT

INSTITUTION: **DATE:**

SYSTEM/EQUIPMENT:

APPLICABLE CONTRACT NO:
PWGSC PROJECT NO:
SPECIFICATIONS:

EQUIPMENT SUPPLIER (NAME AND ADDRESS):

SUPPLIER CONTACT (NAME AND TELEPHONE):

WARRANTY DETAILS:

Expiry date on materials/parts:
Expiry date on installation:
Expiry date on factory labour:

Travel & living expenses during the warranty period:

chargeable to CSC ☐

not chargeable to CSC ☐

Equipment transportation costs are paid by CSC for:

sending to the supplier ☐

returning from the supplier ☐

Negotiated rates for emergency repairs at site due to misuse/abuse during warranty period are as follows:

Not applicable.

Negotiated rates for labour at site after warranty period are as follows:

Not applicable.

DEFICIENCIES:

None remain ☐

List attached ☐

DOCUMENTATION:

Maintenance manual:

Supplied ☐

Due by ;

As-built drawings, cabling and wiring diagrams:

Supplied ☐

Due by ;

Acceptance test results:

Supplied ☐
Due by ;

DISTRIBUTION OF DOCUMENTATION:

1 copy to CESM sent on:
1 copy to RATIS/RTEO sent on:
2 copies to institution sent on:

SPARES:

All delivered ☐
Delivery to be completed by ;

EQUIPMENT LIST:

See attached list. ☐

MAINTENANCE TRAINING:

Completed ☐
Scheduled for ;

SIGNATURE: Project Manager

DISTRIBUTION: CESM, NHQ
RATIS/RTEO, RHQ

Appendix I

Geotechnical Investigation Report:
Proposed Maintenance Building, William Head Institution, Metchosin, BC

Prepared By: **Golder Associates**
Date: **September 10, 2015**
File: **1314470497-010-R-Rev0-5000**

Technical Memorandum
Review of Geotechnical Input for 2015 National Building Code
William Head Institution, Maintenance Building, Metchosin, BC

Prepared By: **Golder Associates**
Date: **April 17, 2018**
File: **1790027-001-TM-Rev0**

REPORT

September 10, 2015

GEOTECHNICAL INVESTIGATION REPORT

Proposed Maintenance Building, William Head Institution, Metchosin, BC

Submitted to:
Public Works and Government Services Canada
641-Burrard Street
Vancouver, BC
V6Z 2V8

Attention: Ms Dianne Dy, AIBC.

Report Number: 1314470497-010-R-Rev0-5000

Distribution:

2 Copies - PWGSC

2 Copies - Golder Associates Ltd.

Golder Associates

Table of Contents

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

This report provides the results of a geotechnical subsurface investigation carried out by Golder Associates Ltd. (Golder) at the site of the proposed new Maintenance Building at the William Head Institution. This site is a revised location; a previously proposed site was located about 150 m to the west of the current site. The investigation was carried out for Public Works and Government Services Canada (PWGSC) according to the scope of services outlined in Call Up No. EZ899-160964/001/TPV and the Terms and Conditions of Standing Offer Agreement No. EZ899-141238/001/TPV for geotechnical services. This report should be read in conjunction with "*Important Information and Limitations of This Report*", which is included in Appendix A, following the text. The reader's attention is specifically drawn to this information for the proper use and interpretation of this report.

2.0 BACKGROUND

2.1 Site Conditions

The Site under consideration is located within the William Head Institution (WHI) facility, located in Metchosin, BC on William Head peninsula at the end of William Head Road (Figure 1). The site is located south of the main entrance in an area that Golder understands was previously used as a sawmill site. The site slopes gently southwest towards the ocean.

2.2 Proposed Development

Based on drawings provided by PWGSC, Golder understands the proposed maintenance building comprises a two storey structure with a plan area of approximately 600 m². The proposed building location provided to Golder is shown on Figure 1; the drawings provided by PWGSC are included in Appendix B.

2.3 Local Geological Conditions

Available published bedrock geological mapping[1] indicates that the bedrock geology in the investigation area is composed of Metchosin Volcanics, a series of pillow basalts, tuff and breccias. The rock is hard and resistant to weathering. Surficial geological mapping[2] indicates the area consists of a veneer (less than 1 m in thickness) of colluvium and till overlying bedrock.

[1] Muller, J.E., 1983, Geology Victoria, Geological Survey of Canada, Map 1553A.

[2] Blythe, H.E. and Rutter, N.W., 1993, Surficial Geology of the Sooke Area, BC Geological Survey Branch, Open File 1993-25

3.0 GEOTECHNICAL INVESTIGATION

Two subsurface field investigations were carried out. The first investigation was carried out on April 30 and May 1 2015. This investigation was conducted primarily to obtain samples for a geo-environmental investigation being carried out by SLR Consultants. A Golder technician was on site to observe and record the geotechnical conditions and prepare geotechnical field logs. Fourteen test pits ranging in depth from 1.5 m to 2.5 m were excavated using a CX 508 excavator. Records of Test Pits (TP15-01 to TP15-14) are provided in Appendix C.

The second geotechnical subsurface investigation of the site was carried out on August 10, 2015. Eight test pits, ranging in depth from 2.6 m to 5.5 m, were excavated using a John Deere 135C, supplied and operated by Hermsen Construction, Victoria BC. This test pit investigation was conducted under the full time inspection of a member of Golder's geotechnical staff, who located the pits in the field, visually examined and logged the subsurface conditions encountered and collected soil samples for visual examination and laboratory testing. The test pit investigation was conducted to assess the existing soil conditions and obtain disturbed soil samples. The locations of the test pits are shown on Figure 1. Records of Test Pits of the second investigation (TP15-16 to TP15-23) are also provided in Appendix C. Test pit TP15-15 was not excavated because of access issues.

During the investigation, no outcrops of bedrock were identified in the immediate area of the proposed building.

4.0 LABORATORY ANALYSES

Samples from the test pits were submitted to Golder's Materials Testing Laboratory in Victoria for geotechnical index testing. Based on the soil conditions encountered during the field investigation the following testing was carried out:

13 - Water contents (ASTM D4959);

2 - Atterberg Limits (ASTM D4318-10); and

2 - Grain Size Analyses (ASTM D422-63).

The results of water content and Atterberg limits testing are presented on the Record of Test Pits in Appendix C. Detailed results of laboratory testing are provided in Appendix D.

5.0 SUBSURFACE CONDITIONS

Detailed descriptions of the subsurface soil and groundwater conditions encountered at the test pit locations, soil water contents, Atterberg Limits and particle size distributions determined from the laboratory testing are provided on the Records of Test Pits provided in Appendix C. Note there is not a record of test pit TP15-15 as it was not excavated. Depths within test pits are referenced from the existing ground surface. Variations in subsurface geotechnical conditions should be expected throughout the area. Accordingly, caution should be exercised when extrapolating soil stratigraphy or other geotechnical aspects between or beyond test pit locations

For discussion purposes, the subsurface conditions at the site have been generalized into the following soil units:

- Topsoil/ fill;
- Sandy Silt, Silty Sand and sandy Silty Clay; and
- Silty Clay.

A detailed discussion of the geotechnical field observations and laboratory testing results is provided in the following sections.

Topsoil/Fill

A unit of loose topsoil/fill, ranging from 0 to 0.5 m thick, was encountered at surface in all test pits except for TP15-17. The material was observed to consist of sand and gravel, silty sand with organics, or sandy organic silt. The unit was described as dark brown to brown, dry, and compact to loose in consistency.

Sandy Clayey Silt

Native sandy clayey silt was encountered underlying the topsoil/fill. The approximate thickness of the silt ranged from 0.4 to 1.4 m. The material composition varied from sandy clayey silt to silty sand and contained some gravel. Cobbles, comprising less than five percent of the material were observed to be present. The material was described as non-cohesive to cohesive with a water content below the plastic limit. The colour of the silt was brown to grey-brown.

The table below provides a summary of the results of natural water contents measured in five samples of the silt.

Test Pit and Sample Number	Sample Depth (m bgs)	Natural Water Content (%)
TP15-18 Sa1	0.5 to 0.6	17.2
TP15-19 Sa1	0.5 to 0.6	16.0
TP15-20 Sa1	0.6 to 0.7	14.0
TP15-21 Sa1	0.7 to 0.8	10.0
TP15-22 Sa1	1.1 to 1.3	4.7

The table below provides a summary of the results of the grain size analyses of two samples of the material.

Test Pit and Sample Number	Sample Depth (m bgs)	Percent Gravel by Weight	Percent Sand by Weight	Percent Fines by Weight
TP15-016 Sa-1	1.2 to 1.3	5	56	39
TP15-23 Sa-1	0.6 to 0.7	18	67	15

Atterberg limit testing was conducted on one sample of this material. The measured plastic limit and liquid limit within a sample of the material were 17.0 and 19.0 percent, respectively. The calculated plasticity index and liquidity index were 4.0 and -0.3 respectively.

Silty Clay

Native silty clay was encountered underlying the sandy clayey silt, to the maximum depth of excavation in most test pits. Most of the test pits terminated within this unit between about 1.5 and 5.5 m below ground surface (m bgs). The other six test pits (TP15-07, TP15-16, TP15-17, TP15-18, TP15-19, TP15-21 and TP15-22), terminated at refusal (inferred bedrock). In these test pits, the silty clay was encountered in a thickness ranging from 0.8 to 4.4 m. The silty clay was observed to be brown, and contained some sand, and traces of gravel. The material was described as cohesive, stiff to hard, with a water content above the plastic limit.

Below the silty clay in TP15-18, a thin layer (0.3 m thick) of compact wet silty sand was encountered above the inferred bedrock.

The table below provides a summary of the results of natural water contents measured in eight samples of the silty clay material.

Test Pit and Sample Number	Sample Depth (m bgs)	Natural Water Content (%)
TP15-16 Sa2	2.8 to 3.0	20.8
TP15-17 Sa2	1.2 to 1.3	17.4
TP15-17 Sa3	2.2 to 2.3	20.5
TP15-18 Sa2	1.1 to 1.2	15.2
TP15-18 Sa3	4.3 to 4.4	22.5
TP15-19 Sa2	1.1 to 1.2	16.7
TP15-20 Sa2	1.1 to 1.2	19.1
TP15-21 Sa2	1.2 to 1.3	16.5

Atterberg limit testing was conducted on one sample of this material. The measured plastic limit and liquid limit within a sample of the material was 21 and 41 percent respectively. The calculated plasticity index and liquidity index were 20 and -0.3 respectively.

Bedrock

Excavation refusal in test pits TP15-16, TP15-17, TP15-18, TP15-19, TP15-21 and TP15-22 was inferred to be reached at the approximate top of the buried bedrock surface. The nearest apparent bedrock outcrops are located approximately 60 m south of the proposed building and approximately 100 to the east.

Based on the refusal impact from a John Deere 135C excavator bucket, the strength of bedrock is estimated as R5 – Very Strong, with an assumed range of Unconfined Compressive Strength 100 MPa to 250 MPa.

5.1 Groundwater

Except for a wet layer of silty sand encountered in the bottom of TP15-18 between 5 and 5.3 m bgs, groundwater seepage was not observed in the test pits advanced during the 2015 investigations. However, based on Golder's experience in similar ground conditions in the greater Victoria area, it is inferred that groundwater levels on the site could rise to near the top of the native silty clay, especially after periods of sustained wet weather (i.e., winter months), given the poor drainage properties of these soils.

6.0 GEOTECHNICAL COMMENTS AND RECOMMENDATIONS

6.1 General

This section of the report addresses the geotechnical design aspects of the project based on our interpretation of the geotechnical investigation results and project requirements. It is stressed that the information in this portion of the report is provided for the guidance of the designers and is intended for this project only. Contractors bidding on or undertaking the works should examine the factual information, satisfy themselves as to the adequacy of the information for construction and make their own interpretation of the factual data as it affects their proposed construction techniques, schedule, safety and equipment capabilities.

6.2 Site Suitability

Based on our interpretation of the results of the site investigation, the geotechnical conditions are considered generally favourable for supporting the proposed development, subject to the site preparation and geotechnical design recommendations described below.

In summary, the key geotechnical issue identified at the site is the variation in ground conditions. The site comprises variable geologic conditions ranging from thin fill overlying a layer of native silty sand or sandy silty clay which in turn overlie silty clay. Bedrock is generally greater than 3 m below the existing ground surface. The silty clay layer ranges from stiff to hard in consistency.

Assuming that footings for the main building will be located in areas underlain by native silty clay, it is recommended the footings be placed over a minimum thickness of 500 mm of granular base course conforming to the recommendations for structural fill provided above. The following serviceability limit state (SLS) and ultimate limit state (ULS) bearing resistances can be used for design.

6.3 Site Preparation Recommendations

6.3.1 Stripping

Site preparation should include removal of surficial topsoil, organic materials, fill and other geotechnically unsuitable materials from within the proposed development area. Stripping should extend beyond the perimeter of all buildings a horizontal distance at least equal to the depth of excavation below footings for foundations. Based on the results of the field investigation, sub-excavation depths are anticipated to range from approximately 0.5 m to 2.0 m bgs. Local areas not investigated at the site may be underlain by thicker deposits of unsuitable materials.

It is recommended that the exposed subgrade be inspected by experienced geotechnical personnel prior to placement of structural fill and/or footing form construction. In areas where exposed subgrade comprises natural deposits, caution will be required to avoid disturbance and softening of those undisturbed natural deposits when exposed to wet weather, construction traffic, proof rolling and fill placement operation. Where soft or disturbed soils are encountered following stripping, these materials should be sub-excavated and replaced with well-compacted granular structural fill, subject to the review and approval of a geotechnical engineer.

Site preparation and foundation construction should be carried out during dry weather conditions, where possible, to avoid shallow groundwater conditions that could develop in areas of fine grained soils or where groundwater could mound during the wet season.

6.3.2 Structural Fill

Structural fill should generally consist of well-graded granular material having less than 8 percent of material (by mass) passing the 0.075 mm sieve size. Structural fill should be placed in horizontal lifts not exceeding 300 mm in loose thickness. Each lift should be uniformly compacted to at least 95 percent of the modified Proctor maximum dry density (MPMDD). Moisture conditioning, such as wetting or drying, may be required to achieve the specified compaction. Field density testing and visual review of structural fill placement by the geotechnical engineer are recommended. Structural fill material placed against existing slopes (either cut or fill slopes) should be keyed into the slope in a series of steps about 0.3 m high and 0.5 m wide to reduce the risk of a weak zone developing at the interface between the existing slope and the placed structural fill.

Where required for foundations and pavement structures, granular base course should comprise well-graded, 25 mm minus crushed gravel meeting the specifications for Granular Base in Section 31 05 17 of the Master Municipal Construction Documents (MMCD) Specifications.

Broken rock may be used as structural fill upon review by a geotechnical engineer. The broken rock fill must be well graded. Broken rock fill must be placed in layers equal in thickness to the size of the largest rock particles but no greater than 300 mm. The top 300 mm of rock fill should be composed of rock particles no greater than 75 mm. Compaction of rock fill should be confirmed by proof rolling of the rock fill surface with a fully loaded water truck or other vehicle with similar wheel load.

6.3.3 Site Drainage

It is anticipated that localized zones of seepage or seasonal, shallow groundwater may be present in soils throughout the site. During construction, provision should be made to intercept and direct groundwater or surface runoff away from work areas. Depending upon the magnitude and extent of near surface groundwater, it may be desirable or necessary to incorporate interceptor ditches and drainage systems as part of the permanent drainage control measures.

Temporary and permanent cut slopes and structural fill should be shaped and graded to direct water away from exposed subgrades, buildings, infrastructure and other areas that are sensitive to softening upon wetting or damage by flooding. If temporary excavation is carried out, or if cut and fill slopes will remain exposed during wet weather, the exposed slopes should be protected from precipitation with polyethylene sheeting, suitably secured over their entire surface to prevent ravelling and scouring or wind damage. Permanent slopes should be protected with surface coverage of concrete, asphalt, rip rap or vegetation, as appropriate.

The final design should include appropriate, permanent perimeter drains to collect groundwater and convey it away from foundations and the underside of floor slabs. A direct hydraulic connection should be provided between the granular base layer under floor slabs and perimeter drainage systems to allow drainage of groundwater from beneath slabs.

6.4 Pavement Recommendations

Golder understands that the site will have parking and access roads surrounding the building. In the absence of specific information on the road and parking locations and traffic volumes/loads the following is recommended:

Asphalt Pavement: 50 mm thickness.

Granular Base Course: 225 mm thickness of 25 mm minus crushed gravel, meeting the gradation specifications for Granular Base in Section 31 05 17 of the MMCD.

Select Granular Sub-base (SGSB): 150 mm thickness over rock or rock fill, 300 mm thickness over clay or other materials. SGSB should meet the specification for Select Granular Sub-Base or Crushed Granular Sub-base in Section 31 05 17 of the MMCD.

Positive drainage is vital to the long-term performance of the roadway pavement. We recommend that the pavement be crowned and graded to provide adequate cross-fall sloping toward the outflow elements.

6.5 Drainage

Appropriate permanent perimeter drains should be installed to collect groundwater and convey it away from foundations and the underside of floor slabs. A direct hydraulic connection should be provided between the granular base layer, under floor slabs, and perimeter drainage systems to allow drainage of groundwater from beneath floor slabs. Providing a hydraulic connection between the granular base layer, under-floor slabs, and perimeter drainage systems requires that the systems not be completely isolated from one another.

6.6 Shallow Foundations

6.6.1 General

Based on the building site location provided and the results of the geotechnical investigation by Golder it is anticipated that the building foundation will be constructed primarily over silty clay overlying bedrock. A minimum 500 mm thick granular base course should be placed below all shallow foundations for drainage and to distribute loads evenly directly below the foundation. Beneath floor slabs, a minimum of 150 mm thick granular base course is recommended. The base course should conform to the recommendations for structural fill provided above.

The structural designer(s) should determine final concrete slab thickness, construction joint spacing, and structural reinforcing required for temperature, strength, and load requirements.

Based on climate data for the Victoria Airport[3], a design freezing index of 162 degree-days below zero degrees Celsius is assumed for the Metchosin area. This results in an estimated frost penetration depth of approximately 500 mm. We recommend that all exterior footings or footings in unheated areas be provided a minimum of 500 mm soil cover.

6.6.2 Strip and Pad Footings

Assuming that footings for the main building will be located in areas underlain by native silty clay, it is recommended the footings be placed over a minimum thickness of 500 mm of granular base course conforming to the recommendations for structural fill provided above. The following serviceability limit state (SLS) and ultimate limit state (ULS) bearing resistances can be used for design.

Table 1: Recommended Bearing Resistances

Foundation Condition	Bearing Resistance (kPa)	
	Serviceability Limit State (SLS)	Ultimate Limit State (ULS)*
Structural Fill over Stiff Clay	150	225

*Based on ultimate bearing resistance with a resistance modification factor of 0.5.

Provided that the structural fill or native subgrade materials are not loosened or disturbed, it is anticipated that foundations designed for these bearing pressures site will be subject to total settlements of less than 25 mm and differential settlements of less than 1 mm vertical per 1 m horizontal. The minimum footing width should be in accordance with National Building Code requirements. If footing widths exceed 1.5 m, the expected settlements should be checked.

[3] http://climate.weather.gc.ca/

6.6.3 Resistance to Sliding, Uplift and Overturning Loads

Resistance to horizontal forces can be provided by friction between the soil or rock and the concrete foundation. An ultimate friction factor of 0.5 can be used to determine the resistance to sliding for concrete foundations cast on structural fill (granular base course)[4]. The recommended interface friction angle between cast-in-place concrete and the recommended structural fill is 26 degrees. It is assumed that footings will be backfilled with suitably compacted granular fill as indicated above.

The ultimate uplift capacity of a spread footing is limited to the weight of the foundation plus the weight of any fill directly above the foundation. Golder recommends using an average unit weight of 21 kN/m^3 for structural fill and 24 kN/m^3 for concrete.

The bearing capacity for eccentric loads, i.e., vertical loads (P) combined with moment (M) may be obtained considering the effective width of the footing (B'), which is equal to the width of the footing (B) minus two times the eccentricity (e), i.e., B'=B-2e, where e=M/P. The eccentric load should be kept within the central third of the footing in accordance with Canadian Foundation Engineering Manual[5] recommendations, which implies that e is equal to or less than B/6. The recommended design parameters provided are applicable to general design of conventional footings bearing on compact to very dense or very stiff to hard native soils or non-frost susceptible structural fill. Bearing resistance and settlement performance of a footing is also a function of footing geometry, embedment depth, and load combinations. As such, different bearing pressures under both an ultimate limit state and a serviceability limit state may be possible. Golder should be provided with the opportunity to review the final foundation configurations and may provide revised parameters for specific footing configurations if deemed necessary.

6.7 Seismic Design Recommendations

Current seismic design loads, based on the 2010 National Building Code of Canada (NBCC), are based on ground motions corresponding to a design seismic event with a two percent probability of exceedance in 50 years (an average return period of 2,475 years). For a given site class, the effects of shaking level and period are incorporated via the acceleration (Fa) and velocity (Fv) based site coefficients defined in Tables 4.1.8.4B and C, respectively, of the 2010 NBCC.

The effects of local site conditions are assessed based on the characteristics of the soil and/or bedrock under a proposed structure. It is anticipated that the proposed structure will be founded partly on rock and partly on fill or shallow native soil. Based on the anticipated properties of the compacted fill, the area of the proposed structure is classified as a Site Class C (very dense soil and soft rock) based on the classification criteria listed in Table 4.1.8.4.A, in Section 4.1.8.4 of the 2010 NBCC.

The earthquake provisions of the National Building Code and the BC Building Code are intended to reduce the risk of collapse of a structure due to an earthquake, but are not intended to ensure that no damage to the structure will occur.

[4] Naval Facilities Engineering Command, "Foundations and Earth Structures, Design Manual 7.02, Chapter 3, Table 1", September 1986.

[5] Canadian Geotechnical Society, "Canadian Foundation Engineering Manual, 4th Edition" 2006

6.7.1 Site-Specific Seismic Parameters for Foundation Design

A site-specific seismic hazard calculation was obtained from the Natural Resources Canada (NRC) for firm ground conditions in accordance with 2010 seismic hazard maps of Canada, and based on location of the site relative to inferred seismic sources and attenuation relationships[6]. The resulting peak horizontal; ground acceleration (PGA) and the five percent damped spectral response acceleration (Sa) values at periods (T) of 0.2, 0.5, 1.0, and 2.0 seconds corresponding to the 2,475-year design earthquake are provided in Appendix E. These accelerations are applicable to Site Class C (very dense soil and soft rock) sites according to the 2010 NBCC and are used to linearly interpolate values for other site classes based on Tables 4.1.8.4B and C of the 2010 NBCC. Based on a site classification as Site Class C, and the seismic hazard calculation, the acceleration (F_a) and velocity (F_v) based site coefficients obtained from Tables 4.1.8.4B and C for are provided in Table below:

Table 2: Values and Fa and Fv

Proposed Structure / Site Area	Site Class	Interpolated Fa Value	Interpolated Fv Value
Administrative Building Structure	C	1.0	1.0

7.0 GEOTECHNICAL INSPECTION AND TESTING

The Geotechnical Engineer of Record should be given the opportunity to review the final plans and specifications to confirm that the geotechnical engineering recommendations provided herein are appropriately incorporated. Provisions should also be made for experienced geotechnical personnel to inspect and approve the exposed subgrade surfaces for foundation construction and/or structural fill placement. Further, we recommend conducting in situ field density testing of the structural fills to confirm that satisfactory compaction is being achieved.

8.0 CLOSURE

We trust that the information contained in this report meets your current requirements. Please contact us if you require any further information.

GOLDER ASSOCIATES LTD.

Don Lister, M.Sc., P.Eng.
Senior Geotechnical Engineer

Reviewed by:

Jeff Fillipone, Ph.D., P.Geo.
Principal, Senior Geologist

DRL/JF/nnv

n:\final\2013\1447\13-1447-0497 pwgsc wood creek quarry\1314470497-010-r-rev0-5000\1314470497-010-r-rev0 geotech investigation 10sep_15.docx

[6] http://www.earthquakescanada.nrcan.gc.ca/hazard-alea/interpolat/index_2010-eng.php, July 2013.

LEGEND

TEST PIT

REFERENCE

BASE MAP PROVIDED BY DGBK ARCHITECTS, DATED APRIL 22, 2015.
FILE NAME: WILLIAM_HEAD_INSTITUTION_TOPO_MAIN_GATE_rev1.dwg.
ORIGINAL SCALE: 1:300m

0 10 20
1:500 METRES

CLIENT
PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

PROJECT
WILLIAM HEAD CORRECTIONAL FACILITY
GEOTECHNICAL SOA

CONSULTANT
Golder Associates

YYYY-MM-DD	2015-08-26
DESIGNED	D. LISTER
PREPARED	R. WIGGINS
REVIEWED	D. LISTER
APPROVED	J. FILLIPONE

TITLE
TEST PIT LOCATION PLAN

PROJECT NO.	PHASE	REV.	FIGURE
13-1447-0497	5000	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

25 mm

0

Path: \\golder.gds\gal\Victoria\Active\2013\1447\13-1447-0497 Phase 1000 PWGSC William Head\09 CAD\Phase 5000\ | File Name: 1314470497-5000-01.dwg

APPENDIX A

Report Limitations

APPENDIX A
IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practicing under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder can not be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Groundwater Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. **The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report.** The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.

APPENDIX B

Reference Drawing

CORRECTIONAL SERVICE CANADA, WILLIAM HEAD INSTITUTION,

MAINTENANCE BUILDING (BUILDING 107)

6000 WILLIAM HEAD ROAD, METCHOSIN, B.C.

ARCHITECTURAL DRAWING LIST

SHEET NO.	SHEET NAME	Sheet Issue Date
A000	COVER PAGE - CEDAR WOOD DESIGN PACKAGE	05/15/2015
A011	FRONT ELEVATION (CEDAR WOOD DESIGN INTENT)	05/15/2015
A012	FLOOR PLANS - Cedar Wood Cutting	05/15/2015
A101	LOCATION PLAN & OVERALL SITE PLAN	05/15/2015
A201	BASE BULIDING - MAIN FLOOR PLAN (Level 1)	05/15/2015
A202	BASE BUILDING - UPPER FLOOR PLAN (Level 2)	05/15/2015
A203	BASE BUILDING - ROOF PLANS	05/15/2015
A211	RM 107 VEHICLE MAINTENANCE GARAGE - EQUIPMENT INFORMATION	05/15/2015
A212	RM 107, 111, 112 VEHICLE MAINTENANCE GARAGE & STORAGE - EQUIPMENT INFORMATION	05/15/2015
A213	RM 114 METAL & WELDING SHOP - EQUIPMENT INFORMATION	05/15/2015
A214	RM 115 CARPENTRY SHOP - EQUIPMENT INFORMATION	05/15/2015
A215	RM 111 GENERAL WORKSHOP - EQUIPMENT INFORMATION	05/15/2015
A221	EQUIPMENT & FURNITURE PLAN - MAIN FLOOR PLAN	05/15/2015
A222	EQUIPMENT & FURNITURE PLAN - UPPER FLOOR PLAN	05/15/2015
A401	FRONT & BACK ELEVATIONS	05/15/2015
A402	SIDE ELEVATIONS	05/15/2015
A501	SECTIONS	05/15/2015
A502	SECTIONS	05/15/2015
A503	SECTIONS	05/15/2015

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Région du Pacifique

CEDAR WOOD DESIGN PACKAGE
(May 15, 2015)

4	95% SUBMISSION	
3	33% SUBMISSION	
2	PRELIMINARY PACKAGE - EQUIPMENT & FURNITURE LAYOUT	
1	SCHEMATIC DESIGN & SITE OPTIONS	

CORRECTIONAL SERVICE CANADA

6000 William Head Road, Metchosin, BC

WILLIAM HEAD INSTITUTION MAINTENANCE BUILDING (BUILDING 107)

Designed by/Concept par: Author

Drawn by/Dessiné par: Checker

PWGSC Project Manager/Administrateur de Projets TPSGC: DARYL SINCLAIR

PRIESTMAN, PAUL

Drawing title/Titre du dessin:

COVER PAGE - CEDAR WOOD DESIGN PACKAGE

Project No./No. du projet	Sheet/Feuille	Revision no./ No. de révision
R.069377.001	A000	

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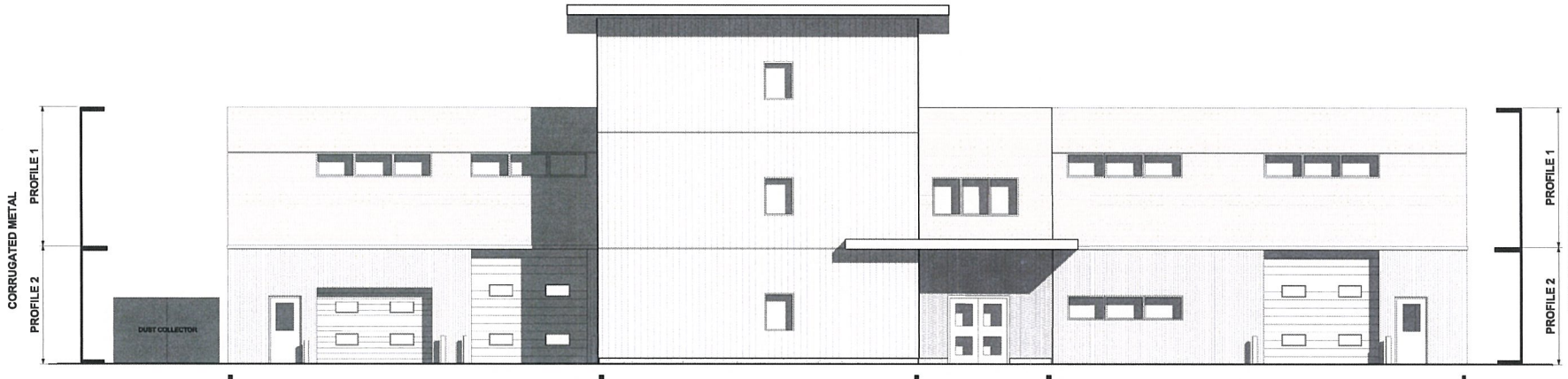
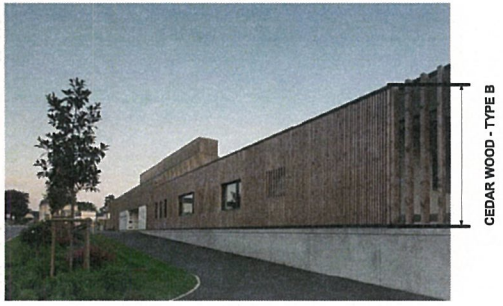


1 A011 FRONT ELEVATION
1 : 50

DESIGN INTENT: NEW MAIN ENTRANCE

- ENTRANCE WITH CEDAR (CLEAR STAINED)
- ADJACENT STAIR & ELEVATOR TOWER WITH CEDAR (COLOR STAINED)



EXTERIOR ELEVATION MATERIALS

CEDAR	CORRUGATED METAL
TYPE A: - ROUGH SAWN CEDAR - BOARD AND BATTEN (8" WIDTH PATTERN) - KILN DRIED - COLOR STAINED	PROFILE 1 PROFILE 2
TYPE B: - CEDAR SLAT 1 x 3 - KILN DRIED - CLEAR STAINED	

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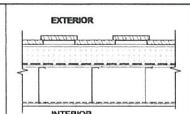
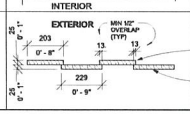
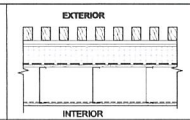
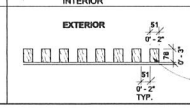
CORRECTIONAL SERVICE CANADA
WILLIAM HEAD INSTITUTION MAINTENANCE BUILDING (BUILDING 107)
6000 William Head Road, Metchosin, BC

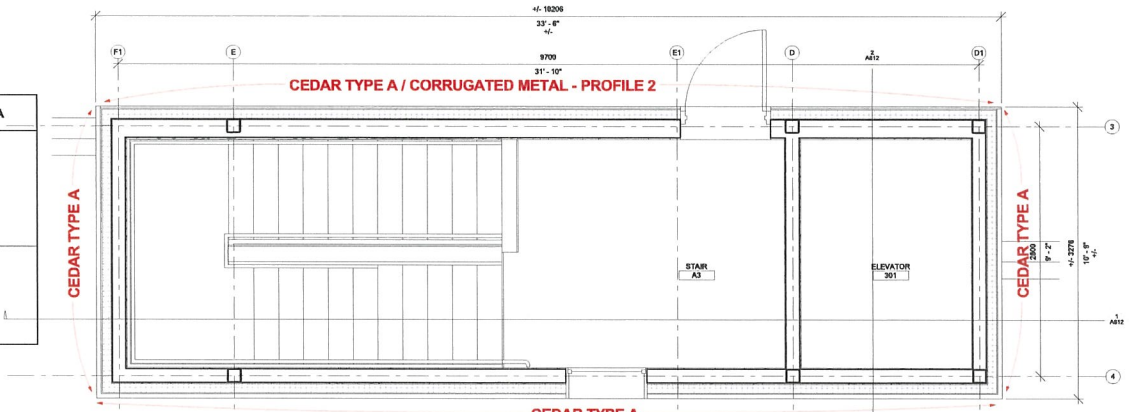
FRONT ELEVATION (CEDAR WOOD DESIGN INTENT)

Sheet/ Feuille A011
Project No./No. du projet R.069377.001
Date 09/15/2015

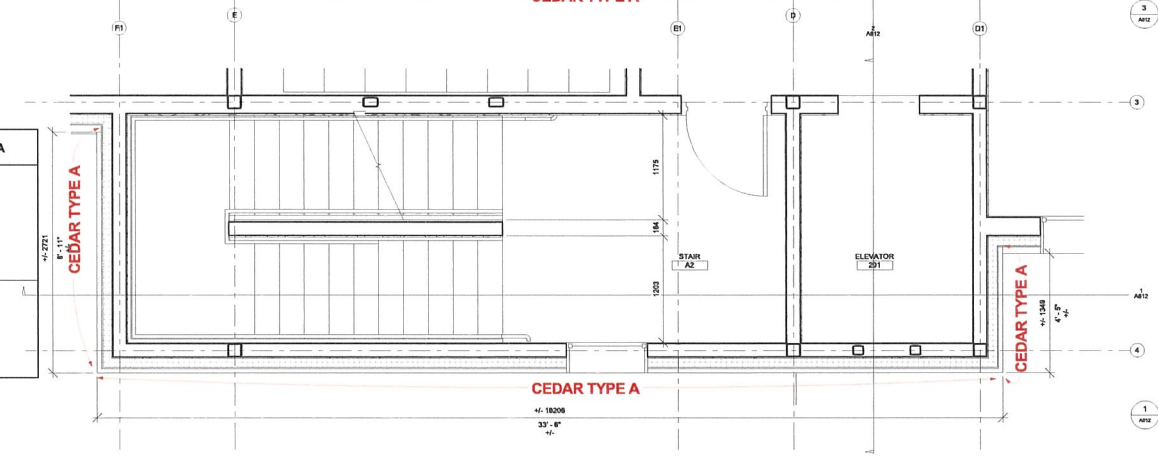
EDAR WOOD EXTERIOR WALL			TOTAL WOOD AREA
'PE A		25mm CEDAR ROUGH SAWN BOARD AND BATTEN (8" PATTERN) 114mm HORIZONAL Z BAR @ 300mm O.C. w WEEP HOLES 102mm RIGID INSULATION PEEL & STICK 13mm EXTERIOR SHEATHING 203mm STEEL STUDS @ 300mm O.C. W/ 6mil POLY VAPOUR BARRIER 16mm GYPSUM WALLBOARD	210 sm + (20%) 45 sm = 255 sm
EDAR JTTING FO		203mm (8") WIDTH X 25mm (1") THK ROUGH SAWN CEDAR BOARD 229mm (9") WIDTH X 25mm (1") THK ROUGH SAWN CEDAR BOARD	50% 8" BOARD 50% 9" BOARD

EDAR WOOD EXTERIOR WALL			TOTAL WOOD AREA
'PE B		51mm (2") X 76mm (3") CEDAR ROUGH SAWN SLAT HARDIE PANEL (PAINTED BLACK) 114mm HORIZONAL Z BAR @ 300mm O.C. w WEEP HOLES 102mm RIGID INSULATION PEEL & STICK 13mm EXTERIOR SHEATHING 203mm STEEL STUDS @ 300mm O.C. W/ 6mil POLY VAPOUR BARRIER 16mm GYPSUM WALLBOARD	22 sm / 2 = 10 sm + (20% EXTRA) 2 sm = 12 sm
EDAR JTTING FO		51mm (2") WIDTH X 76mm (3") THICK ROUGH SAWN CEDAR SLAT	

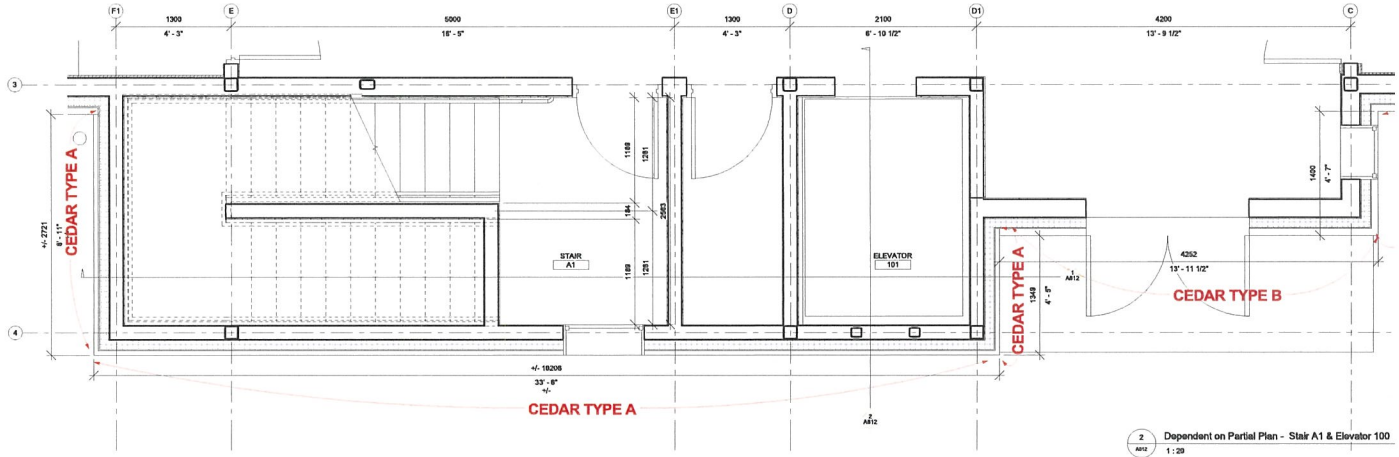
'PE B: 2" X 3" ROUGH SAWN CEDAR TO BE USED
STEAD OF 1x3 FOR BETTER DURABILITY.



3 A012 Dependent on Partial Plan - Stair A3
1 : 29



1 A012 Dependent on Partial Plan - Stair A2 & Elevator 200
1 : 29



2 A012 Dependent on Partial Plan - Stair A1 & Elevator 100
1 : 29

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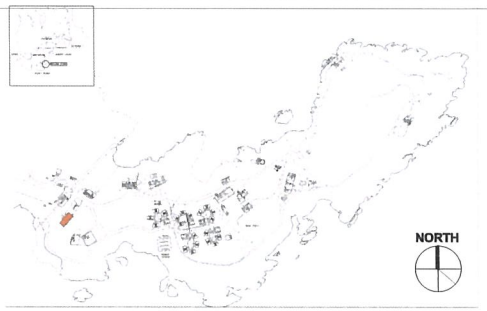
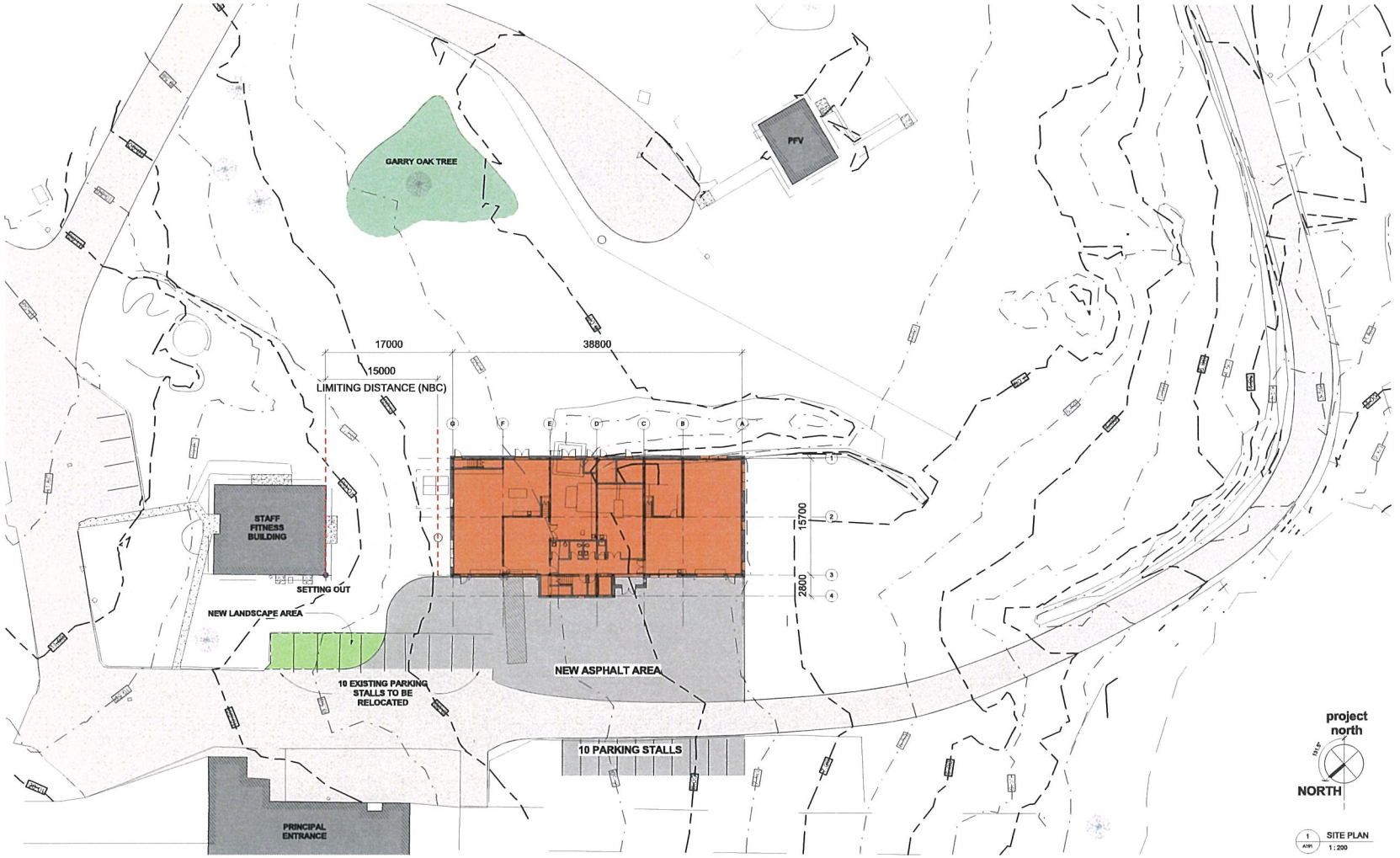
CORRECTIONAL SERVICE CANADA
WILLIAM HEAD INSTITUTION MAINTENANCE BUILDING (BUILDING 107)
6000 William Head Road, Metchosin, BC

FLOOR PLANS - Cedar Wood Cutting

Sheet/ Feuille A012
Project No./No. du projet R.069377.001
Date 09/15/2015



2 A101 PROJECT LOCATION PLAN
1 : 5000



1 A101 SITE PLAN
1 : 200

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

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Pacific Region
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Région du Pacifique

CEDAR WOOD DESIGN PACKAGE (May 15, 2015)

No.	Description/Description	Date/Date
4	90% SUBMISSION	Nov 28, 2014
3	33% SUBMISSION	Oct 3, 2014
2	PRELIMINARY PACKAGE - EQUIPMENT & FURNITURE LAYOUT	Sept 8, 2014
1	SCHEMATIC DESIGN & SITE OPTIONS	Aug 18, 2014

Client/Client

CORRECTIONAL SERVICE CANADA

Project Site/Titre du projet

6000 William Head Road, Metchosin, BC

WILLIAM HEAD INSTITUTION MAINTENANCE BUILDING (BUILDING 107)

Consultant Approval Box Only

Designed by/Concept par
DD

Drawn by/Dessiné par
DD

PWGSC Project Manager/Administrateur de Projets TPSGC
DARYL SINCLAIR

PWGSC, Engineer, Manager, Architectural and Engineering Services / TPSGC, Ingénieur, Services d'architecture et de génie, TPSGC
PREETPAUL PAUL

Drawing title/Titre du dessin

LOCATION PLAN & OVERALL SITE PLAN

Project No./No. du projet	Sheet/Feuille	Revision no./ No. de révision
R.069377.001	A101	

PWGSC – A3 – 11X17A1

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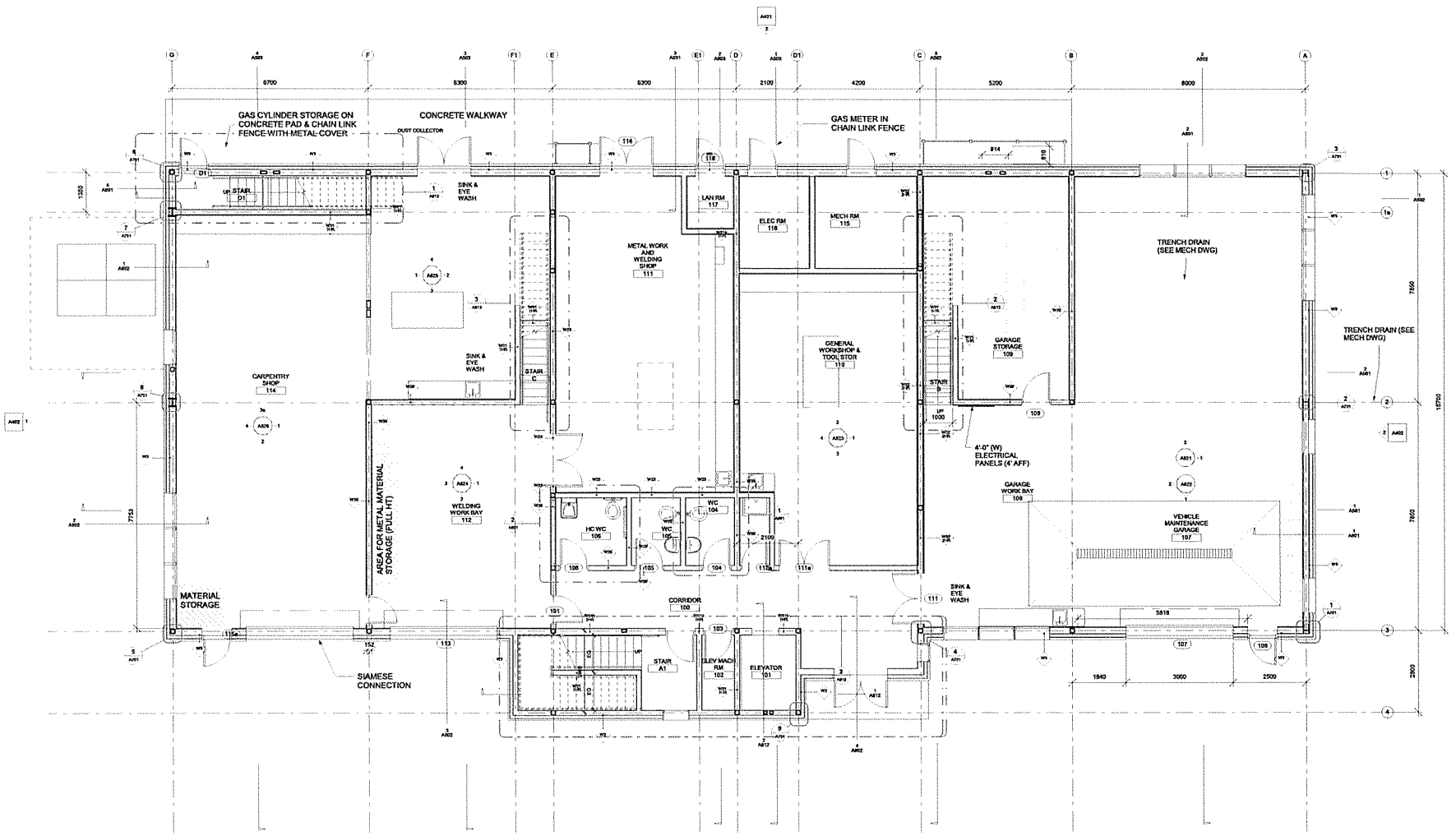

1 A201 MAIN FLOOR PLAN
1 : 50

EQUIPMENT & FURNITURE
LEGEND & GENERAL NOTE:

NOTE: REFER TO A211 TO A215 FOR DETAILED EQUIPMENT INFORMATION AND MINIMUM CLEARANCES.

H SYMBOL FOR THE EQUIPMENT

DOTTED LINE INDICATES MINIMUM CLEARANCE AROUND THE EQUIPMENT

EXISTING EQUIPMENT / FURNITURE SYSTEM TO BE RELOCATED (NOT SHADED)

* NEW STORAGE & WORK BENCHTABLE (SHADED) (FLOOR PLAN INDICATES THE ITEMS FOR SPACE PLANNING PURPOSE ONLY. CONFIRMATION IS REQUIRED IF THEY ARE PART OF THE CONTRACT)

* NEW EQUIPMENT - DUST COLLECTOR WILL BE PART OF THE CONTRACT (MECHANICAL SYSTEM)

* NEW FURNITURE ON UPPER FLOOR (NOT SHADED)

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Région du Pacifique

CEDAR WOOD DESIGN PACKAGE (May 15, 2015)

4	90% SUBMISSION	Nov 28, 2014
3	33% SUBMISSION	Oct 3, 2014
2	PRELIMINARY PACKAGE - EQUIPMENT & FURNITURE LAYOUT	Sept 5, 2014
1	SCHEMATIC DESIGN & SITE OPTIONS	Aug 15, 2014
Symbol / Symbole	Description / Description	Date / Date

Client/Client

CORRECTIONAL SERVICE CANADA

Project title/Titre du projet

6000 William Head Road, Metchosin, BC

WILLIAM HEAD INSTITUTION MAINTENANCE BUILDING (BUILDING 107)

Consultant Approval Box Only

Designed by/Concept par
DD

Drawn by/Dessiné par

PWGSC Project Manager/Administrateur de Projets TPSGC
DARYL SINCLAIR
PWGSC Regional Manager, Architectural and Engineering Services/ Gestionnaire régional, Services d'architecture et de génie, TPSGC
PROJETPAUL PAUL

Drawing title/Titre du dessin

BASE BUILDING - MAIN FLOOR PLAN (Level 1)

Project No./No. du projet	Sheet/ Feuille	Revision no./ no. Révision
R.069377.001	A201	

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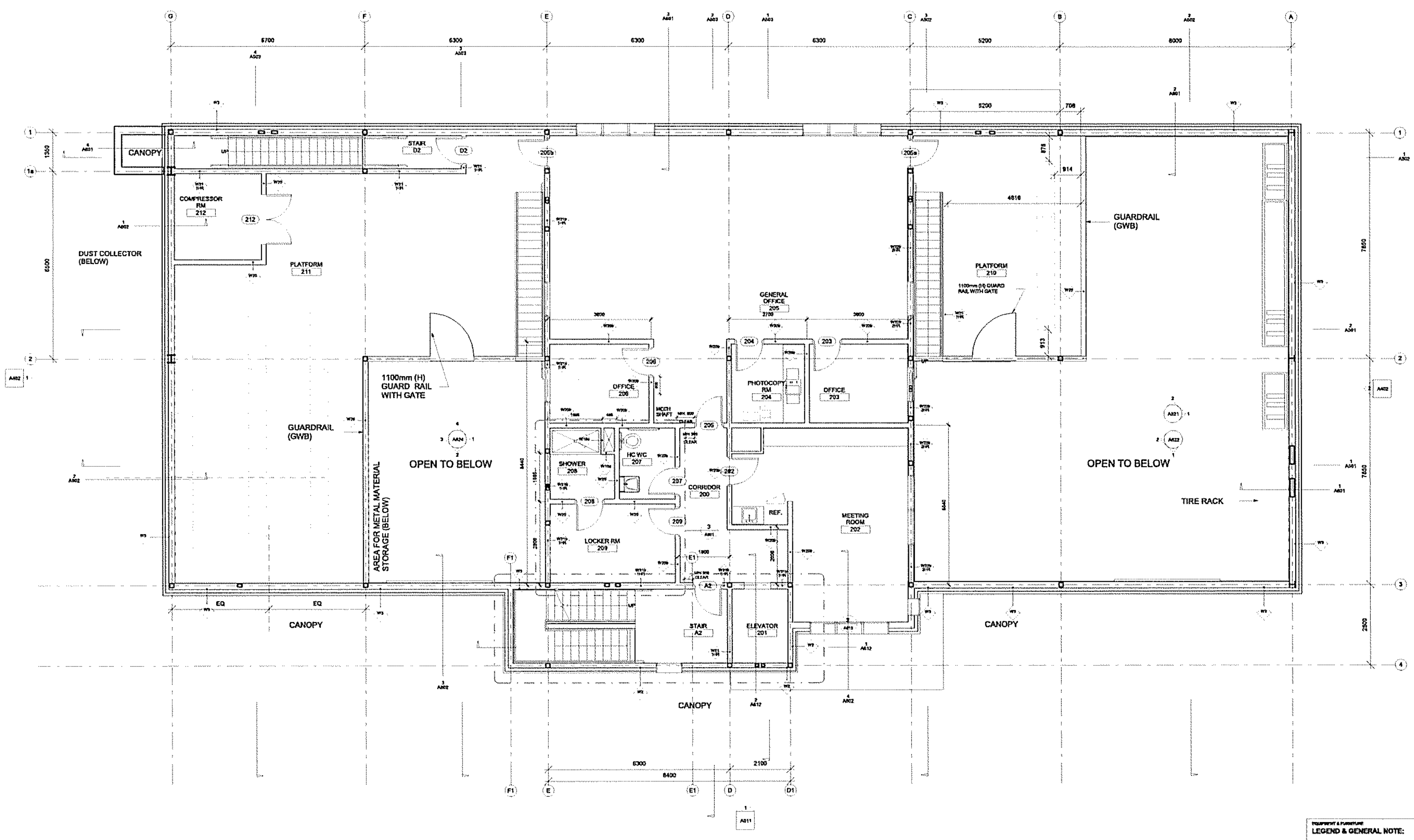
CEDAR WOOD DESIGN PACKAGE
(May 15, 2015)



REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Région du Pacifique

4	99% SUBMISSION	
3	33% SUBMISSION	
2	PRELIMINARY PACKAGE - EQUIPMENT & FURNITURE LAYOUT	
1	SCHEMATIC DESIGN & SITE OPTIONS	

CORRECTIONAL SERVICE CANADA

6000 William Head Road, Metchosin, BC

WILLIAM HEAD INSTITUTION MAINTENANCE BUILDING (BUILDING 107)

Designed by/Conçu par: DD

DARYL SINCLAIR

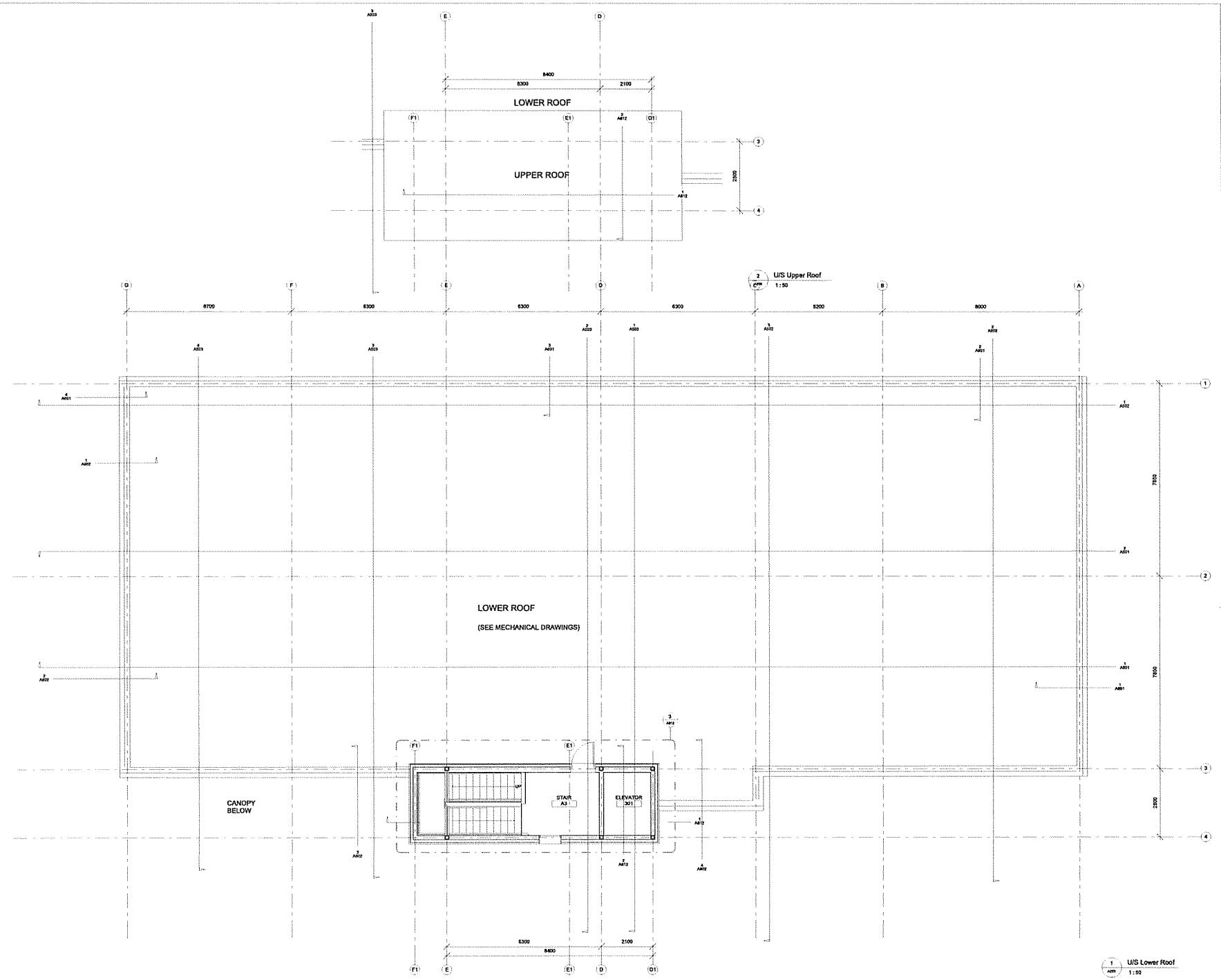
PREETPAUL PAUL

BASE BUILDING - UPPER FLOOR PLAN (Level 2)

R.069377.001

A202

8/15/2015 9:12:12 PM



Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Région du Pacifique

CEDAR WOOD DESIGN PACKAGE (May 15, 2015)

No.	Description/Description	Date/Date
4	90% SUBMISSION	Mar 26, 2015
3	33% SUBMISSION	Oct 3, 2014
2	PRELIMINARY PACKAGE - EQUIPMENT & FURNITURE LAYOUT	Sept 9, 2014
1	SCHEMATIC DESIGN & SITE OPTIONS	Aug 18, 2014

Consultant/Conseiller

CORRECTIONAL SERVICE CANADA

Project title/Titre du projet

6000 William Head Road, Metchosin, BC

WILLIAM HEAD INSTITUTION MAINTENANCE BUILDING (BUILDING 107)

Consultant Approval Box Only

Designed by/Concept par
DO

Drawn by/Dessiné par

PWGSC Project Manager/Administrateur de Projets TPSGC
DARYL SINCLAIR

PWGSC Regional Manager, Architecture and Engineering Services/Gestionnaire régional, Services d'architecture et de génie TPSGC
PRZETPAN, PAUL

Drawing title/Titre du dessin

BASE BUILDING - ROOF PLANS

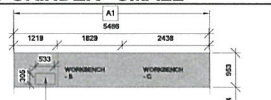
Project No./No. du projet	Sheet/Feuille	Revision no./No. de révision
R.069377.001	A203	

5/15/2015 5:12:13 PM

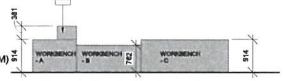
A1 WORK BENCH x 3

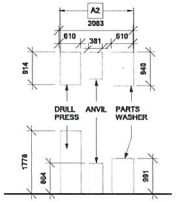
A1a GRINDER - SMALL | **WORK BENCH** | **WORK BENCH** | **A2 DRILL PRESS, ANVIL & PARTS WASHER** | **A3 OIL DRUM UNIT x 4**

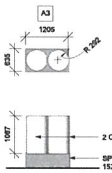
FLOOR PLAN

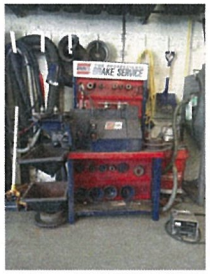


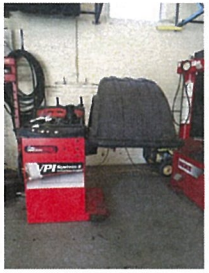
ELEVATION (IN BLOCK FORM)







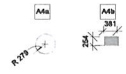




A4a SPILL KIT

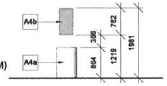
A4b SPILL CONTROL STATION | **A5 BRAKE LATHE** | **A6 BALANCER** | **A7 TIRE MACHINE** | **A8 HYDRAULIC PRESS**

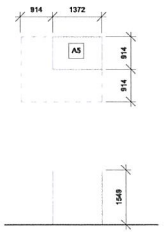
FLOOR PLAN

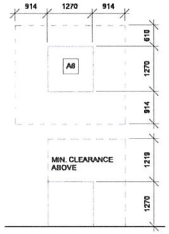


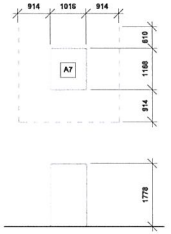
NOTE: SPILL CONTROL STATION & SPILL KIT WILL BE LOCATED CLOSE TO EACH OTHER AS SHOWN ON ELEVATION BELOW.

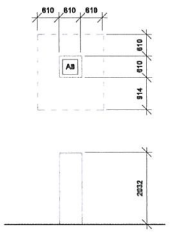
ELEVATION (IN BLOCK FORM)

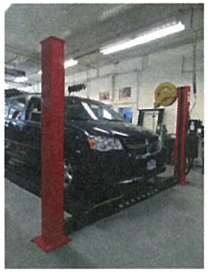








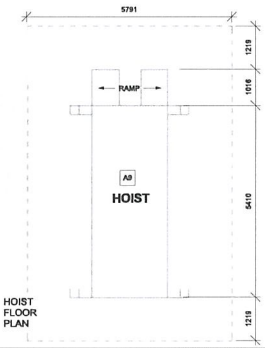




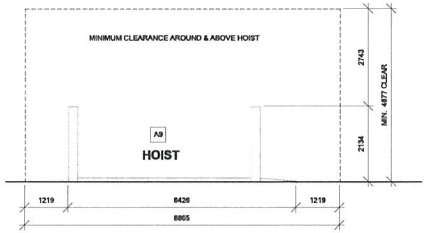
A9 HOIST

HOIST

HOIST FLOOR PLAN



HOIST SIDE ELEVATION



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FOR NON-STRUCTURAL ELEMENTS I.E. FURNITURE / SHELVES OVER 3'-0" HEIGHT, TOOLBOXES/INSTRUMENTS AND WHEEL RACKS SUPPORTED AGAINST NON STRUCTURAL WALLS AT HIGH ELEVATIONS ETC. SHALL BE RESTRAINT SEISMICALLY.

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LEGEND:

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N1 SYMBOL WITH PRE-FIX "N" INDICATES NEW EQUIPMENTS/FURNITURE(OSCI)

DOTTED LINE INDICATES MINIMUM CLEARANCE AROUND THE EQUIPMENT

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
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Client/client

CORRECTIONAL SERVICE CANADA

Project title/Titre du projet

6000 William Head Road, Metchosin, BC

WILLIAM HEAD INSTITUTION MAINTENANCE BUILDING (BUILDING 107)

Consultant Approval Box Only

Designed by/Concept par
DO

Drawn by/Dessiné par
Checker

PWGSC Project Manager/Administrateur de Projets TPSGC
DARYL SINCLAIR

TPSGC, Regional Manager, Architectural and Engineering Services/ Gestionnaire régional, Services d'architecte et de génie, TPSGC
PRIESTPAUL PAUL

Drawing title/Titre du dessin

RM 107 VEHICLE MAINTENANCE GARAGE - EQUIPMENT INFORMATION

Project No./No. du projet: R.069377.001
Sheet/ Feuille: A211
Revision no./ No. de révision no.:

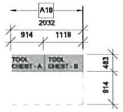
PWGSC — A3 — 11893X41

5/15/2015 5:12:18 PM

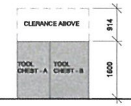
A11 AUTO REPAIR UNIT x 4 (MOBILE)

A10 TOOL CHEST x 2 (MOBILE)

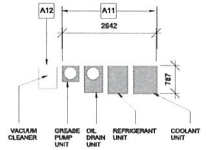
FLOOR PLAN



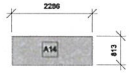
ELEVATION (IN BLOCK FORM)



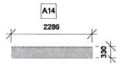
A12 VACUUM CLEANER (MOBILE)



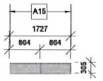
A14 BENCH (MOBILE)



A14 PARTS SHELF - A

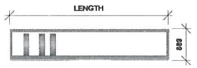


A15 PARTS SHELF - B x 2



A18 TIRE RACK x 5

FLOOR PLAN



	LENGTH	TOTAL NO.
TIRE RACK - A	128"	1
TIRE RACK - B	175"	3
TIRE RACK - C	200"	1

FOR STORAGE PURPOSE:

S3 FLAMMABLE STORAGE CABINET 34" (D)

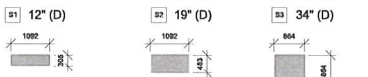
S1 FLAMMABLE STORAGE CABINET 12" (D)

S4 STORAGE CABINET 16" (D)

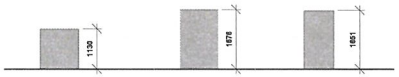
S5 STORAGE CABINET 20" (D)

S1 S2 S3 FLAMMABLE STORAGE CABINET - EXISTING

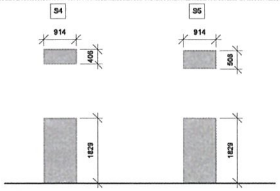
FLOOR PLAN



ELEVATION (IN BLOCK FORM)



S4 STORAGE CABINET 16" (D)
S5 STORAGE CABINET 20" (D)



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6000 William Head Road, Metchosin, BC

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Consultant Approval Box Only

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DD

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Checker

PWGSC Project Manager/Administrateur de Projets TPSGC
DARYL SINCLAR

TPSGC, Regional Manager, Architectural and Engineering Services/ Gestionnaire régional, Services d'architecture et de génie, TPSGC
PRIEETPAUL PAUL

Drawing title/Titre du dessin

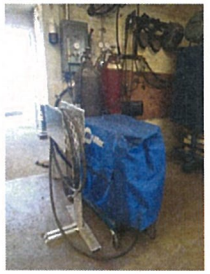
RM 107, 111, 112 VEHICLE MAINTENANCE GARAGE & STORAGE - EQUIPMENT INFORMATION

Project No./No. du projet	Sheet/ Feuille	Revision no./ No. de révision no.
R.069377.001	A212	

5/15/2015 5:12:22 PM

B1 WORK BENCH

B2 PLASMA

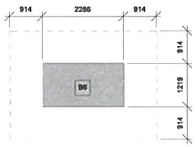


B3 MIG (MOBILE)

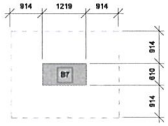
B4 TIG (MOBILE)

B5 WATER BATH (MOBILE)

B6 WELDING TABLE

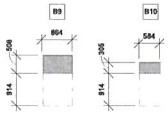


B7 BAND SAW (MOBILE)



B8 DRILL PRESS

B9 GRINDER - LARGE
B10 GRINDER - SMALL



B11 CABINET (MOBILE)

B12 GAS CYLINDERS (MOBILE)

B13 BENCH VICE

MEASUREMENTS REQUIRED

B13

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DARYL SINCLAR

PWGSC Regional Manager, Architectural and Engineering Services/ Gestionnaire régional, Services d'architecture et de génie, TPSGC
PREETPAUL PAUL

Drawing title/Titre du dessin

RM 114 METAL & WELDING SHOP - EQUIPMENT INFORMATION

Project No./No. du projet	Sheet/ Feuille	Revision no./ No. de révision no.
R.069377.001	A213	

5/15/2015 5:12:26 PM

PWGSC – A2 – 11858A41

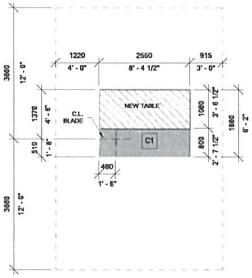
C1 **TABLE SAW**

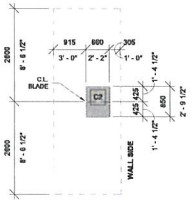
UNDER TABLE SAW

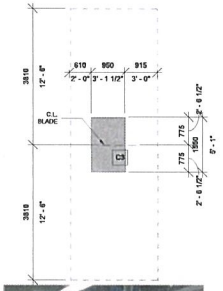
C2 **ROUTER (MOBILE)**

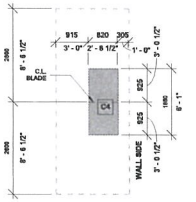
C3 **PLANER**

C4 **JOINER**









C5 **SHAPER**

NOT FOR RELOCATION

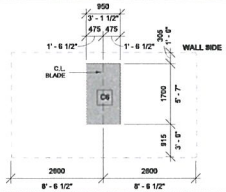
C6 **BAND SAW**

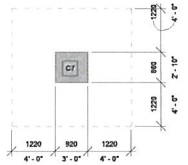
C7 **SANDER**

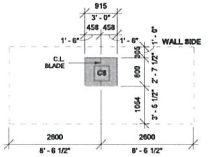
C8 **CHOP SAW (MOBILE)**

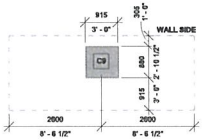
NOTE:
ONLY ONE CHOP SAW TO BE RELOCATED TO NEW BUILDING.

C9 **DRILL PRESS**









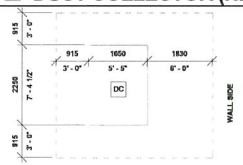
C10 **GRINDER - SMALL**

RADIAL ARM SAW

NOT FOR RELOCATION

NOTE:
DUST COLLECTOR IS NEW EQUIPMENT AND IS PART OF MECHANICAL SYSTEM OF BASE BULIDING, NOT OSCI ITEMS.

DC **DUST COLLECTOR (NEW)**



NOTE:
1) EQUIPMENT DIMENSIONS ARE APPROXIMATE. CONTRACTOR TO VERIFY ON SITE AND REPORT ANY DISCREPANCIES IMMEDIATELY.

2) AS PER REQUIREMENTS OF **CAN/CSA S832-06 (R2011) FOR "LIFE SAFETY":**
FOR NON-STRUCTURAL ELEMENTS I.E. FURNITURE / SHELVES OVER 3'-0" HEIGHT, TOOL/BOXES/INSTRUMENTS AND WHEEL RACKS SUPPORTED AGAINST NON STRUCTURAL WALLS AT HIGH ELEVATIONS ETC, SHALL BE RESTRAINT SEISMICALLY.

3) OWNER SUPPLIED CONTRACTOR INSTALLED (OSCI) ITEMS ARE:
2a) EXISTING EQUIPMENTS / FURNITURE TO BE RELOCATED TO NEW WHI MAINTENANCE BUILDING
2b) NEW EQUIPMENTS / FURNITURE TO BE PURCHASED BY OWNER (TO BE CONFIRMED IF IT IS PART OF THIS CONTRACT)

4) EQUIPMENT NOTED **"(MOBILE)"** WILL HAVE MOBILE SUPPORT WITH WHEELS TO BE PROVIDED / CUSTOM MADE BY WHI BEFORE EQUIPMENT RELOCATION

LEGEND:

C1 SYMBOL INDICATES EXISTING EQUIPMENTS/FURNITURE (OSCI) TO BE RELOCATED TO NEW WHI MAINTENANCE BUILDING

N1 SYMBOL WITH PRE-FIX "N" INDICATES NEW EQUIPMENTS/FURNITURE(OSCI)

DOTTED LINE INCIDATES MINIMUM CLEARANCE AROUND THE EQUIPMENT

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Région du Pacifique

CEDAR WOOD DESIGN PACKAGE (May 15, 2015)

4	90% SUBMISSION	Nov 28, 2014
3	33% SUBMISSION	Oct 3, 2014
2	PRELIMINARY PACKAGE - EQUIPMENT & FURNITURE LAYOUT	Sept 8, 2014
1	SCHEMATIC DESIGN & SITE OPTIONS	Aug 18, 2014
Revision/ Révision	Description/Description	Date/Date

Client/client

CORRECTIONAL SERVICE CANADA

Project title/Titre du projet

6000 William Head Road, Metchosin, BC

WILLIAM HEAD INSTITUTION MAINTENANCE BUILDING (BUILDING 107)

Consultant Approval Box Only

Designed by/Conçu par
DG

Drawn by/Dessiné par
Checker

PWGSC Project Manager/Administrateur de Projets TPSGC
DARYL SINCLAIR

PWGSC Regional Manager, Architecture and Engineering Services/ Gestionnaire régional, Services d'architecture et de génie, TPSGC
PRIETPAUL PAUL

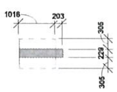
Drawing title/Titre du dessin

RM 115 CARPENTRY SHOP - EQUIPMENT INFORMATION

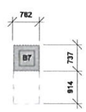
Project No./No. du projet	Sheet/ Feuille	Revision no./ No. de révision no.
R.069377.001	A214	

5/15/2015 5:12:31 PM

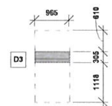
D1 **ROLLER**



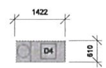
D2 **MILLER**



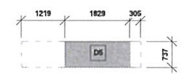
D3 **FINGER BRAKE**



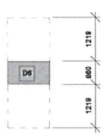
D4 **SAND BLASTER (MOBILE)**



D5 **LATHE**



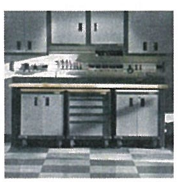
D6 **SHEAR**



EQUIPMENT SHOWN NOT FOR RELOCATION

EQUIPMENT SHOWN NOT FOR RELOCATION

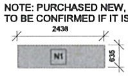
NEW EQUIPMENTS/FURNITURE (OSCI):



N1 **ALL STEEL WORK BENCH**

NOTE: PURCHASED NEW, SAME AS FVI ISS BUILDING.
TO BE CONFIRMED IF IT IS PART OF THE CONTRACT.

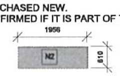
FLOOR PLAN

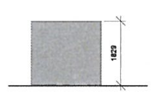


ELEVATION
(IN BLOCK FORM)

N2 **STORAGE RACK**

NOTE: PURCHASED NEW.
TO BE CONFIRMED IF IT IS PART OF THE CONTRACT.





N3 **FLAMMABLE STORAGE CABINET - NEW**

NOTE: PURCHASED NEW.
TO BE CONFIRMED IF IT IS PART OF THE CONTRACT.

DIMENSIONS OF N3 = S1 / S2 / S3

NOTE:

1) EQUIPMENT DIMENSIONS ARE APPROXIMATE. CONTRACTOR TO VERIFY ON SITE AND REPORT ANY DISCREPANCIES IMMEDIATELY.

2) AS PER REQUIREMENTS OF **CAN/CSA S832-06 (R2011) FOR "LIFE SAFETY":**
FOR NON-STRUCTURAL ELEMENTS I.E. FURNITURE / SHELVES OVER 3'-0" HEIGHT, TOOL/BOXES/INSTRUMENTS AND WHEEL RACKS SUPPORTED AGAINST NON STRUCTURAL WALLS AT HIGH ELEVATIONS ETC, SHALL BE RESTRAINT SEISMICALLY.

3) OWNER SUPPLIED CONTRACTOR INSTALLED (OSCI) ITEMS ARE:
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4) EQUIPMENT NOTED **"(MOBLIE)"** WILL HAVE MOBILE SUPPORT WITH WHEELS TO BE PROVIDED / CUSTOM MADE BY WHI BEFORE EQUIPMENT RELOCATION

LEGEND:

C1 SYMBOL INDICATES EXISTING EQUIPMENTS/FURNITURE (OSCI) TO BE RELOCATED TO NEW WHI MAINTENANCE BUILDING

N1 SYMBOL WITH PRE-FIX "N" INDICATES NEW EQUIPMENTS/FURNITURE(OSCI)

- - - DOTTED LINE INCIDATES MINIMUM CLEARANCE AROUND THE EQUIPMENT

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada
REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Région du Pacifique

CEDAR WOOD DESIGN PACKAGE
(May 15, 2015)

Revision/Révision	Description/Description	Date/Date
4	66% SUBMISSION	Nov 28, 2014
3	33% SUBMISSION	Oct 3, 2014
2	PRELIMINARY PACKAGE - EQUIPMENT & FURNITURE LAYOUT	Sept 8, 2014
1	SCHEMATIC DESIGN & SITE OPTIONS	Aug 18, 2014

Client/client

CORRECTIONAL SERVICE CANADA

Project title/Titre du projet

6000 William Head Road, Metchosin, BC

WILLIAM HEAD INSTITUTION MAINTENANCE BUILDING (BUILDING 107)

Consultant Approval Box Only

Designed by/Concept par
DD

Drawn by/Dessine par
Checker

PWGSC Project Manager/Administrateur de Projets TPSGC
DARYL SINCLAR

PWGSC, Regional Manager, Architectural and Engineering Services/ Gestionnaire régionale, Services d'architectural et de génie, TPSGC
PREETIPAUL PAUL

Drawing title/Titre du dessin

RM 111 GENERAL WORKSHOP - EQUIPMENT INFORMATION

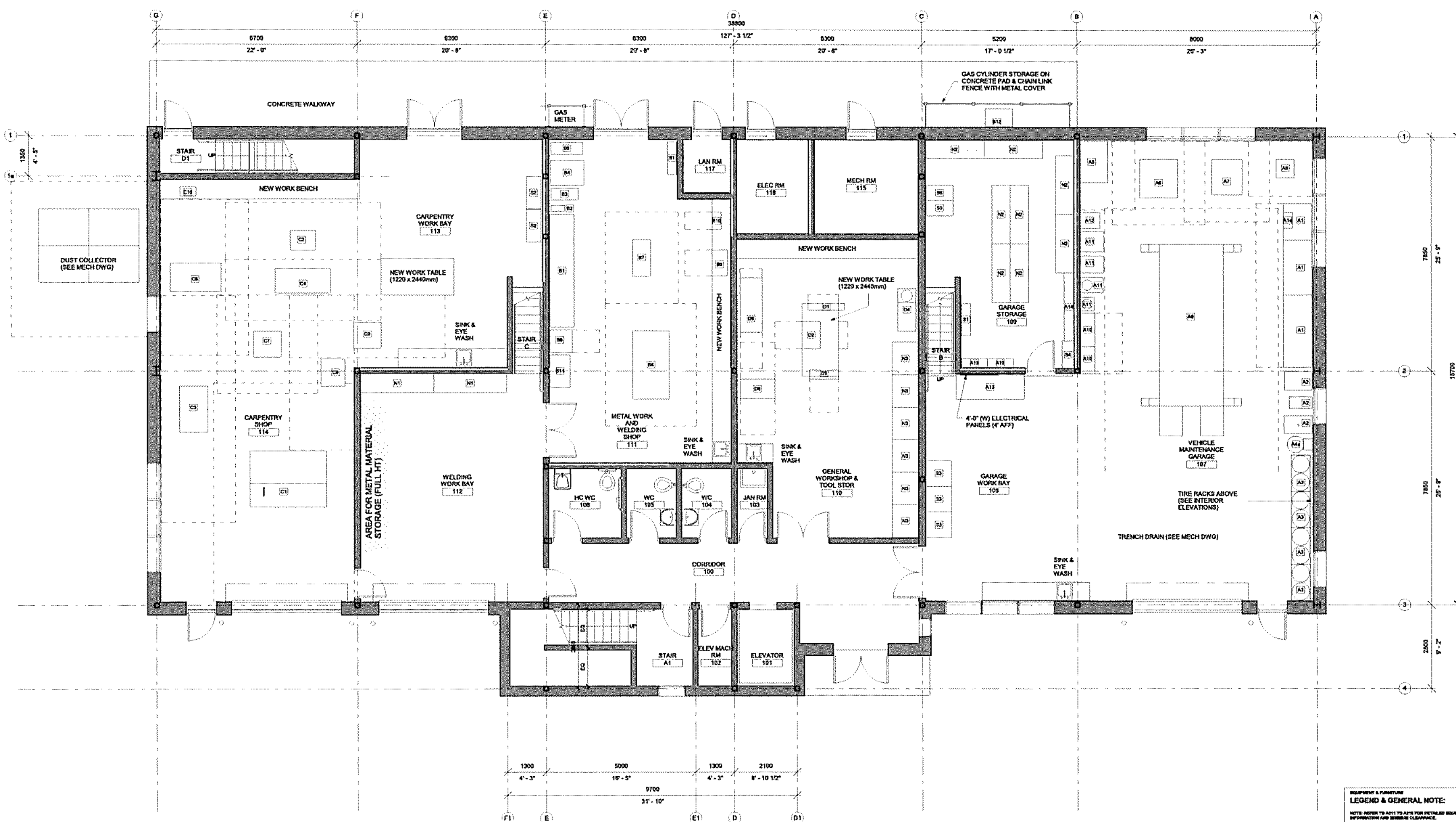
Project No./No. du projet	Sheet/ Feuille	Revision no./ La Révision no.
R.069377.001	A215	

5/15/2015 5:12:35 PM

PWGSC - A2 - 1189X841

CEDAR WOOD DESIGN PACKAGE
(May 15, 2015)

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Région du Pacifique



Revision	Description	Date
4	[illegible] SUBMISSION	[illegible]
3	[illegible] SUBMISSION	[illegible]
2	PRELIMINARY PACKAGE - EQUIPMENT & FURNITURE LAYOUT	[illegible]
1	SCHEMATIC DESIGN & SITE OPTIONS	[illegible]

Client/client

CORRECTIONAL SERVICE CANADA

Project title/Titre du projet

6000 William Head Road, Metchosin, BC

WILLIAM HEAD INSTITUTION MAINTENANCE BUILDING (BUILDING 107)

Consultant Approval Box Only

Designed by/Conception par: Author

Drawn by/Dessiné par: Checker

PWGSC Project Manager/Administrateur de Projets TPSGC: DARYL SINCLAR

PWGSC, Regional Manager, Architecture and Engineering Services/Gestionnaire régionale, Services d'architecture et de génie, TPSGC: PREETIPAUL PAUL

Drawing title/Titre du dessin

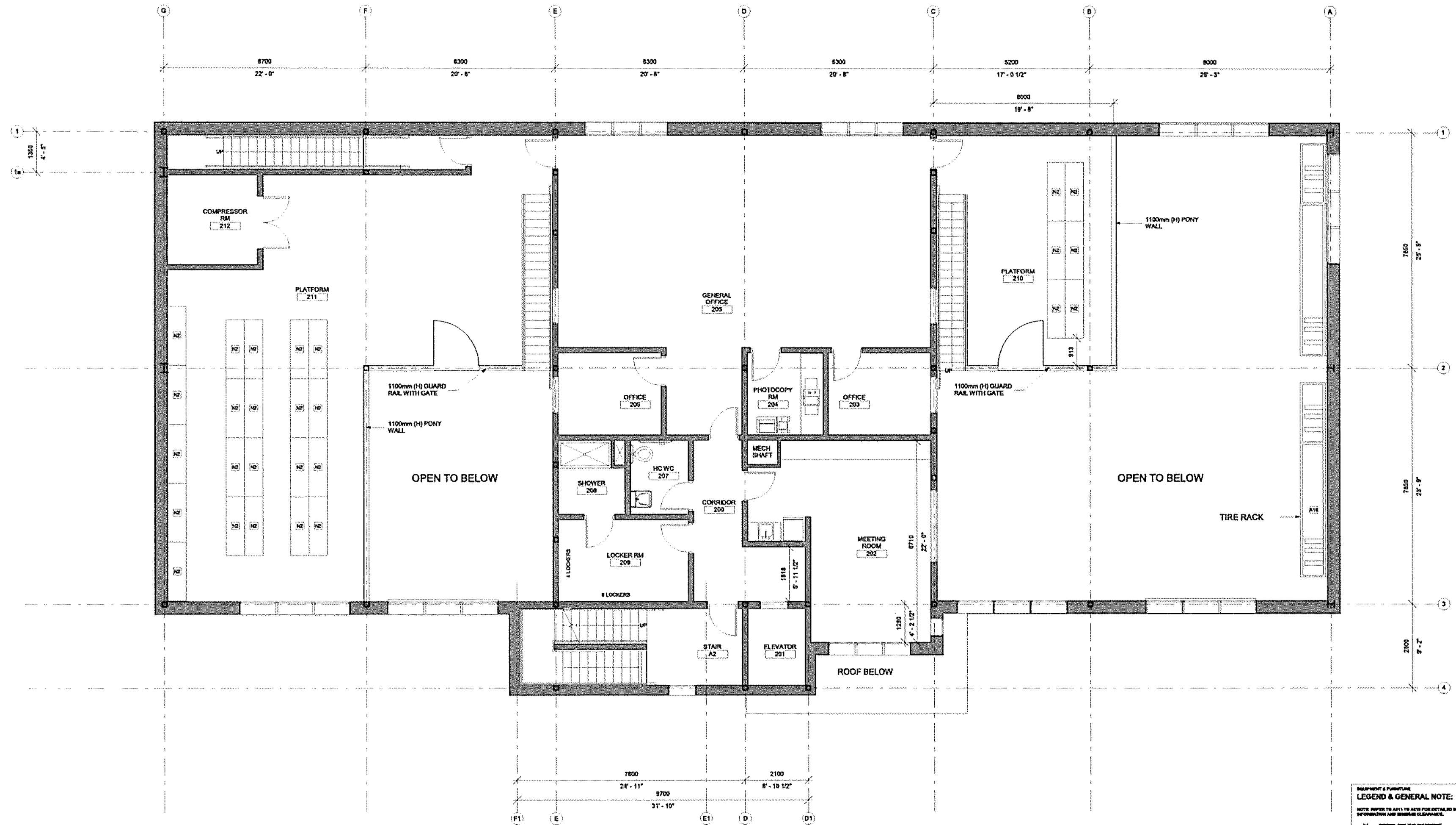
EQUIPMENT & FURNITURE PLAN - MAIN FLOOR PLAN

Project no./No. du projet: R.069377.001

Sheet/Feuille: **A221**

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada
REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Région du Pacifique

CEDAR WOOD DESIGN PACKAGE (May 15, 2015)



UPPER FLOOR PLAN
1:50

LEGEND & GENERAL NOTE:

Revision	Description	Date
4	95% SUBMISSION	Nov 20, 2014
3	33% SUBMISSION	Oct 3, 2014
2	PRELIMINARY PACKAGE - EQUIPMENT & FURNITURE LAYOUT	Sept 8, 2014
1	SCHEMATIC DESIGN & SITE OPTIONS	Aug 18, 2014

Client/client: CORRECTIONAL SERVICE CANADA

Project title/Titre du projet: 6000 William Head Road, Metchosin, BC

WILLIAM HEAD INSTITUTION MAINTENANCE BUILDING (BUILDING 107)

Designed by/Concept par: Author
Drawn by/Dessiné par: Checker
PWGSC Project Manager/Administrateur de Projets TPSGC: DARYL SINCLAR
PWGSC, Regional Manager, Architectural and Engineering Services: PREETIPAUL PAUL

Drawing title/Titre du dessin: EQUIPMENT & FURNITURE PLAN - UPPER FLOOR PLAN

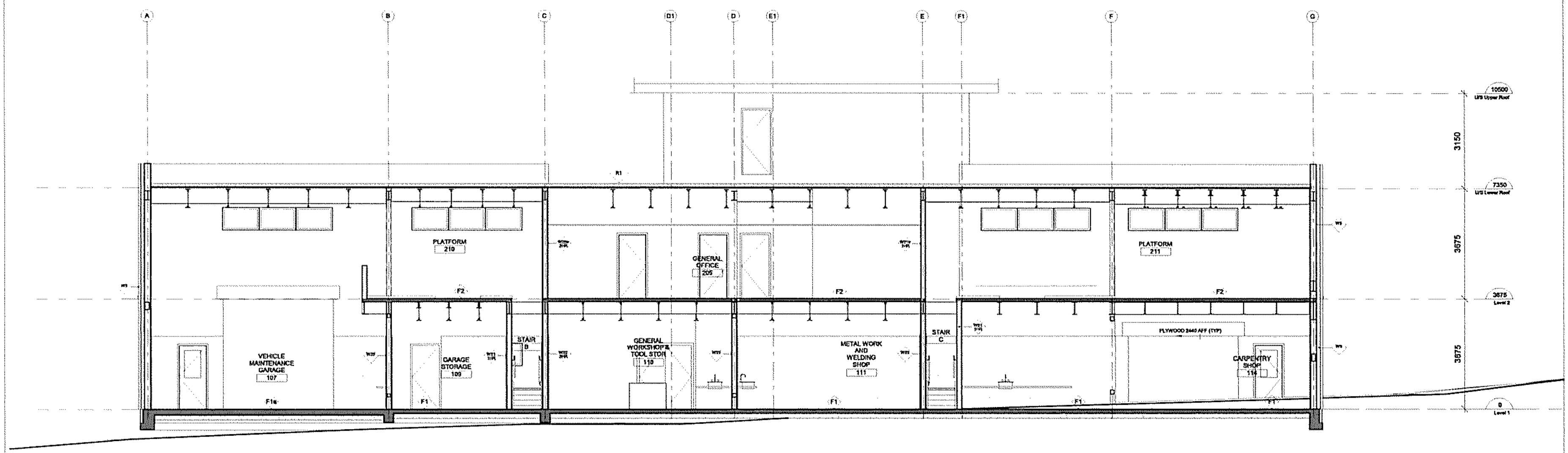
Project No./No. du projet: R.069377.001
Sheet/Feuille: A222

5/15/2015 9:12:37 PM

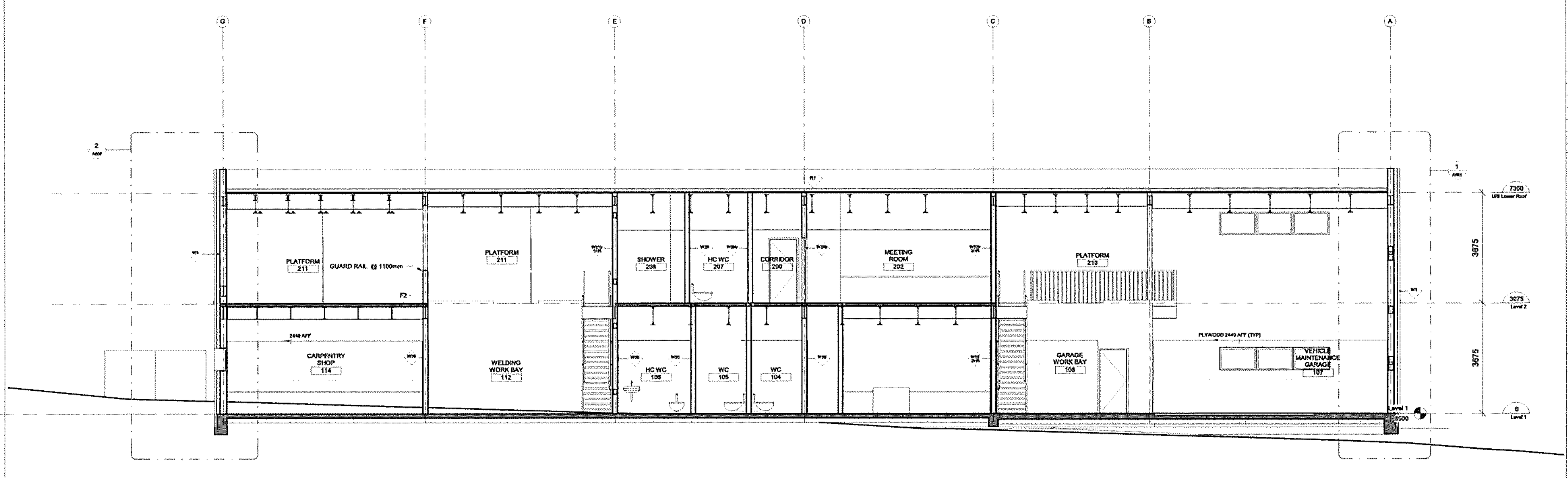
BUILDING SECTION NOTE:

1) OWNER SUPPIED CONTRACTOR INSTALLED (OSCI) EQUIPMENTS ARE NOT SHOWN FOR CLARITY.

2) FOR OSCI INFORMATION, REFER TO DRAWING A210 & A220 & A820 SERIES FOR DETAILS



2 Building Section 2-2
1 : 50



1 Building Section 1-1
1 : 50

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Région du Pacifique

CEDAR WOOD DESIGN PACKAGE
(May 15, 2015)

Revision	Description	Date
4	66% SUBMISSION	Nov 28, 2014
3	33% SUBMISSION	Oct 3, 2014
2	PRELIMINARY PACKAGE - EQUIPMENT & FURNITURE LAYOUT	Sept 5, 2014
1	SCHEMATIC DESIGN & SITE OPTIONS	Aug 15, 2014

Client/client

CORRECTIONAL SERVICE CANADA

Project title/Titre du projet

6000 William Head Road, Metchosin, BC

WILLIAM HEAD INSTITUTION MAINTENANCE BUILDING (BUILDING 107)

Designed by/Conception par
DD

PWGSC Project Manager/Administrateur de Projets TPSGC
DARYL SINCLAR

PRZETPAUL PAUL

Drawing title/Titre du dessin

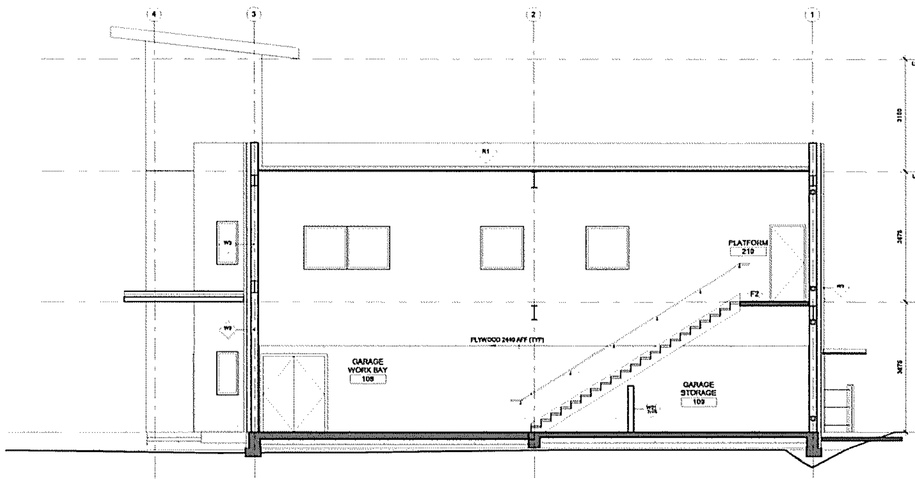
SECTIONS

Project No./No. du projet	Sheet/Feuille
R.069377.001	A501

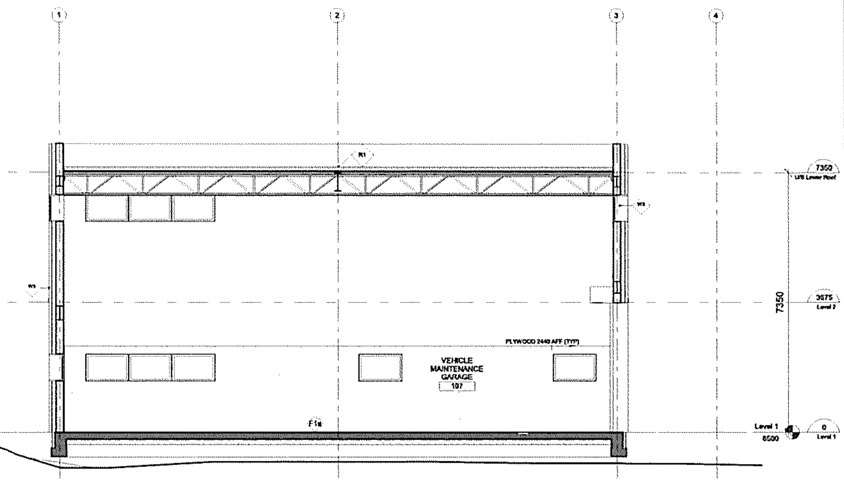
BUILDING SECTION NOTE:

1) OWNER SUPPIED CONTRACTOR INSTALLED (OSCI) EQUIPMENTS ARE NOT SHOWN FOR CLARITY.

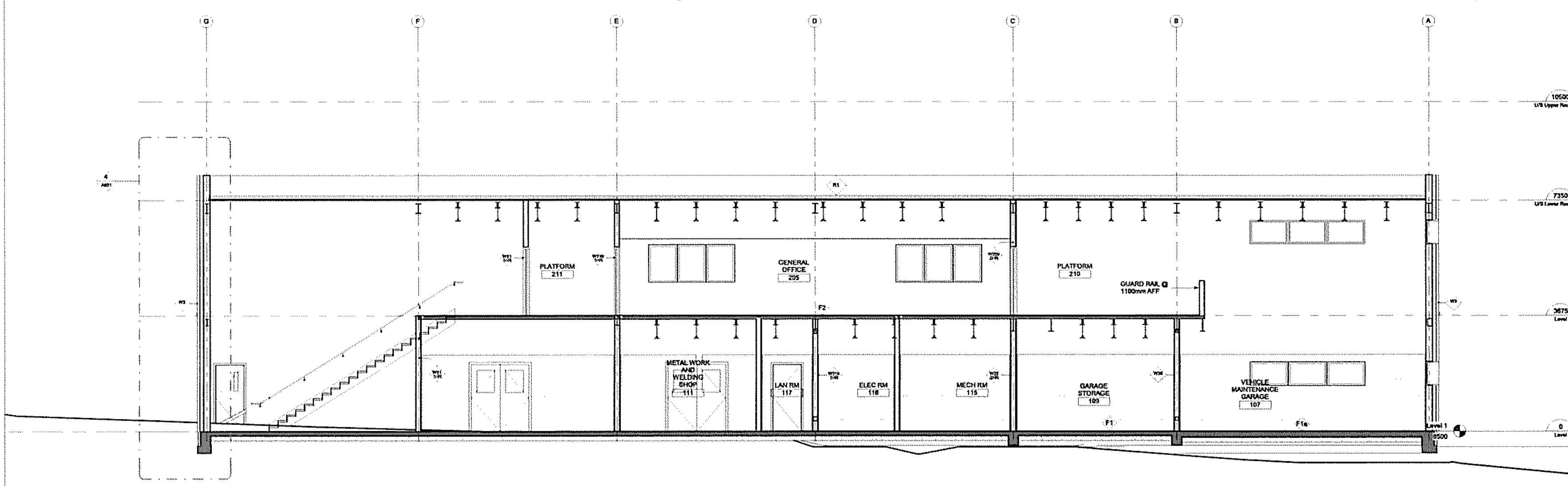
2) FOR OSCI INFORMATION, REFER TO DRAWING A210 & A220 & A820 SERIES FOR DETAILS



3 Building Section B-B
1 : 50



2 Building Section A-A
1 : 50



1 Building Section 3-3
1 : 50

CEDAR WOOD DESIGN PACKAGE
(May 15, 2015)

Revision	Description	Date
4	66% SUBMISSION	Nov 28, 2014
3	33% SUBMISSION	Oct 3, 2014
2	PRELIMINARY PACKAGE - EQUIPMENT & FURNITURE LAYOUT	Sept 5, 2014
1	SCHEMATIC DESIGN & SITE OPTIONS	Aug 15, 2014

Client/client

CORRECTIONAL SERVICE CANADA

Project title/Titre du projet

6000 William Head Road, Metchosin, BC

WILLIAM HEAD INSTITUTION MAINTENANCE BUILDING (BUILDING 107)

Consultant Approval Due Only

Designed by/Concept par
DO

Drawn by/Dessiné par
Checker

PWGSC Project Manager/Administrateur de Projets TPSGC
DARYL SINCLAR

PWGSC, Regional Manager, Architectural and Engineering Services
PREETIPAUL PAUL

Drawing title/Titre du dessin

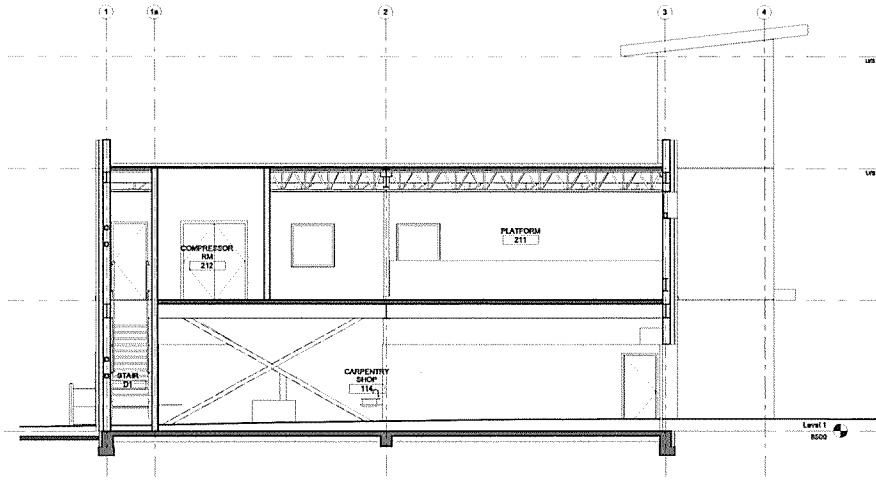
SECTIONS

Project No./No. du projet: R.069377.001
Sheet/Feuille: A502

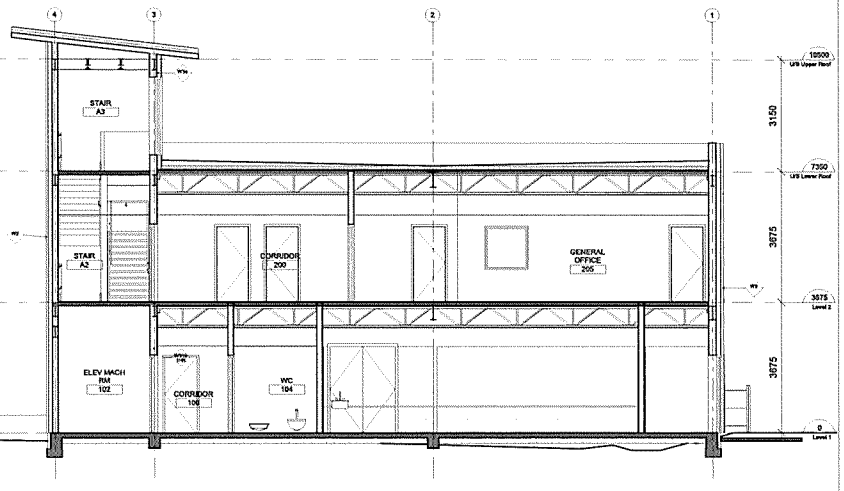
BUILDING SECTION NOTE:

1) OWNER SUPPIED CONTRACTOR INSTALLED (OSCI) EQUIPMENTS ARE NOT SHOWN FOR CLARITY.

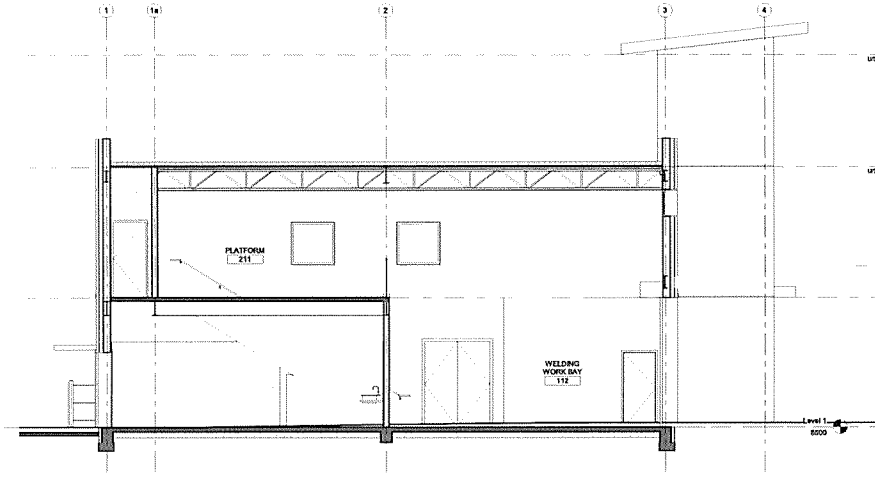
2) FOR OSCI INFORMATION, REFER TO DRAWING A210 & A220 & A820 SERIES FOR DETAILS



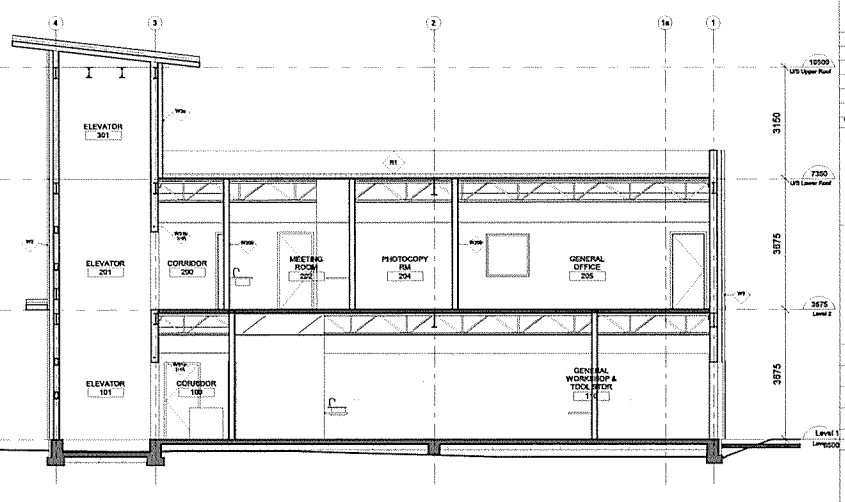
4 Building Section F-F
1 : 50



2 Building Section D-D
1 : 50



3 Building Section E-E
1 : 50



1 Building Section C-C
1 : 50

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Région du Pacifique

CEDAR WOOD DESIGN PACKAGE (May 15, 2015)

4	90% SUBMISSION	Nov 28, 2014
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2	PRELIMINARY PACKAGE - EQUIPMENT & FURNITURE LAYOUT	Sept 8, 2014
1	SCHEMATIC DESIGN & SITE OPTIONS	Aug 18, 2014
Revision / Révision	Description / Description	Date / Date

Client / Client

CORRECTIONAL SERVICE CANADA

Project Site / Titre du projet

6000 William Head Road, Metchosin, BC

WILLIAM HEAD INSTITUTION MAINTENANCE BUILDING (BUILDING 107)

Consultant Approval Box Only

Designed by / Concept par
DD

Drawn by / Dessiné par

PWGSC Project Manager / Administrateur de Projets TPSGC
DARYL ENGLAR

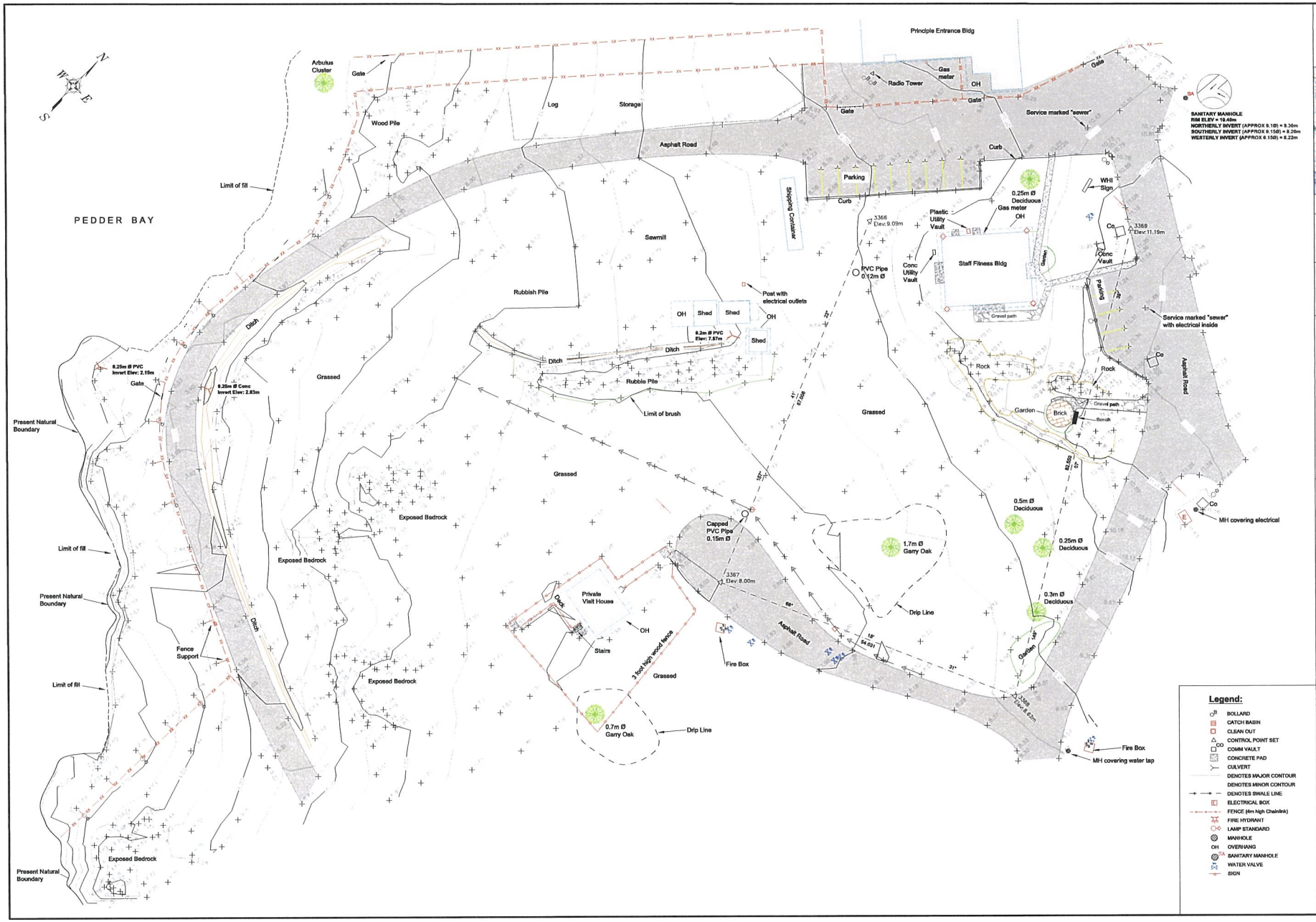
PWGSC Regional Manager, Architecture and Engineering Services / Gestionnaire régional, Services d'architecture et de génie, TPSGC
PETER PAUL

Drawing Title / Titre du dessin

SECTIONS

Project No. / No. du projet	Sheet / Feuille	Revision no. / No. de révision
R.069377.001	A503	

5/15/2015 9:12:42 PM



Public Works and Government Services Canada
Geomatics Services

Travaux Publics et Services gouvernementaux Canada

219-800 Burrard Street
Vancouver, BC, V6Z 0B8
604.775.7079

LOCATION MAP BCGS 92B.033

project
CORRECTIONS SERVICE CANADA WILLIAM HEAD INSTITUTION MAINTENANCE BUILDING

drawing / dessin
TOPOGRAPHIC SURVEY PLAN OF WILLIAM HEAD INSTITUTION FOR PROPOSED MAINTENANCE BUILDING LOCATION

Scale 1:300
10 0 5 10 15

THE INTENDED PLOT SIZE OF THIS PLAN IS 559mm IN WIDTH BY 864mm IN HEIGHT (D SIZE) WHEN PLOTTED AT A SCALE OF 1:300

Date of Survey: April 15th, 2015
FB # 036, Pg 57-72

This Survey was conducted using dual frequency RTK GNSS observations and Trimble S6 Total Station. Control points were derived from dual frequency, carrier phase GNSS observations Using BC Active Control Point Esquimalt (GCM 600411)

Elevations are Orthometric, and are derived from Ddual frequency RTK GNSS Observations, and Referenced to Ht2.0 (CGVD28)

Bearings are UTM NAD83(CSRS) Grid and Referenced to the 123rd Meridian

All distances are ground unless otherwise noted.

drawn	C. M. BRYENTON	dessiné
date	2015-04-22	
approved		approuvé
date		
project number	R.069377.001	no. du projet
drawing no.	SK5485.00	no. du dessin
EDRM no.	504649	
survey file no.	SF3439.00	

APPENDIX C

Records of Test Pits

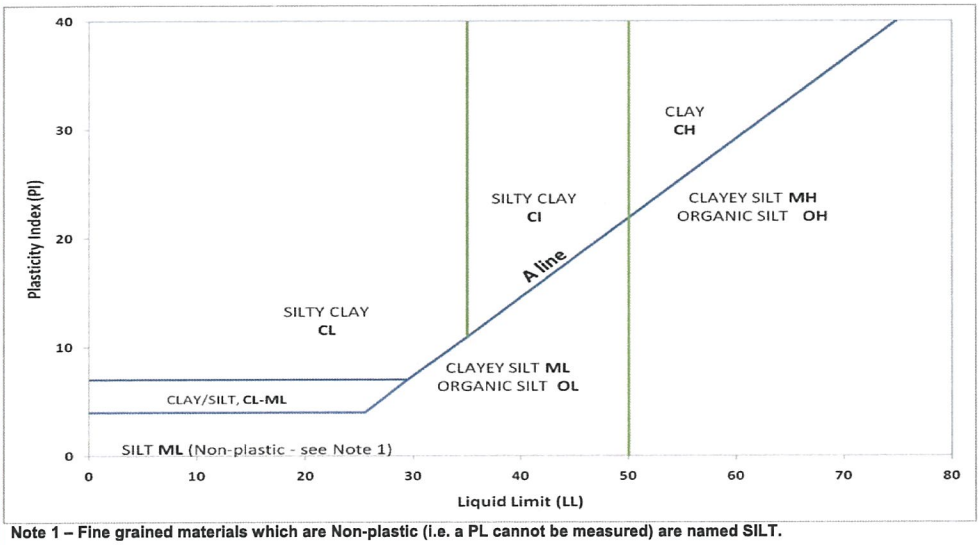
Golder Associates

METHOD OF SOIL CLASSIFICATION

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$	$Cc = \frac{D_{30}^2}{D_{10} x D_{60}}$	Organic Content	USCS Group Symbol	Group Name
INORGANIC (Organic Content <30% by mass)	COARSE GRAINED SOILS (>50% by mass is larger than 0.075 mm)	GRAVELS (>50% by mass is larger than 4.75 mm)	Gravels with <12% fines (by mass)	Poorly Graded	<4	≤1 or ≥3	<30%	GP	GRAVEL
				Well Graded	≥4	1 to 3		GW	GRAVEL
			Gravels with >12% fines (by mass)	Below A Line	n/a			GM	SILTY GRAVEL
				Above A Line	n/a			GC	CLAYEY GRAVEL
		SANDS (>50% by mass is smaller than 4.75 mm)	Sands with <12% fines (by mass)	Poorly Graded	<6	≤1 or ≥3		SP	SAND
				Well Graded	≥6	1 to 3		SW	SAND
			Sands with >12% fines (by mass)	Below A Line	n/a			SM	SILTY SAND
				Above A Line	n/a			SC	CLAYEY SAND

Organic or Inorganic	Soil Group	Type of Soil	Laboratory Tests	Field Indicators				Organic Content	USCS Group Symbol	Group Name
				Dilatancy	Dry Strength	Thread Diameter	Toughness (of 3 mm thread)			
INORGANIC (Organic Content <30% by mass)	FINE GRAINED SOILS (>50% by mass is smaller than 0.075 mm)	SILTS (PI and LL plot below A-Line on Plasticity Chart)	Liquid Limit <50	Rapid	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT
				Slow	None to Low	3mm to 6 mm	None to low	<5%	ML	CLAYEY SILT
				Slow to very slow	Low to medium	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT
			Liquid Limit >50	Slow to very slow	Low to medium	3mm to 6 mm	Low to medium	<5%	MH	CLAYEY SILT
				None	Medium to High	1 mm to 3 mm	Medium to High	5% to 30%	OH	ORGANIC SILT
		CLAYS (PI and LL plot above A-Line on Plasticity Chart)	Liquid Limit <35	None	Low to medium	~ 3 mm	Low to medium	0% to 30%	CL	SILTY CLAY
			Liquid Limit 35 to 50	None	Medium to High	1 mm to 3 mm	Medium		CI	SILTY CLAY
			Liquid Limit >50	None	High	<1 mm	High		CH	CLAY
HIGHLY ORGANIC SOILS (Organic Content >30% by mass)		Peat and mineral soil mixtures						30% to 75%	PT	SILTY PEAT, SANDY PEAT
		Predominantly peat, may contain some mineral soil, fibrous or amorphous peat						>75%		PEAT

PLASTICITY CHART



Note 1 – Fine grained materials which are Non-plastic (i.e. a PL cannot be measured) are named SILT.

Dual Symbol — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC, CL-ML used when the soil has between 5 and 12% fines (*i.e.* between "clean" sand and "dirty" sand) or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart.

Borderline Symbol — A borderline symbol is two symbols separated by a slash, for example, CL/CI, GM/SM, CL/ML.

SYMBOLS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>300	>12
COBBLES	Not Applicable	75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY	Classified by plasticity	<0.075	< (200)

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
≤ 5	trace
5 to 12	some
12 to 35	Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable
>35	Use 'and' to combine major constituents (*i.e.,* SAND and GRAVEL, SAND and CLAY)

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) drive open sampler for a distance of 300 mm (12 in.).

Piezo-Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance; N_d:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
SS	Split-spoon
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

SOIL TESTS

w	water content
PL	plastic limit
LL	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

Note: [1] Tests which are anisotropically consolidated prior to shear are shown as CAD, CAU.

NON-COHESIVE (COHESIONLESS) SOILS

Compactness

Term	SPT 'N' (blows/0.3m) *
Very Loose	0 - 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

1. SPT 'N' in accordance with ASTM D 1586, uncorrected for overburden pressure effects or energy transfer.
2. Definition of compactness descriptions based on SPT 'N' ranges from Terzaghi and Peck (1967) and correspond to typical average N_{60} values.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

COHESIVE SOILS

Consistency

Term	Undrained Shear Strength (kPa)	SPT 'N' (blows/0.3m)
Very Soft	<12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

1. SPT 'N' in accordance with ASTM D 1586, uncorrected for overburden pressure effects or energy transfer.

Water Content

Term	Description
w < PL	Material is estimated to be drier than the Plastic Limit.
w ~ PL	Material is estimated to be close to the Plastic Limit.
w > PL	Material is estimated to be wetter than the Plastic Limit.

Golder Associates

PROJECT No.: 13-1447-0497 / 5000

CLIENT: PWGSC
PROJECT: Geotechnical SOA
LOCATION: William Head Correctional Facility
N: ~5354114 E: ~459868 UTM NAD83 Zone: 10
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

RECORD OF TEST PIT: TP15-01

EXCAVATION DATE: April 30, 2015

INCLINATION: -90°

SHEET 1 OF 1

DATUM: Ground Surface

TEST PIT DIMENSIONS:

3 m Length x 0.6 m Width

DEPTH SCALE METRES	EXCAVATION METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY %	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ◐ / Pocket Pen - ■) 20 40 60 80	WATER CONTENT PERCENT Wp ⊢○W⊣ Wl, NP - Non-Plastic 10 20 30 40	GRADATION % GRAVEL	GRADATION % SAND	GRADATION % FINES	PLASTICITY	FROZEN GROUND DESCRIPTION	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE, THERMISTOR INSTALLATION OR SEEPAGE OBSERVATION
0		Ground Surface														
	Excavator / Excavator Bucket	TOPSOIL - **(SM)** SILTY SAND, some gravel; black-brown, with cobbles, with organics (FIBROUS PEAT); non-cohesive, moist, loose.		0.00	1	G										
1		**(ML)** sandy CLAYEY SILT; brown; cohesive, w>PL, soft.		0.60	2	G										
2		**(CL)** SILTY CLAY, trace sand; brown-grey; cohesive, w<PL, very stiff to hard.		1.30	3	G										
		End of Test Pit.		2.50												
3																
4																
5																
6																

DEPTH SCALE
1 : 50

Golder Associates

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: JP
CHECKED: DL

REV: 0

National IM Server:GINT_GAL_NATIONALIM Unique Project ID: Output Form:BC_TESTPIT WITH PHOTO nwiggins 9/10/15

PROJECT No.: 13-1447-0497 / 5000

CLIENT: PWGSC
PROJECT: Geotechnical SOA
LOCATION: William Head Correctional Facility
N: ~5354118 E: ~459859 UTM NAD83 Zone: 10
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

RECORD OF TEST PIT: TP15-02

EXCAVATION DATE: May 1, 2015

INCLINATION: -90°

SHEET 1 OF 1

DATUM: Ground Surface

TEST PIT DIMENSIONS:

3 m Length x 0.6 m Width

DEPTH SCALE METRES	EXCAVATION METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ◐ / Pocket Pen - ■) 20 40 60 80	WATER CONTENT PERCENT Wp ⊢ W ⊣ Wl, NP - Non-Plastic 10 20 30 40	GRADATION % GRAVEL	GRADATION % SAND	GRADATION % FINES	PLASTICITY	FROZEN GROUND DESCRIPTION	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE, THERMISTOR INSTALLATION OR SEEPAGE OBSERVATION
		Ground Surface														
0	Excavator Excavator Bucket	FILL - **(SM/GM)** SILTY SAND and SILTY GRAVEL; brown-grey, with organics (FIBROUS PEAT); non-cohesive, moist, loose.		0.10	1	G										
		(SM/GM) SILTY SAND and SILTY GRAVEL; black-brown, with organics (TOPSOIL / FIBROUS PEAT); non-cohesive, moist, loose.		0.90	2	G										
1		**(ML)** sandy CLAYEY SILT, trace to some gravel; brown, with cobbles; cohesive, w>PL, soft to firm.														
2		**(CL)** sandy SILTY CLAY, trace gravel; grey-brown; cohesive, w<PL, stiff to very stiff		2.00	3	G										
		End of Test Pit.		2.30												
3																
4																
5																
6																

DEPTH SCALE
1 : 50

Golder Associates

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: JP
CHECKED: DL

REV: 0

PROJECT No.: 13-1447-0497 / 5000

CLIENT: PWGSC
PROJECT: Geotechnical SOA
LOCATION: William Head Correctional Facility
N: ~5354125 E: ~459850 UTM NAD83 Zone: 10
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

RECORD OF TEST PIT: TP15-03

EXCAVATION DATE: May 1, 2015

INCLINATION: -90°

SHEET 1 OF 1

DATUM: Ground Surface

TEST PIT DIMENSIONS:

3 m Length x 0.6 m Width

DEPTH SCALE METRES	EXCAVATION METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY %	SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ◐, Pocket Pen - ■) 20 40 60 80 / WATER CONTENT PERCENT Wp ⊢○W⊣ Wl, NP - Non-Plastic 10 20 30 40	GRADATION % GRAVEL	SAND	FINES	PLASTICITY	FROZEN GROUND DESCRIPTION	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE, THERMISTOR INSTALLATION OR SEEPAGE OBSERVATION
0		Ground Surface												
	Excavator / Excavator Bucket	FILL - **(SM/GM)** SILTY SAND and SILTY GRAVEL; grey-brown, trace organics; non-cohesive, moist, loose.		0.00	1	G								
		(ML) sandy CLAYEY SILT, trace to some gravel; brown, with cobbles; cohesive, w>PL, soft to firm.		0.40	2	G								
1		**(CL)** sandy SILTY CLAY, trace gravel; grey-brown; cohesive, w<PL, stiff. - becoming very stiff with depth.		1.10										
2					3	G								
		End of Test Pit.		2.20										
3														
4														
5														
6														

DEPTH SCALE
1 : 50

Golder Associates

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: JP
CHECKED: DL

REV: 0

PROJECT No.: 13-1447-0497 / 5000

CLIENT: PWGSC
PROJECT: Geotechnical SOA
LOCATION: William Head Correctional Facility
N: ~5354100 E: ~459851 UTM NAD83 Zone: 10
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

RECORD OF TEST PIT: TP15-04

EXCAVATION DATE: April 30, 2015

INCLINATION: -90°

SHEET 1 OF 1

DATUM: Ground Surface

TEST PIT DIMENSIONS:

3.5 m Length x 2 m Width

DEPTH SCALE METRES	EXCAVATION METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY %	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ◐ / Pocket Pen - ▩) 20 40 60 80	WATER CONTENT PERCENT Wp W Wl NP - Non-Plastic 10 20 30 40	GRADATION % GRAVEL	GRADATION % SAND	GRADATION % FINES	PLASTICITY	FROZEN GROUND DESCRIPTION	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE, THERMISTOR INSTALLATION OR SEEPAGE OBSERVATION
0		Ground Surface														
	Excavator / Excavator Bucket	FILL - **(SP/GP)** SAND and GRAVEL, some fines; grey-brown, with cobbles; non-cohesive, moist to wet, loose. - one 0.4 m boulder at surface.		0.00	1	G										
1		**(ML)** sandy CLAYEY SILT, trace gravel; brown-grey; cohesive, w>PL, soft.		0.40	2	G										
2		**(CL)** SILTY CLAY, trace to some sand; brown-grey, (NATIVE); cohesive, w<PL, very stiff to hard.		1.40	3	G										
		End of Test Pit.		2.10												
3																
4																
5																
6																

DEPTH SCALE
1 : 50

Golder Associates

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: JP
CHECKED: DL

REV: 0

PROJECT No.: 13-1447-0497 / 5000

CLIENT: PWGSC
PROJECT: Geotechnical SOA
LOCATION: William Head Correctional Facility
N: ~5354109 E: ~459841 UTM NAD83 Zone: 10
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

RECORD OF TEST PIT: TP15-05

EXCAVATION DATE: April 30, 2015

INCLINATION: -90°

SHEET 1 OF 1

DATUM: Ground Surface

TEST PIT DIMENSIONS:

3.5 m Length x 0.6 m Width

DEPTH SCALE METRES	EXCAVATION METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY %	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ◐ / Pocket Pen - ■) 20 40 60 80	WATER CONTENT PERCENT Wp ⊢○W⊣ Wl, NP - Non-Plastic 10 20 30 40	GRADATION % GRAVEL	GRADATION % SAND	GRADATION % FINES	PLASTICITY	FROZEN GROUND DESCRIPTION	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE, THERMISTOR INSTALLATION OR SEEPAGE OBSERVATION
0		Ground Surface														
	Excavator / Excavator Bucket	FILL - **(SP/GP)** SAND and GRAVEL, some fines; grey; non-cohesive, moist, loose.		0.00	1	G										
		(CL) sandy SILTY CLAY, trace to some gravel; brown-grey; cohesive, w>PL, firm.		0.20	2	G										
1		**(CL)** SILTY CLAY, trace sand; light brown; cohesive, w<PL, very stiff.		0.90												
2					3	G										
		End of Test Pit.		2.70												
3																
4																
5																
6																

DEPTH SCALE
1 : 50

Golder Associates

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: JP
CHECKED: DL

REV: 0

National IM Server:GINT_GAL_NATIONALIM Unique Project ID: Output Form:BC_TESTPIT WITH PHOTO rwiggins 9/10/15

PROJECT No.: 13-1447-0497 / 5000

CLIENT: PWGSC
PROJECT: Geotechnical SOA
LOCATION: William Head Correctional Facility
N: ~5354116 E: ~459837 UTM NAD83 Zone: 10
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

RECORD OF TEST PIT: TP15-06

EXCAVATION DATE: May 1, 2015

INCLINATION: -90°

SHEET 1 OF 1

DATUM: Ground Surface

TEST PIT DIMENSIONS:

3 m Length x 0.6 m Width

DEPTH SCALE METRES	EXCAVATION METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	RECOVERY %	SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ◐, Pocket Pen - ■) 20 40 60 80	WATER CONTENT PERCENT Wp W Wl NP - Non-Plastic 10 20 30 40	GRADATION % GRAVEL	SAND	FINES	PLASTICITY	FROZEN GROUND DESCRIPTION	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE, THERMISTOR INSTALLATION OR SEEPAGE OBSERVATION
0		Ground Surface														
	Excavator / Excavator Bucket	FILL - **(SM/GM)** SILTY SAND and SILTY GRAVEL; grey-brown, trace organics (FIBROUS PEAT); non-cohesive, moist, loose.		0.00	1	G										
				0.30	2	G										
		(ML) sandy CLAYEY SILT, trace to some gravel; brown, with cobbles; cohesive, w>PL, soft to firm.														
1		**(CL)** sandy SILTY CLAY, trace gravel; grey-brown; cohesive, w<PL, stiff. - becoming very stiff with depth.		1.00												
2					3	G										
		End of Test Pit.		2.10												
3																
4																
5																
6																

DEPTH SCALE
1 : 50

Golder Associates

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: JP
CHECKED: DL

REV: 0

PROJECT No.: 13-1447-0497 / 5000

CLIENT: PWGSC

PROJECT: Geotechnical SOA

LOCATION: William Head Correctional Facility

N: ~5354108 E: ~459824 UTM NAD83 Zone: 10

Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

RECORD OF TEST PIT: TP15-07

EXCAVATION DATE: April 30, 2015

INCLINATION: -90°

SHEET 1 OF 1

DATUM: Ground Surface

TEST PIT DIMENSIONS:

3 m Length x 0.6 m Width

DEPTH SCALE METRES	EXCAVATION METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY %	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ◐ / Pocket Pen - ■) 20 40 60 80	WATER CONTENT PERCENT Wp W Wl NP - Non-Plastic 10 20 30 40	GRADATION % GRAVEL	GRADATION % SAND	GRADATION % FINES	PLASTICITY	FROZEN GROUND DESCRIPTION	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE, THERMISTOR INSTALLATION OR SEEPAGE OBSERVATION
0		Ground Surface														
	Excavator / Excavator Bucket	FILL - **(SP/GP)** SAND and GRAVEL, some fines; grey, with pockets of organics (FIBROUS PEAT); non-cohesive, moist, loose.		0.00	1	G										
				0.20												
		(CL) CLAYEY SILT, some gravel, some sand; brown-grey; cohesive, w>PL, soft to firm.			2	G										
1		**(CL)** SILTY CLAY, trace to some gravel; brown-grey; cohesive, w<PL, very stiff to hard.		0.90												
2					3	G										
		End of Test Pit. (Refusal)		2.10												
		NOTE: Possible bedrock.														
3																
4																
5																
6																

DEPTH SCALE

1 : 50

Golder Associates

SOIL CLASSIFICATION SYSTEM: GACS

LOGGED: JP

CHECKED: DL

REV: 0

PROJECT No.: 13-1447-0497 / 5000

CLIENT: PWGSC
PROJECT: Geotechnical SOA
LOCATION: William Head Correctional Facility
N: ~5354095 E: ~459821 UTM NAD83 Zone: 10
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

RECORD OF TEST PIT: TP15-08

EXCAVATION DATE: April 30, 2015

INCLINATION: -90°

SHEET 1 OF 1

DATUM: Ground Surface

TEST PIT DIMENSIONS:

3 m Length x 0.6 m Width

DEPTH SCALE METRES	EXCAVATION METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY %	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ◐ / Pocket Pen - ■) 20 40 60 80	WATER CONTENT PERCENT Wp W Wl NP - Non-Plastic 10 20 30 40	GRADATION % GRAVEL	GRADATION % SAND	GRADATION % FINES	PLASTICITY	FROZEN GROUND DESCRIPTION	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE, THERMISTOR INSTALLATION OR SEEPAGE OBSERVATION
0		Ground Surface														
	Excavator / Excavator Bucket	FILL - **(SP/GP)** SAND and GRAVEL, some fines; grey-black, with organics (FIBROUS PEAT); non-cohesive, moist, loose.		0.00	1	G										
				0.20	2	G										
		(CL) CLAYEY SILT, some gravel, some sand; brown-grey; cohesive, w>PL, soft to firm.		0.60												
1		**(CL)** SILTY CLAY, trace to some sand; brown-grey; cohesive, w<PL, very stiff to hard.														
2					3	G										
		End of Test Pit.		2.20												
3																
4																
5																
6																

DEPTH SCALE

1 : 50

Golder Associates

SOIL CLASSIFICATION SYSTEM: GACS

LOGGED: JP

CHECKED: DL

REV: 0

PROJECT No.: 13-1447-0497 / 5000

CLIENT: PWGSC
PROJECT: Geotechnical SOA
LOCATION: William Head Correctional Facility
N: ~5354084 E: ~459838 UTM NAD83 Zone: 10
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

RECORD OF TEST PIT: TP15-09

EXCAVATION DATE: April 30, 2015

INCLINATION: -90°

SHEET 1 OF 1

DATUM: Ground Surface

TEST PIT DIMENSIONS:

3 m Length x 0.6 m Width

DEPTH SCALE METRES	EXCAVATION METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY %	SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Pocket Pen -; Q - ●, U - ◐) 20 40 60 80 / WATER CONTENT PERCENT Wp W Wl, NP - Non-Plastic 10 20 30 40	GRADATION % GRAVEL	GRADATION % SAND	GRADATION % FINES	PLASTICITY	FROZEN GROUND DESCRIPTION	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE, THERMISTOR INSTALLATION OR SEEPAGE OBSERVATION
0		Ground Surface													
	Excavator / Excavator Bucket	FILL - **(SM/GM)** SILTY SAND and SILTY GRAVEL; brown-grey, with organics (FIBROUS PEAT); non-cohesive, moist, loose.		0.00	1	G									
		(CL) CLAYEY SILT, trace to some gravel; brown-grey; cohesive, w>PL, firm.		0.50	2	G									
1		**(CL)** SILTY CLAY, trace to some sand; light brown; cohesive, w<PL, very stiff to hard.		0.90	3	G									
2															
		End of Test Pit.		2.40											
3															
4															
5															
6															

DEPTH SCALE
1 : 50

Golder Associates

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: JP
CHECKED: DL

REV: 0

National IM Server:GINT_GAL_NATIONALIM Unique Project ID: Output Form:BC_TESTPIT WITH PHOTO rwiggins 9/10/15

PROJECT No.: 13-1447-0497 / 5000

CLIENT: PWGSC
PROJECT: Geotechnical SOA
LOCATION: William Head Correctional Facility
N: ~5354097 E: ~459830 UTM NAD83 Zone: 10
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

RECORD OF TEST PIT: TP15-10

EXCAVATION DATE: April 30, 2015

INCLINATION: -90°

SHEET 1 OF 1

DATUM: Ground Surface

TEST PIT DIMENSIONS:

2.5 m Length x 0.6 m Width

DEPTH SCALE METRES	EXCAVATION METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY %	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ◐ / Pocket Pen - ■) 20 40 60 80	WATER CONTENT PERCENT Wp W Wl NP - Non-Plastic 10 20 30 40	GRADATION % GRAVEL	GRADATION % SAND	GRADATION % FINES	PLASTICITY	FROZEN GROUND DESCRIPTION	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE, THERMISTOR INSTALLATION OR SEEPAGE OBSERVATION
0		Ground Surface														
0	Excavator / Excavator Bucket	FILL - **(SC/GC)** sandy CLAYEY SAND and CLAYEY GRAVEL; grey-black, with cobbles, with organics (FIBROUS PEAT); cohesive, w>PL, soft.		0.00	1	G										
1	Excavator / Excavator Bucket	**(CL)** CLAYEY SILT, some gravel; light brown; cohesive, w<PL, very stiff to hard.		0.50	2	G										
1		End of Test Pit.		1.50												
2																
3																
4																
5																
6																

DEPTH SCALE
1 : 50

Golder Associates

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: JP
CHECKED: DL

REV: 0

PROJECT No.: 13-1447-0497 / 5000

CLIENT: PWGSC
PROJECT: Geotechnical SOA
LOCATION: William Head Correctional Facility
N: ~5354092 E: ~459836 UTM NAD83 Zone: 10
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

RECORD OF TEST PIT: TP15-11

EXCAVATION DATE: April 30, 2015

INCLINATION: -90°

SHEET 1 OF 1

DATUM: Ground Surface

TEST PIT DIMENSIONS:

3.5 m Length x 0.6 m Width

DEPTH SCALE METRES	EXCAVATION METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY %	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ◐ / Pocket Pen - ■) 20 40 60 80	WATER CONTENT PERCENT Wp W Wl NP - Non-Plastic 10 20 30 40	GRADATION % GRAVEL	GRADATION % SAND	GRADATION % FINES	PLASTICITY	FROZEN GROUND DESCRIPTION	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE, THERMISTOR INSTALLATION OR SEEPAGE OBSERVATION
0		Ground Surface														
	Excavator / Excavator Bucket	FILL - **(SC/GC)** CLAYEY SAND and CLAYEY GRAVEL; grey-black, with cobbles, with organics (FIBROUS PEAT); cohesive, w>PL, soft.		0.00	1	G										
				0.15	2	G										
		(CL) sandy CLAYEY SILT, trace to some gravel; brown-grey; cohesive, w>PL, firm.		0.50												
1		**(CL)** SILTY CLAY, trace to some sand; light brown; cohesive, w<PL, very stiff to hard.														
					3	G										
2		End of Test Pit.		2.00												
3																
4																
5																
6																

DEPTH SCALE
1 : 50

Golder Associates

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: JP
CHECKED: DL

REV: 0

PROJECT No.: 13-1447-0497 / 5000

CLIENT: PWGSC
PROJECT: Geotechnical SOA
LOCATION: William Head Correctional Facility
N: ~5354084 E: ~459844 UTM NAD83 Zone: 10
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

RECORD OF TEST PIT: TP15-12

EXCAVATION DATE: April 30, 2015

INCLINATION: -90°

SHEET 1 OF 1

DATUM: Ground Surface

TEST PIT DIMENSIONS:

3 m Length x 0.6 m Width

DEPTH SCALE METRES	EXCAVATION METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY %	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ◐ / Pocket Pen - ■) 20 40 60 80	WATER CONTENT PERCENT Wp W Wl NP - Non-Plastic 10 20 30 40	GRADATION % GRAVEL	GRADATION % SAND	GRADATION % FINES	PLASTICITY	FROZEN GROUND DESCRIPTION	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE, THERMISTOR INSTALLATION OR SEEPAGE OBSERVATION
		Ground Surface														
0	Excavator / Excavator Bucket	**(CL)** sandy CLAYEY SILT, trace to some gravel; grey-brown, mottled orange; cohesive, w>PL, soft to firm.		0.00	1	G										
1	Excavator / Excavator Bucket	**(CL)** sandy SILTY CLAY, trace to some gravel; light brown; cohesive, w~PL, very stiff.		1.40	2	G										
2		End of Test Pit.		1.90												
3																
4																
5																
6																

DEPTH SCALE
1 : 50

Golder Associates

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: JP
CHECKED: DL

REV: 0

PROJECT No.: 13-1447-0497 / 5000

CLIENT: PWGSC
PROJECT: Geotechnical SOA
LOCATION: William Head Correctional Facility
N: ~5354077 E: ~459838 UTM NAD83 Zone: 10
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

RECORD OF TEST PIT: TP15-13

EXCAVATION DATE: April 30, 2015

INCLINATION: -90°

SHEET 1 OF 1

DATUM: Ground Surface

TEST PIT DIMENSIONS:

2.5 m Length x 0.6 m Width

DEPTH SCALE METRES	EXCAVATION METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY %	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ◐ / Pocket Pen - ■) 20 40 60 80	WATER CONTENT PERCENT Wp W WI NP - Non-Plastic 10 20 30 40	GRADATION % GRAVEL	GRADATION % SAND	GRADATION % FINES	PLASTICITY	FROZEN GROUND DESCRIPTION	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE, THERMISTOR INSTALLATION OR SEEPAGE OBSERVATION
0		Ground Surface														
	Excavator / Excavator Bucket	**(CL)** sandy CLAYEY SILT, trace to some gravel; brown; cohesive, w>PL, soft to firm.		0.00	GSA-01	G										
1	Excavator / Excavator Bucket	**(CL)** SILTY CLAY, trace to some sand, trace gravel; light brown; cohesive, w~PL, very stiff.		0.70	GSA-02	G										
		End of Test Pit.		1.50												
2																
3																
4																
5																
6																

DEPTH SCALE
1 : 50

Golder Associates

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: JP
CHECKED: DL

REV: 0

PROJECT No.: 13-1447-0497 / 5000

CLIENT: PWGSC
PROJECT: Geotechnical SOA
LOCATION: William Head Correctional Facility
N: ~5354097 E: ~459843 UTM NAD83 Zone: 10
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

RECORD OF TEST PIT: TP15-14

EXCAVATION DATE: April 30, 2015

INCLINATION: -90°

SHEET 1 OF 1

DATUM: Ground Surface

TEST PIT DIMENSIONS:

3 m Length x 0.6 m Width

DEPTH SCALE METRES	EXCAVATION METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY %	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ◐ / Pocket Pen - ■) 20 40 60 80	WATER CONTENT PERCENT Wp W Wl NP - Non-Plastic 10 20 30 40	GRADATION % GRAVEL	GRADATION % SAND	GRADATION % FINES	PLASTICITY	FROZEN GROUND DESCRIPTION	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE, THERMISTOR INSTALLATION OR SEEPAGE OBSERVATION
0		Ground Surface														
	Excavator / Excavator Bucket	FILL - **(SP/GP)** SAND and GRAVEL, some fines; grey; non-cohesive, moist, loose.		0.00	1	G										
				0.20	2	G										
		(CL) CLAYEY SILT, some gravel, some sand; brown-grey; cohesive, w>PL, soft to firm.		0.50												
1		**(CL)** SILTY CLAY, trace to some sand; brown-grey; cohesive, w<PL, very stiff to hard.														
2					3	G										
		End of Test Pit.		2.00												
3																
4																
5																
6																

DEPTH SCALE
1 : 50

Golder Associates

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: JP
CHECKED: DL

REV: 0

PROJECT No.: 13-1447-0497 / 5000

CLIENT: PWGSC
PROJECT: WHCF - Maintenance Building
LOCATION: Victoria, B.C.
N: ~5354101 E: ~459841 UTM NAD83 Zone: 10
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

RECORD OF TEST PIT: TP15-16

EXCAVATION DATE: August 10, 2015
EXCAVATION CONTRACTOR: Hermsen Construction Ltd.
INCLINATION: -90°

SHEET 1 OF 1
DATUM: Ground Surface
TEST PIT DIMENSIONS:
3.5 m Length x 1.5 m Width

DEPTH SCALE METRES	EXCAVATION METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY %	SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ◐, Pocket Pen - ■) 20 40 60 80 / WATER CONTENT PERCENT Wp W Wl NP - Non-Plastic 10 20 30 40	GRADATION % GRAVEL	GRADATION % SAND	GRADATION % FINES	PLASTICITY	FROZEN GROUND DESCRIPTION	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE, THERMISTOR INSTALLATION OR SEEPAGE OBSERVATION
0		Ground Surface													
	Excavator, Excavator Bucket	FILL - **(SM-GM)** SILTY SAND to SILTY GRAVEL; brown; dry, compact.		0.00											
1		**(ML)** sandy CLAYEY SILT, trace to some gravel; brown, with cobbles (<5%); cohesive, moist, stiff.		0.40					5	56	39				
2		**(CL)** SILTY CLAY, some sand to sandy, trace gravel; brown; cohesive, moist, stiff to very stiff.		1.60				○							
3		End of Test Pit. (Refusal) NOTE: Possible bedrock.		3.00											
4															
5															
6															

DEPTH SCALE
1 : 50

Golder Associates

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: DM
CHECKED: DL

REV: 0

National IM Server:GINT_GAL_NATIONALIM Unique Project ID: Output Form:BC_TESTPIT WITH PHOTO AWood 18/12/17

PROJECT No.: 13-1447-0497 / 5000

CLIENT: PWGSC
PROJECT: WHCF - Maintenance Building
LOCATION: Victoria, B.C.

N: ~5354093 E: ~459846 UTM NAD83 Zone: 10
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

RECORD OF TEST PIT: TP15-17

EXCAVATION DATE: August 10, 2015
EXCAVATION CONTRACTOR: Hermsen Construction Ltd.

INCLINATION: -90°

SHEET 1 OF 1

DATUM: Ground Surface

TEST PIT DIMENSIONS:

3.5 m Length x 1.5 m Width

DEPTH SCALE METRES	EXCAVATION METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY %	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● rem V. ⊕ U - ◐ Pocket Pen - ■) 20 40 60 80 / WATER CONTENT PERCENT Wp I—○W—I WI (NP - Non-Plastic) 10 20 30 40	GRADATION % GRAVEL	GRADATION % SAND	GRADATION % FINES	PLASTICITY	FROZEN GROUND DESCRIPTION	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE, THERMISTOR INSTALLATION OR SEEPAGE OBSERVATION
		Ground Surface												
0	Excavator Excavator Bucket	**(ML)** sandy CLAYEY SILT, trace gravel; brown, with cobbles (<5%); cohesive, dry, stiff.		0.00										
		(CL) SILTY CLAY, some sand, trace gravel; brown; cohesive, moist, stiff to very stiff.		0.40				○						
1														
2								○						
3														
4														
		End of Test Pit. (Refusal) NOTE: Possible bedrock.		4.20										
5														
6														

DEPTH SCALE
1 : 50

Golder Associates

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: DM
CHECKED: DL

REV: 0

National IM Server:GINT_GAL_NATIONALIM Unique Project ID: Output Form:BC_TESTPIT WITH PHOTO AWood 18/12/17

PROJECT No.: 13-1447-0497 / 5000

CLIENT: PWGSC
PROJECT: WHCF - Maintenance Building
LOCATION: Victoria, B.C.
N: ~5354109 E: ~459847 UTM NAD83 Zone: 10
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

RECORD OF TEST PIT: TP15-18

EXCAVATION DATE: August 10, 2015
EXCAVATION CONTRACTOR: Hermsen Construction Ltd.
INCLINATION: -90°

SHEET 1 OF 1
DATUM: Ground Surface
TEST PIT DIMENSIONS:
3.5 m Length x 1.5 m Width

DEPTH SCALE METRES	EXCAVATION METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY %	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ◐ / Pocket Pen - ■) 20 40 60 80	WATER CONTENT PERCENT Wp W Wl NP - Non-Plastic 10 20 30 40	GRADATION % GRAVEL	GRADATION % SAND	GRADATION % FINES	PLASTICITY	FROZEN GROUND DESCRIPTION	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE, THERMISTOR INSTALLATION OR SEEPAGE OBSERVATION
0		Ground Surface														
	Excavator Excavator Bucket	FILL - **(SM-GM)** SILTY SAND and SILTY GRAVEL; brown; non-cohesive, dry, compact.		0.00												
		(ML) sandy CLAYEY SILT, some GRAVEL; with cobbles (<5%); m<PL, stiff.		0.30				○								
1		**(CL)** SILTY CLAY, some sand, trace gravel; brown; cohesive, w<PL, stiff to very stiff.		0.90				○	⊢——⊣							
2																
3																
4																
		(CL) SILTY CLAY, trace sand; grey; cohesive, w~PL, stiff to very stiff.		4.30				○								
5		**(SM)** SILTY SAND; brown; wet, compact.		5.00												
		End of Test Pit. (Refusal)		5.30												
		NOTE: Possible bedrock.														
6																

DEPTH SCALE
1 : 50

Golder Associates

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: DM
CHECKED: DL

REV: 0

National IM Server:GINT_GAL_NATIONALIM Unique Project ID: Output Form:BG_TESTPIT WITH PHOTO AWood 18/12/17

PROJECT No.: 13-1447-0497 / 5000

CLIENT: PWGSC
PROJECT: WHCF - Maintenance Building
LOCATION: Victoria, B.C.

N: ~5354101 E: ~459851 UTM NAD83 Zone: 10
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

RECORD OF TEST PIT: TP15-19

EXCAVATION DATE: August 10, 2015
EXCAVATION CONTRACTOR: Hermsen Construction Ltd.

INCLINATION: -90°

SHEET 1 OF 1

DATUM: Ground Surface

TEST PIT DIMENSIONS:

3.5 m Length x 1.5 m Width

DEPTH SCALE METRES	EXCAVATION METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY %	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ◐ / Pocket Pen - ■) 20 40 60 80	WATER CONTENT PERCENT Wp W Wl NP - Non-Plastic 10 20 30 40	GRADATION % GRAVEL	GRADATION % SAND	GRADATION % FINES	PLASTICITY	FROZEN GROUND DESCRIPTION	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE, THERMISTOR INSTALLATION OR SEEPAGE OBSERVATION
		Ground Surface														
0	Excavator Excavator Bucket	FILL - **(SM-GM)** SILTY SAND and SILTY GRAVEL; brown; non-cohesive, dry, compact.		0.00												
		(ML) sandy CLAYEY SILT, some gravel; with cobbles (<5%); cohesive, w<PL, stiff.		0.25												
1		**(CL)** SILTY CLAY, some sand, trace gravel; brown; cohesive, w<PL, stiff to very stiff.		0.70												
2																
3																
4																
		End of Test Pit. (Refusal)		4.50												
5		NOTE: Possible bedrock.														
6																

DEPTH SCALE
1 : 50

Golder Associates

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: DM
CHECKED: DL

REV: 0

PROJECT No.: 13-1447-0497 / 5000

CLIENT: PWGSC
PROJECT: WHCF - Maintenance Building
LOCATION: Victoria, B.C.
N: ~5354099 E: ~459861 UTM NAD83 Zone: 10
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

RECORD OF TEST PIT: TP15-20

EXCAVATION DATE: August 10, 2015
EXCAVATION CONTRACTOR: Hermsen Construction Ltd.
INCLINATION: -90°

SHEET 1 OF 1
DATUM: Ground Surface
TEST PIT DIMENSIONS:
3.5 m Length x 1.5 m Width

DEPTH SCALE METRES	EXCAVATION METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY %	SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ◐, Pocket Pen - ■) 20 40 60 80 / WATER CONTENT PERCENT Wp I ○W I Wl NP - Non-Plastic 10 20 30 40	GRADATION % GRAVEL	SAND	FINES	PLASTICITY	FROZEN GROUND DESCRIPTION	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE, THERMISTOR INSTALLATION OR SEEPAGE OBSERVATION
0		Ground Surface												
	Excavator	**(OL)** sandy ORGANIC SILT, trace gravel; dark brown; non-cohesive, moist, loose.		0.00										
	Excavator Bucket	**(ML)** sandy CLAYEY SILT, trace to some gravel; brown, with cobbles (<5%); cohesive, w<PL, stiff.		0.30				○						
1		**(CL)** SILTY CLAY, some sand, trace gravel; brown; cohesive, w<PL, stiff to very stiff.		0.90				○						
2														
3														
4														
5														
		End of Test Pit. NOTE: Limit of excavator reach.		5.50										
6														

DEPTH SCALE
1 : 50

Golder Associates

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: DM
CHECKED: DL

REV: 0

PROJECT No.: 13-1447-0497 / 5000

CLIENT: PWGSC
PROJECT: WHCF - Maintenance Building
LOCATION: Victoria, B.C.
N: ~5354130 E: ~459866 UTM NAD83 Zone: 10
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

RECORD OF TEST PIT: TP15-21

EXCAVATION DATE: August 10, 2015
EXCAVATION CONTRACTOR: Hermsen Construction Ltd.
INCLINATION: -90°

SHEET 1 OF 1
DATUM: Ground Surface
TEST PIT DIMENSIONS:
3.5 m Length x 1.5 m Width

DEPTH SCALE METRES	EXCAVATION METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY %	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ◐ / Pocket Pen - ■) 20 40 60 80	WATER CONTENT PERCENT Wp ⊢ ○ W ⊣ Wl (NP - Non-Plastic) 10 20 30 40	GRADATION % GRAVEL	GRADATION % SAND	GRADATION % FINES	PLASTICITY	FROZEN GROUND DESCRIPTION	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE, THERMISTOR INSTALLATION OR SEEPAGE OBSERVATION
		Ground Surface														
0	Excavator / Excavator Bucket	**(OL)** sandy ORGANIC SILT, trace gravel; brown; non-cohesive, dry, loose.		0.00												
		(ML) sandy CLAYEY SILT, some gravel; brown, with cobbles (<5%); cohesive, w<PL, stiff.		0.40				○								
1		**(CL)** SILTY CLAY, some sand, trace gravel; brown; cohesive, w<PL, stiff to very stiff.		0.95				○								
2																
3		End of Test Pit. (Refusal) NOTE: Possible bedrock.		2.80												
4																
5																
6																

DEPTH SCALE
1 : 50

Golder Associates

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: DM
CHECKED: DL

REV: 0

National IM Server:GINT_GAL_NATIONALIM Unique Project ID: Output Form:BC_TESTPIT WITH PHOTO AWood 18/12/17

PROJECT No.: 13-1447-0497 / 5000

CLIENT: PWGSC
PROJECT: WHCF - Maintenance Building
LOCATION: Victoria, B.C.
N: ~5354123 E: ~459877 UTM NAD83 Zone: 10
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

RECORD OF TEST PIT: TP15-22

EXCAVATION DATE: August 10, 2015
EXCAVATION CONTRACTOR: Hermsen Construction Ltd.
INCLINATION: -90°

SHEET 1 OF 1
DATUM: Ground Surface
TEST PIT DIMENSIONS:
3.5 m Length x 1.5 m Width

DEPTH SCALE METRES	EXCAVATION METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY %	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ◐ / Pocket Pen - ■) 20 40 60 80	WATER CONTENT PERCENT Wp W Wl NP - Non-Plastic 10 20 30 40	GRADATION % GRAVEL	GRADATION % SAND	GRADATION % FINES	PLASTICITY	FROZEN GROUND DESCRIPTION	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE, THERMISTOR INSTALLATION OR SEEPAGE OBSERVATION
		Ground Surface														
0	Excavator / Excavator Bucket	**(OL)** sandy ORGANIC SILT, some gravel; dark brown; non-cohesive, dry, loose.		0.00												
1		**(ML)** sandy CLAYEY SILT, some gravel; brown, with cobbles (<5%); cohesive, w<PL, stiff.		0.50				○								
2		**(CL)** SILTY CLAY, some sand, trace gravel; brown, with cobbles (<5%); cohesive, w<PL, stiff.		1.30												
		End of Test Pit. (Refusal) NOTE: Possible bedrock.		2.10												
3																
4																
5																
6																

DEPTH SCALE
1 : 50

Golder Associates

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: DM
CHECKED: DL

REV: 0

National IM Server:GINT_GAL_NATIONALIM Unique Project ID: Output Form:BC_TESTPIT WITH PHOTO AWood 18/12/17

PROJECT No.: 13-1447-0497 / 5000

RECORD OF TEST PIT: TP15-23

SHEET 1 OF 1

DATUM: Ground Surface

CLIENT: PWGSC
PROJECT: WHCF - Maintenance Building
LOCATION: Victoria, B.C.
N: ~5354117 E: ~459879 UTM NAD83 Zone: 10
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

EXCAVATION DATE: August 10, 2015
EXCAVATION CONTRACTOR: Hermsen Construction Ltd.
INCLINATION: -90°

TEST PIT DIMENSIONS:
3.5 m Length x 1.5 m Width

DEPTH SCALE METRES	EXCAVATION METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY %	SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ◐, Pocket Pen - ■) 20 40 60 80 / WATER CONTENT PERCENT Wp W Wl, NP - Non-Plastic 10 20 30 40	GRADATION % GRAVEL	GRADATION % SAND	GRADATION % FINES	PLASTICITY	FROZEN GROUND DESCRIPTION	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE, THERMISTOR INSTALLATION OR SEEPAGE OBSERVATION
0		Ground Surface												
	Excavator, Excavator Bucket	**(OL)** sandy ORGANIC SILT, some gravel; dark brown; non-cohesive, dry, loose.		0.00										
		(SM) SILTY SAND, some gravel; brown, with cobbles; non-cohesive, dry, compact.		0.30					18	67	15			
1		**(ML)** sandy CLAYEY SILT, some gravel; brown; cohesive, w<PL, stiff.		1.10										
		(CL) SILTY CLAY, trace to some sand, trace gravel; brown; cohesive, w<PL, stiff to very stiff.		1.70										
2														
		End of Test Pit.		2.60										
3														
4														
5														
6														

DEPTH SCALE
1 : 50

Golder Associates

SOIL CLASSIFICATION SYSTEM: GACS
LOGGED: DM
CHECKED: DL

REV: 0

APPENDIX D

Geotechnical Laboratory Testing Results

Golder Associates

Golder Associates

WATER CONTENT DETERMINATION

ASTM D 2216

Client: PWGSC
Project: WHCF - Maintenance Building
Location: Victoria, B.C.
Project No.: 13-1447-0497 **Phase:** 5000

Project No.: 13-1447-0497 **Phase:** 5000
Lab Schedule No.:

Sample Location	Sample No.	Specimen No.	Depth Interval		Water Content (%)
			Depth (m)	Bottom (m)	
TP15-16	2		2.80	3.00	20.8
TP15-17	2		1.20	1.30	17.4
TP15-17	3		2.20	2.30	20.5
TP15-18	1		0.50	0.60	17.2
TP15-18	2		1.10	1.20	15.2
TP15-18	3		4.30	4.40	22.5
TP15-19	1		0.50	0.60	16.0
TP15-19	2		1.10	1.20	16.7
TP15-20	1		0.60	0.70	14.0
TP15-20	2		1.10	1.20	19.1
TP15-21	1		0.70	0.80	10.0
TP15-21	2		1.20	1.30	16.5
TP15-22	1		1.10	1.30	4.7

DRL 8/28/2015

Checked Date

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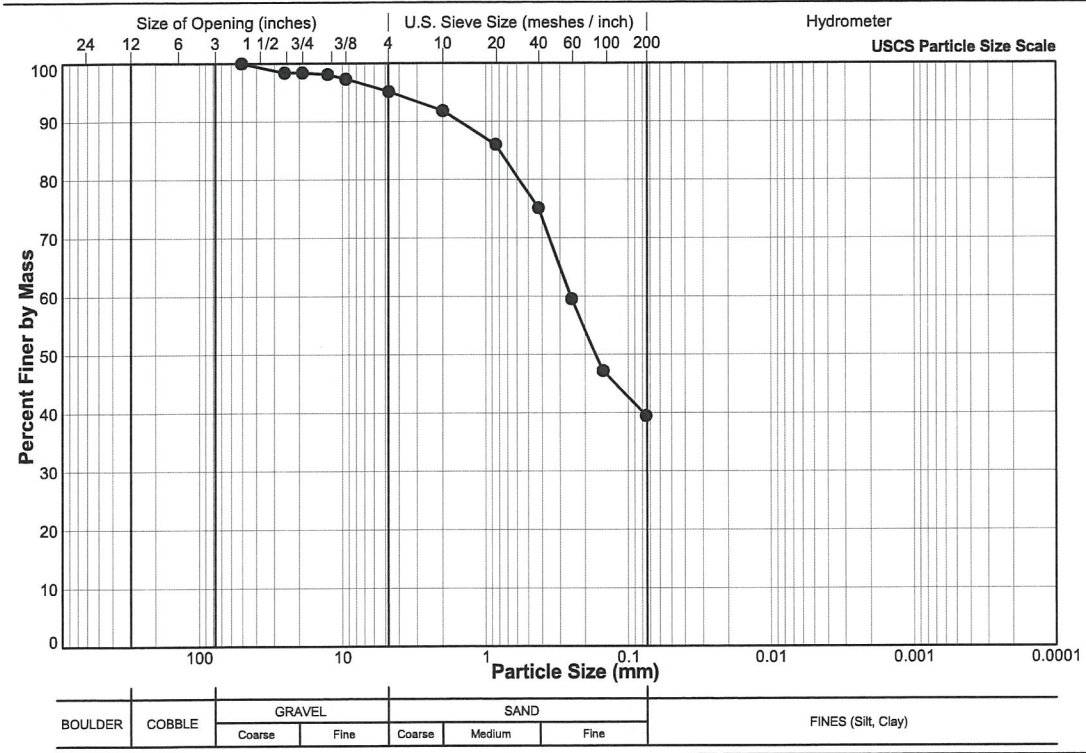
SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM C136, C117

Client: PWGSC
Project: WHCF - Maintenance Building
Location: Victoria, B.C.
Project No.: 13-1447-0497 **Phase:** 5000

Sample Location: TP15-16
Sample No.: 1
Depth Interval (m): 1.20 to 1.30
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
2"	50.8		100.0
1"	25.4		98.4
3/4"	19.1		98.4
1/2"	12.7		98.1
3/8"	9.5		97.3
#4 US MESH	4.75		95.2
#10 US MESH	2		91.8
#20 US MESH	0.85		86.0
#40 US MESH	0.425		75.2
#60 US MESH	0.25		59.5
#100 US MESH	0.15		47.2
#200 US MESH	0.075		39.5

AA	8/25/2015	DRL	8/28/2015
Tech	Date	Checked	Date

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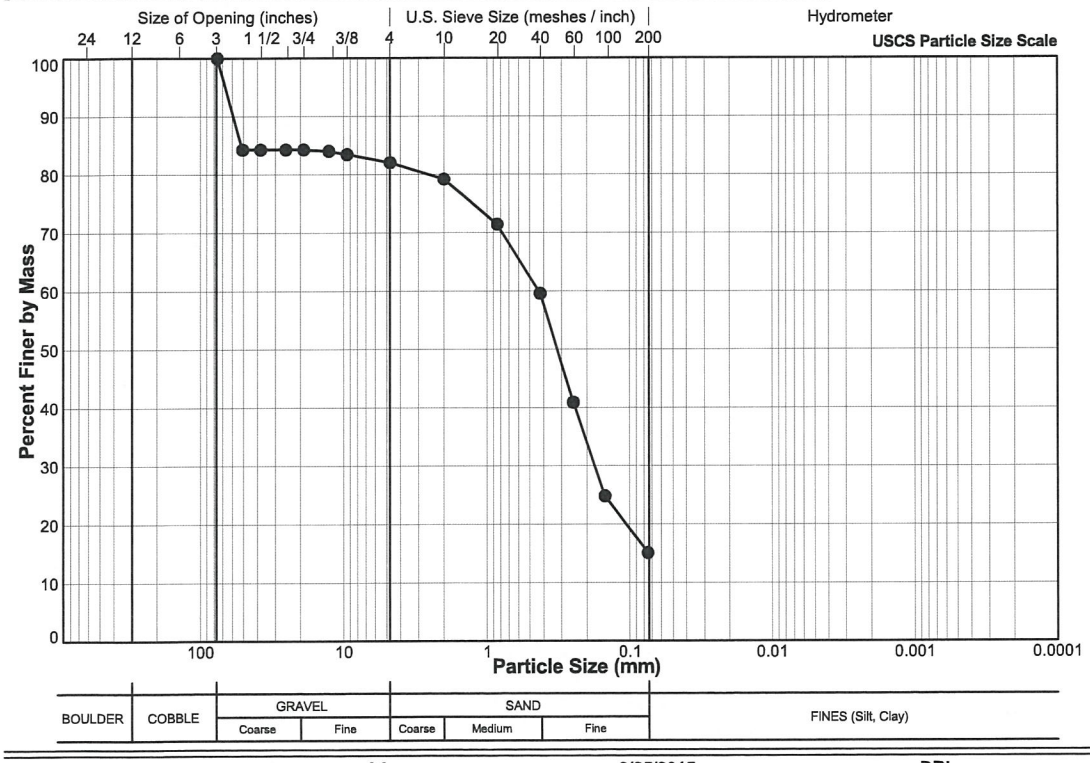
SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM C136, C117

Client: PWGSC
Project: WHCF - Maintenance Building
Location: Victoria, B.C.
Project No.: 13-1447-0497 **Phase:** 5000

Sample Location: TP15-23
Sample No.: 1
Depth Interval (m): 0.60 to 0.70
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
3"	76.2		100.0
2"	50.8		84.3
1 1/2"	38.1		84.3
1"	25.4		84.3
3/4"	19.1		84.3
1/2"	12.7		84.0
3/8"	9.5		83.5
#4 US MESH	4.75		82.1
#10 US MESH	2		79.2
#20 US MESH	0.85		71.5
#40 US MESH	0.425		59.6
#60 US MESH	0.25		40.9
#100 US MESH	0.15		24.8
#200 US MESH	0.075		15.1

AA	8/25/2015	DRL	8/28/2015
Tech	Date	Checked	Date

National IM Server:GINT GAL NATIONALIM Unique Project ID:983 Output Form: LAB PARTICLE SIZE (W/ GRADATIONS) 2015 dmackie 8/31/15

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LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS

ASTM D 4318-10

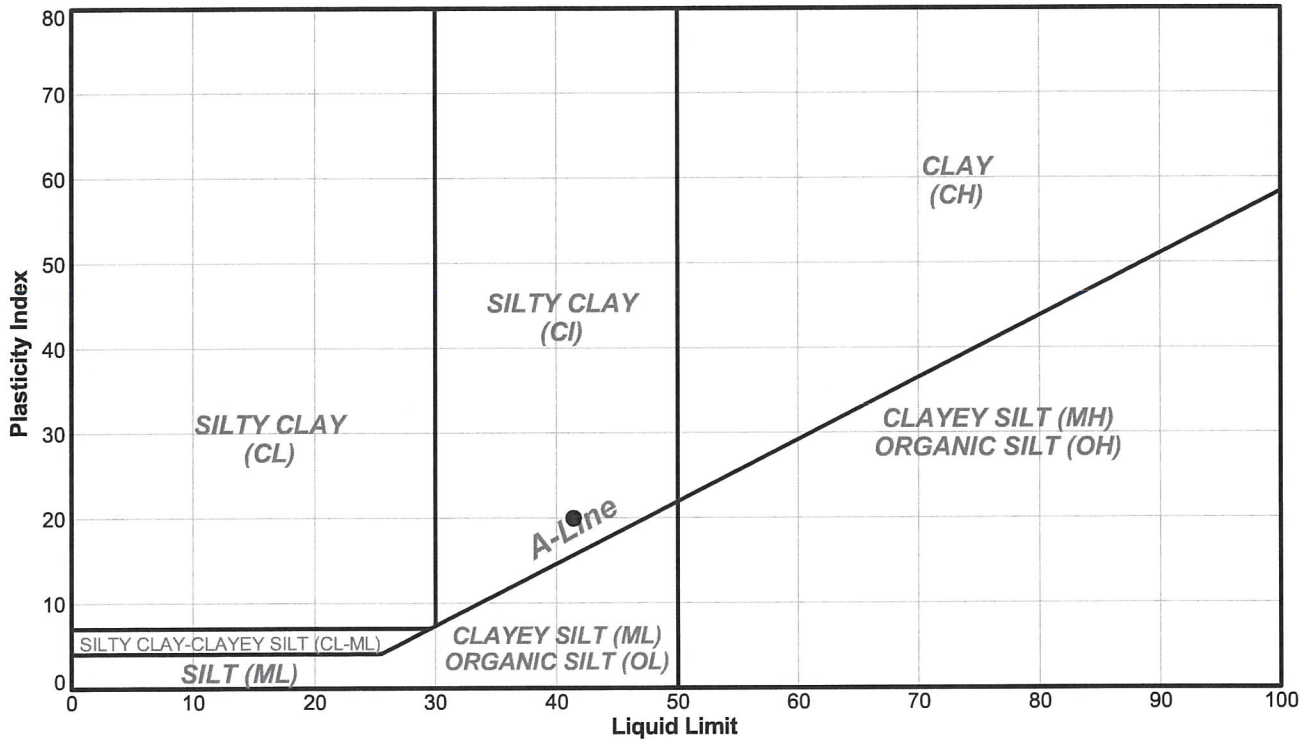
Client: PWGSC
Project: WHCF - Maintenance Building
Location: Victoria, B.C.
Project No.: 13-1447-0497 **Phase:** 5000

Test Pit ID: TP15-18
Sample No.: 2
Depth Interval (m): 1.10 to 1.20
Lab Schedule No.:

Other Remarks: N/A

Test Method: A-Multi Point | **Preparation Method:** Wet

PLASTICITY CHART



Sym.	Sample Location	Sample / Specimen Number	Depth (m)	Bottom (m)	Percent Passing #40 Sieve (%)	Liquid Limit	Plastic Limit	Plasticity Index	Natural Water Content (%)	Liquidity Index
●	TP15-18	2	1.10	1.20	ND	41	21	20.0	15.2	-0.3

NP - NON-PLASTIC RESULT ND - NOT DETERMINED

AA	8/26/2015	DRL	8/28/2015
Tech	Date	Checked	Date

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LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS

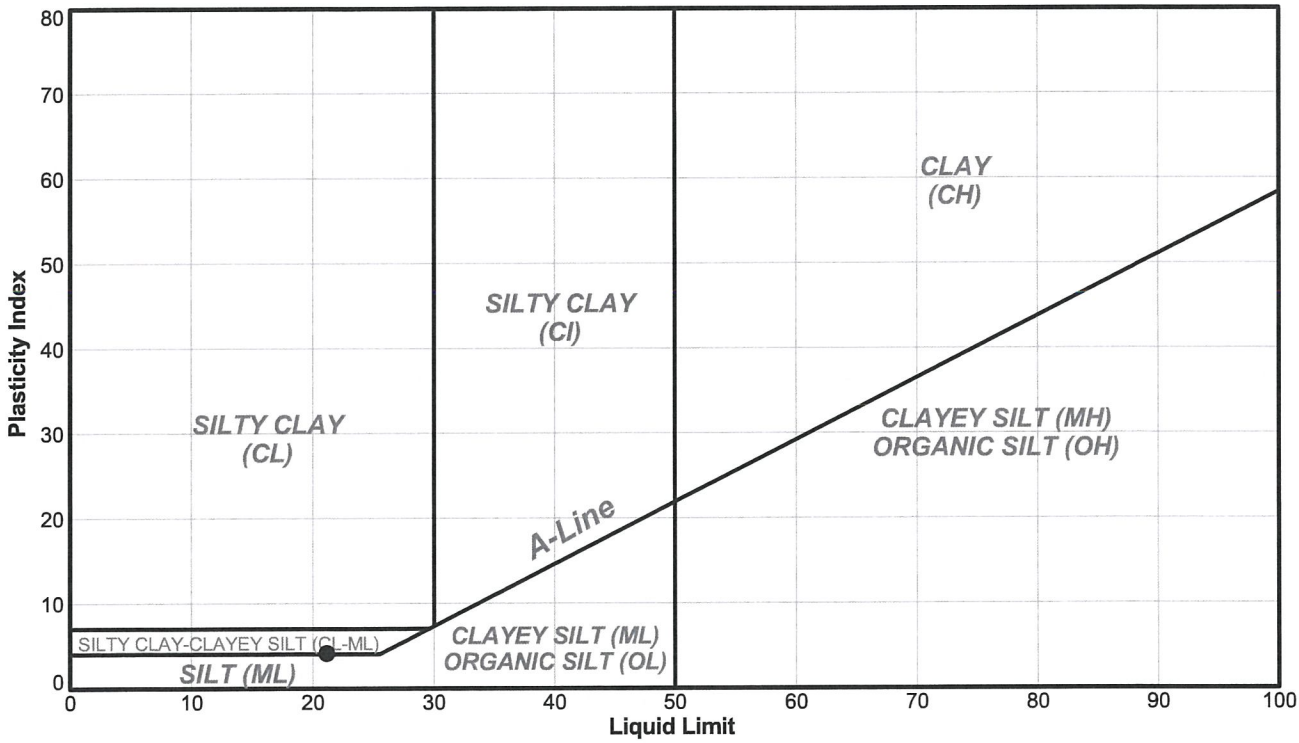
ASTM D 4318-10

Client:	PWGSC	**Test Pit ID:**	TP15-19
Project:	WHCF - Maintenance Building	**Sample No.:**	1
Location:	Victoria, B.C.	**Depth Interval (m):**	0.50 to 0.60
Project No.:	13-1447-0497 **Phase:** 5000	**Lab Schedule No.:**	

Other Remarks: N/A

Test Method: A-Multi Point	**Preparation Method:** Wet

PLASTICITY CHART



Sym.	Sample Location	Sample / Specimen Number	Depth (m)	Bottom (m)	Percent Passing #40 Sieve (%)	Liquid Limit	Plastic Limit	Plasticity Index	Natural Water Content (%)	Liquidity Index
●	TP15-19	1	0.50	0.60	ND	21	17	4.0	16.0	-0.3

NP - NON-PLASTIC RESULT ND - NOT DETERMINED

AA	8/26/2015	DRL	8/28/2015
Tech	Date	Checked	Date

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APPENDIX E

Site Specific Seismic Hazard Calculation

Golder Associates

2010 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

Requested by: A. Ramey, Golder Associates

September 03, 2015

Site Coordinates: 48.3387 North 123.5416 West

User File Reference: Williams Head Institute

National Building Code ground motions:
2% probability of exceedance in 50 years (0.000404 per annum)

Sa(0.2)	Sa(0.5)	Sa(1.0)	Sa(2.0)	PGA (g)
1.149	0.779	0.366	0.181	0.569

Notes. Spectral and peak hazard values are determined for firm ground (NBCC 2010 soil class C - average shear wave velocity 360-750 m/s). Median (50th percentile) values are given in units of g. 5% damped spectral acceleration (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are tabulated. Only 2 significant figures are to be used. ***These values have been interpolated from a 10 km spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the calculated values.*** Warning: You are in a region which considers the hazard from a deterministic Cascadia subduction event for the National Building Code. Values determined for high probabilities (0.01 per annum) in this region do not consider the hazard from this type of earthquake.

Ground motions for other probabilities:

Probability of exceedance per annum	0.010	0.0021	0.001
Probability of exceedance in 50 years	40%	10%	5%
Sa(0.2)	0.304	0.634	0.842
Sa(0.5)	0.199	0.423	0.565
Sa(1.0)	0.094	0.199	0.267
Sa(2.0)	0.042	0.092	0.126
PGA	0.154	0.316	0.419

References

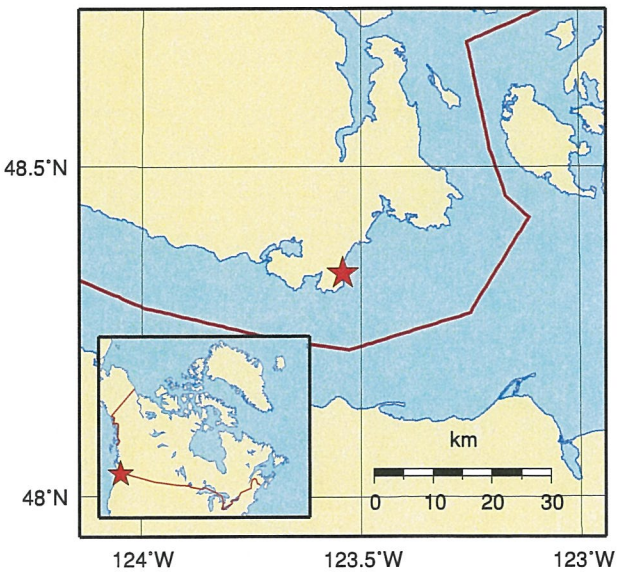
National Building Code of Canada 2010 NRCC no. 53301; sections 4.1.8, 9.20.1.2, 9.23.10.2, 9.31.6.2, and 6.2.1.3
Appendix C: Climatic Information for Building Design in Canada - table in Appendix C starting on page C-11 of Division B, volume 2

User's Guide - NBC 2010, Structural Commentaries NRCC no. 53543 (in preparation)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File xxxx
Fourth generation seismic hazard maps of Canada: Maps and grid values to be used with the 2010 National Building Code of Canada (in preparation)

See the websites *www.EarthquakesCanada.ca* and *www.nationalcodes.ca* for more information

Aussi disponible en français



At Golder Associates we strive to be the most respected global company providing consulting, design, and construction services in earth, environment, and related areas of energy. Employee owned since our formation in 1960, our focus, unique culture and operating environment offer opportunities and the freedom to excel, which attracts the leading specialists in our fields. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America, and South America.

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Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

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Golder Associates

GOLDER

TECHNICAL MEMORANDUM

DATE 17 April 2018

1790027-001-TM-Rev0

TO Konhee Ho
DGBK Architects

FROM Sarah Morse, PEng, PMP

EMAIL smorse@golder.com

REVIEW OF GEOTECHNICAL INPUT FOR 2015 NATIONAL BUILDING CODE
WILLIAM HEAD INSTITUTION, MAINTENANCE BUILDING
METCHOSIN, BRITISH COLUMBIA

This report provides the results of the review of geotechnical recommendations provided by Golder Associates Ltd. (Golder) for the proposed maintenance building at William Head Institution in Metchosin, British Columbia (The Site). This report provides geotechnical information and recommendations supplemental to that provided in Golder's previous investigation report for the Site. It is recommended that this report be read in conjunction with the previous report.[1] This report should also be read in conjunction with "*Important Information and Limitations of This Report*", which is included in Attachment 1. The reader's attention is specifically drawn to this information for the proper use and interpretation of this report.

Public Services and Procurement Canada (PSPC) is leading the design and construction of a proposed new Maintenance Building at the William Head Institution (WHI), in Metchosin, British Columbia on behalf of Correctional Service Canada (CSC). The proposed structure is to be 2 storeys with a footprint of approximately 1,160 m². Seismic design recommendations provided in the previous geotechnical report were based on the requirements of the 2010 National Building Code of Canada (NBCC 2010). This technical memorandum provides updated seismic design recommendations incorporating the requirements of the 2015 National Building Code of Canada (NBCC 2015).

1.0 UPDATED SEISMIC DESIGN RECOMMENDATIONS

Current seismic design loads, based on the 2015 National Building Code of Canada (NBCC), are based on ground motions corresponding to a design seismic event with a two percent probability of exceedance in 50 years (return period of 2,475 years). For a given site class, the effects of shaking level and period are incorporated via the site factors F(T) defined in Tables 4.1.8.4B through I, of the 2015 NBCC.

The effects of local site conditions are assessed based on the characteristics of the soil and/or bedrock under a proposed structure. It is anticipated that the proposed structure will be founded partly on rock and partly on fill or shallow native soil over bedrock. Based on the anticipated properties of the compacted fill, the area of the proposed structure is classified as a Site Class C (very dense soil and soft rock) based on the classification criteria listed in Table 4.1.8.4.A, in Section 4.1.8.4 of the 2015 NBCC.

[1] Golder Associates Ltd, 2015. Geotechnical Investigation Report, Proposed Maintenance Building, William Head Institution, Metchosin, BC: report dated 10 September 2015; Golder Ref. 1314470497-010-R-Rev0-5000

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The earthquake provisions of the National Building Code and the BC Building Code are intended to reduce the risk of collapse of a structure due to an earthquake, but are not intended to ensure that no damage to the structure will occur.

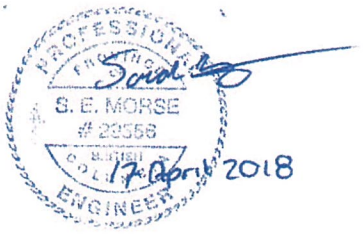
Site-Specific Seismic Parameters for Foundation Design

A site-specific seismic hazard calculation was obtained from the Natural Resources Canada (NRC) for firm ground conditions in accordance with 2015 seismic hazard maps of Canada, and based on location of the site relative to inferred seismic sources and attenuation relationships[2]. The resulting peak horizontal; ground acceleration (PGA) and the five percent damped spectral response acceleration (Sa) values corresponding to the 2,475-year design earthquake are provided in Attachment 2. These accelerations are applicable to Site Class C (very dense soil and soft rock) sites according to the 2015 NBCC and are used to linearly interpolate values for other site classes based on Tables 4.1.8.4B through I of the 2015 NBCC. Based on a site classification as Site Class C, and the seismic hazard calculation, the site factors F(T) are equal to 1.0, indicating that the Sa values can be used without modification.

2.0 CLOSURE

We trust that the information contained in this technical memorandum meets your current requirements. Please contact us if you require further information.

Golder Associates Ltd.



Sarah Morse, PEng, PMP
Geotechnical Engineer

M. (Yogi) Yogendrakumar, PhD, PEng
Principal, Senior Geotechnical Engineer

SEM/MY/nnv

Attachments: Attachment 1 – Important Information and Limitations of this Report
Attachment 2 – 2015 National Building Code Seismic Hazard Calculation

https://golderassociates.sharepoint.com/sites/20303g/deliverables/issued to client - reserved for wp/1790027-001-tm-rev0/1790027-001-tm-rev0-bldg codereview-17apr_18.docx

[2] http://www.earthquakescanada.nrcan.gc.ca/hazard/interpolator/index_2015-en.php.

ATTACHMENT 1

Important Information and Limitations of this Report

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder can not be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client cannot rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Groundwater Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist.

In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. **The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report.** The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.

ATTACHMENT 2

2015 National Building Code Seismic Hazard Calculation

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

April 13, 2018

Site: 48.3394 N, 123.5356 W User File Reference: William Head Institution

Requested by: ,

National Building Code ground motions: 2% probability of exceedance in 50 years (0.000404 per annum)

Sa(0.05)	Sa(0.1)	**Sa(0.2)**	Sa(0.3)	**Sa(0.5)**	**Sa(1.0)**	**Sa(2.0)**	**Sa(5.0)**	**Sa(10.0)**	**PGA (g)**	**PGV (m/s)**
0.709	1.097	**1.324**	1.348	**1.206**	**0.727**	**0.435**	**0.137**	**0.048**	**0.596**	**0.864**

Notes. Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC 2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are specified in **bold** font. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. ***These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.***

Ground motions for other probabilities:

Probability of exceedance per annum	0.010	0.0021	0.001
Probability of exceedance in 50 years	40%	10%	5%
Sa(0.05)	0.154	0.362	0.502
Sa(0.1)	0.236	0.561	0.784
Sa(0.2)	0.290	0.683	0.945
Sa(0.3)	0.286	0.686	0.956
Sa(0.5)	0.235	0.592	0.840
Sa(1.0)	0.112	0.311	0.472
Sa(2.0)	0.058	0.172	0.273
Sa(5.0)	0.011	0.038	0.077
Sa(10.0)	0.0039	0.013	0.026
PGA	0.124	0.302	0.424
PGV	0.141	0.390	0.580

References

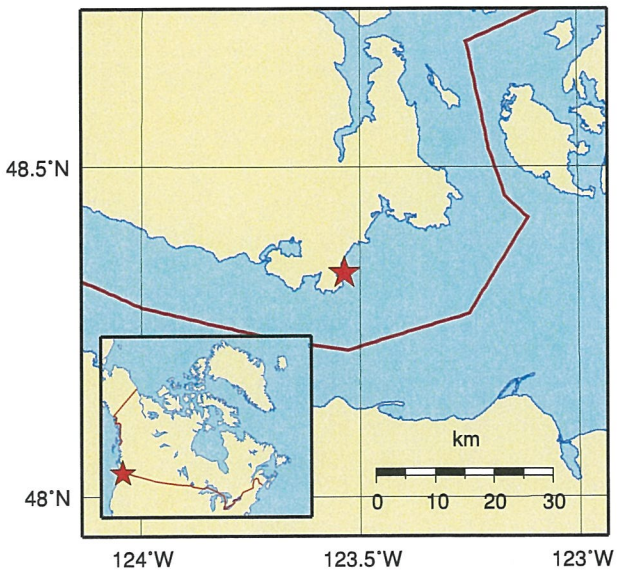
National Building Code of Canada 2015 NRCC no. 56190;
Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

User's Guide - NBC 2015, Structural Commentaries NRCC no. xxxxxx (in preparation)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites *www.EarthquakesCanada.ca* and *www.nationalcodes.ca* for more information

Aussi disponible en français



Natural Resources Canada Ressources naturelles Canada

Canada

Appendix II

Electrical:
Maintenance Handover Report

CORRECTIONAL SERVICE OF CANADA
TECHNICAL SERVICES BRANCH
ELECTRONICS SYSTEMS
MAINTENANCE HANDOVER REPORT

INSTITUTION: **DATE:**

SYSTEM/EQUIPMENT:

APPLICABLE CONTRACT NO:
PWGSC PROJECT NO:
SPECIFICATIONS:

EQUIPMENT SUPPLIER (NAME AND ADDRESS):

SUPPLIER CONTACT (NAME AND TELEPHONE):

WARRANTY DETAILS:

Expiry date on materials/parts:
Expiry date on installation:
Expiry date on factory labour:

Travel & living expenses during the warranty period:

chargeable to CSC ☐

not chargeable to CSC ☐

Equipment transportation costs are paid by CSC for:

sending to the supplier ☐

returning from the supplier ☐

Negotiated rates for emergency repairs at site due to misuse/abuse during warranty period are as follows:

Not applicable.

Negotiated rates for labour at site after warranty period are as follows:

Not applicable.

DEFICIENCIES:

None remain ☐

List attached ☐

DOCUMENTATION:

Maintenance manual:

Supplied ☐

Due by ;

As-built drawings, cabling and wiring diagrams:

Supplied ☐

Due by ;

Acceptance test results:

Supplied ☐

Due by ;

DISTRIBUTION OF DOCUMENTATION:

1 copy to CESM sent on:
1 copy to RATIS/RTEO sent on:
2 copies to institution sent on:

SPARES:

All delivered ☐

Delivery to be completed by ;

EQUIPMENT LIST:

See attached list. ☐

MAINTENANCE TRAINING:

Completed ☐

Scheduled for ;

SIGNATURE: Project Manager

DISTRIBUTION: CESM, NHQ
RATIS/RTEO, RHQ