SPECIFICATION

for

NEW POLICE BUILDING
100 MILE HOUSE BC

100 % COMPLETE SUBMISSION

for the

GOVERNMENT OF CANADA

prepared by: Number Ten Architectural Group

MARCH 07, 2012

SET NO: _____

number 10

architecture · interior design · graphic design

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6 pages

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1 SUMMARY OF WORK

.1 Work covered by Contract Documents:

.1 Work under this Contract comprises construction of new Police Building and civil work as noted; landscaping, asphalt paving and remedial work as indicated, located at 841 & 851 Alder Avenue in 100 Mile House, B.C.

.2 Work by Others:

.1 Work executed by Departmental Representative prior to Substantial completion, is not a part of this Contract:

.1 Supply and installation of stand alone radio transmitter/receiver antenna mast support and associated coax cable and connections. (Note: concrete base support, setting of anchor bolts and grounding for antenna mast is included in this Contract)

.2 Supply and installation of modular office furniture including PAC poles integral with the furniture. (Note: Connection of power and data wiring to furniture is included in this Contract)

.3 Contractor's Use of Premises:

.1 Contractor has unrestricted use of site until Substantial Completion.

.2 Contractor will limit use of premises for Work, for storage, and for access, to allow;

.1 Work by others noted in paragraph 1.2.

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

.4 Following Substantial Completion and occupancy all workers performing work at the construction site must pass a security clearance.

2 WORK RESTRICTIONS

.1 Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Coordinate interruptions with local authority having jurisdiction and local residences and businesses affected by the disruption.

.3 Provide for pedestrian and vehicular traffic.

.4 Construct barriers in accordance with Section Temporary Barriers and Enclosures.

3 CONSTRUCTION WORK SCHEDULE

.1 Commence work immediately upon official notification of acceptance of offer and complete the work within forty-six (46) weeks 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. 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.

.2 Work affected by submittal shall not proceed until review is complete.

.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.4 Where items or information is not produced in SI Metric units converted values are acceptable.

.5 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 co-ordinated 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.

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

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

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

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

.10 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 Progress Photographs:

.1 Provide construction photographs in accordance with procedures and submission requirements specified in this clause.

.2 Progress Photographs:

.1 Provide digital photographs with images of minimum 3.2 megapixels resolution and stored in Jpeg format with minimal compression.

.2 Number of viewpoints: four (4), locations of viewpoints directed by Departmental Representative. Reference Section 26 05 00 paragraph 3.11 for photographic record of electrical work in progress. Number of photos as directed by Departmental Representative.

.1 Reference Section 26 05 00 paragraph 3.11 for photographic record of electrical work in progress.

.3 Frequency: monthly, submitted on disk with monthly progress statement, sent via e-mail or as directed by Departmental Representative.

.4 Identify photos by location, date and sequential numbering system.

.3 Final Photographs:

.1 Provide digital photographs with images of minimum 3.2 megapixels resolution and stored in Jpeg format with minimal compression. Where photos are e-mailed compression can be increased.

.2 Number of viewpoints:

.1 Each side of building for a total of 4.

.2 Interior of rooms and finishes for a total of 8.

.3 Locations of viewpoints determined by Departmental Representative.

.3 Submit final photographs in digital format on CD, USB flashdrive or memory card, before final acceptance of building.

.4 Label disks and identify with name and project number of project. Indicate exposure dates and viewpoints of each photo and photo number.

.7 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.

.1 Submit either bond copies or one (1) pdf file capable of accepting review input or other media as directed by Departmental Representative.

.3 Accompany submissions with transmittal letter in duplicate.

.8 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 is for the sole purpose of ascertaining conformance with the general concept.

.2 The Departmental Representative’s review does not mean that approval is given for 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 subtrades.

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 adjoining property.

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 will pay cost of examination and replacement.

.2 Independent Inspection Agencies:

.1 Contractor will appoint and pay for services of testing laboratory, approved by Departmental Representative, including the following:

.1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.

.2 Inspection and testing performed exclusively for Contractor's convenience.

.3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.

.4 Mill tests and certificates of compliance.

.2 Where tests or inspections by testing laboratory has revealed the Work is not in accordance with contract requirements, pay costs for additional tests or inspections as required by Departmental Representative to verify acceptability of corrected work.

.3 Contractor's responsibilities:
- .1 Provide labour, equipment and facilities to:
  - .1 Provide access to Work for inspection and testing.
  - .2 Facilitate inspections and tests.
  - .3 Make good Work disturbed by inspection and test.
  - .4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.
- .2 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Departmental Representative.

.4 Reports:
- .1 Submit copy of inspection and test reports to Departmental Representative. Submit either four (4) bond copies or one (1) pdf file as directed by Departmental Representative.
- .2 Provide copies to subcontractor of work being inspected or tested manufacturer or fabricator of material being inspected or tested.
- .3 Tests and Mix Designs:
  - .1 Furnish test results and mix designs as specified and as requested Departmental Representative.

.3 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.

.4 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.

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 Arrange, pay for and maintain temporary water supply in accordance with local authority, governing regulations and ordinances.

.2 Permanent water supply system installed under this contract may be used for construction requirements provided that guarantees are not affected thereby. Replace damaged components.

.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 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.

.6 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.

.7 Pay costs for maintaining temporary heat, when using permanent heating system, until official date of Substantial Completion

.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.

.6 Temporary Communication Facilities:

.1 Provide and pay for temporary telephone and fax/internet hook up lines necessary for own use.

.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:

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

.2 Hoists: 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 Build and maintain temporary access where required and provide snow removal during period of Work.

.6 Contractor's Site Office:

.1 Provide office of size to accommodate site meetings and 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.

.2 When permanent water and drain connections are completed, provide temporary water closets and urinals complete with temporary enclosures. Permanent facilities may be used on approval of Departmental Representative. Maintain in clean condition.

.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 Contractor signboard identifying Prime Contractor and subcontractors to be erected and paid for by Contractor.

.5 Remove signs from site at completion of project or as directed by Departmental Representative.

11 TEMPORARY BARRIERS AND ENCLOSURES

.1 Hoarding:

.1 Erect temporary site enclosure using 1.8 m high temporary construction fencing. Provide lockable truck gate. Maintain fence in good repair.

.2 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

.2 Enclosure of Structure:

.1 Provide temporary weathertight enclosures and protection for exterior openings until permanently enclosed. Design enclosures to withstand wind pressure. Provide lockable entry as required for moving personnel equipment and materials.

.2 Provide temporary enclosures to secure building from entry of unauthorized personnel during construction period.

.3 Guardrails and Excavations:

.1 Provide secure, rigid guard rails and barricades around deep excavations, open edges of floors and roofs etc.

.2 Provide as required by governing authorities.

.4 Access to Site:

.1 Provide and maintain access roads as may be required for access to Work.

.5 Public Traffic Flow:

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.

.6 Protection for Off-Site and Public Property:

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

.7 Protection of Building Finishes:

.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 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 born 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 specified quality 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.

.6 Quality of Work:
.1 Ensure Quality of Work meets or exceeds specifications, 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, in accordance with General Conditions.

.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 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

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

.3 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 governing authorities, with minimum of disturbance to pedestrian and vehicular traffic.

.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 firestopping material, full thickness of the construction element.

.12 Refinish surfaces to match adjacent finishes: For continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.

.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 Clear snow and ice from access to building.

.4 Provide on-site containers for collection of waste materials and debris.

.5 Provide and use clearly marked separate bins for recycling. Refer to-Construction/Demolition Waste Management And Disposal.

.6 Clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations.

.7 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

.8 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

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

.10 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 and.

.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.

.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 Fire Commissioner, Utility companies have been submitted.
.5 Operation of systems have been demonstrated to Departments 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 reinspection.

18 CLOSEOUT SUBMITTALS

.1 Record Drawings:
.1 As work progresses, maintain accurate records to show all deviations from the Contract Drawings.

.2 Departmental Representative will provide one printed set of Contract drawings, specifically for showing deviations from Contract drawings.

.3 Note on as-built Contract Drawings as changes occur. At completion supply:

.1 One (1) set of marked up as-built drawings showing all changes to Contract drawings, including:

.1 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.2 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.4 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 Maintenance manual:

.1 On completion of project submit to Departmental Representative three (3) CD R/ disk copies and one 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 Refer to Specifications for Interactive Operating & Maintenance (IOM) System following this section for O&M requirements

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

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

.5 Include scanned guarantees, diagrams and drawings.

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

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

.8 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.

.5 Final Photographs:
.1 Specified in paragraph 4.6.3.

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.

20 COMMISSIONING

.1 Specified in Section 01 9100 Commissioning:

END OF SECTION

Specifications for Interactive Operating & Maintenance (IOM) System

1.1 All as-built drawings and operation and maintenance (O&M) manuals listed under the Scope of Work shall be converted, where necessary, into Portable Data File (PDF) format for viewing using the Adobe Acrobat Reader.

1.2 Documentation storage and retrieval system shall be structured based on a database framework with direct links to the appropriate PDF files. Documents retrieval and viewing shall be executed through a menu driven approach.

1.3 The Program shall provide multi-level of password entry for access to add new or edit stored data by authorized users.

1.4 Program shall be capable of storing separately and independently data of multiple buildings and shall be expandable for addition of new buildings and systems.

1.5 Data of each building shall be accessible by the input of either the building name or building number as defined by the program user.

1.6 Data of each building shall be organized in accordance with the following structure:

1.6.1 Building General Information

Building data shall be collected and stored in a database format as an integral part of the Program. Building data shall include the following:

- Building Name
- Building Address
- Facility Manager
- Building Photo

1.6.2 Service / Disciplines

O&M data and as-built drawings shall be classified by their corresponding disciplines, including:

- Mechanical
- Electrical

Under each discipline, data shall be grouped into the following four major categories:

1.6.2.1 Basic Documents

'Basic Documents' shall, according to the type of services or disciplines, include the full contents of each hard copy of the O&M manuals with the addition of Miscellaneous Maintenance Reports and Records, or as defined by the user. In general the following shall be included unless specifically excluded by the user:

- Introduction
- Consultant/Contractor/Suppliers List

- System Description
- Maintenance and Lubrication Schedules
- Testing and Commissioning (T&C) Reports
- Misc. Reports
- Specifications
- Equipment and/or point schedules as identified in the hard copy documents
- Others as stipulated by the user

All Basic Documents PDF files shall be enhanced with appropriate bookmarks to facilitate searching of information within the document or linking to other relevant documents for references.

1.6.2.2 'As-Built' Drawings

'As-built' drawings shall be converted from the original electronic files, such as CAD and Microstation, into PDF format. If only the hard copies of the 'as-built' drawings are available, they shall be scanned and saved in PDF format. PDF files of the 'As-built' drawings shall be enhanced with the following bookmarks to zoom into legible views on the computer screen as a minimum:

- Drawing Number and Title
- Drawing Notes
- Major Equipment Locations
- Cross-links to other related drawings
- Revisions

1.6.2.3 System Data

Building systems shall be identified by their services, disciplines, function, nature and specific scope. System data shall be classified into the following categories:

- System Description
- Schematic (where applicable)
- Equipment List

Provide hot key buttons, where applicable, for direct access to drawings/data referenced on the schematics. The same shall be applied to listed equipment for direct links to the corresponding equipment data.

1.6.2.4 Equipment Data

Equipment data shall be classified into the following categories:

- Equipment submittals
- T&C Report
- Maintenance Data
- Maintenance Records
- Photo

Provide a summary screen to list all equipment classified under a specific system. On the summary screen, provide direct links to the corresponding equipment data under each category with addition links to the relevant 'As-built' drawings.

1.7 Program shall be executed by Professional Engineers with a minimum of 10 years post qualification experience in the field of Building Services Engineering.

1.8 The Contractor shall provide a minimum of 3 past job references as proven record of similar undertakings commissioned by internationally renowned institutions or government agencies.

1.9 The Contractor shall provide a session of program demonstration free of charge to the Owner to prove meeting the intents of the commission. Time of the program demonstration subsequent to the Tender Return shall be set and agreed with the Owner.

1 CASH ALLOWANCES

.1 Expend Cash Allowances as directed by Departmental Representative.

.2 Cash allowances, unless otherwise specified, cover net cost to Contractor of services, products, construction machinery and equipment, freight, handling, unloading, storage installation and other authorized expenses incurred in performing Work.

.3 Contract Price, and not cash allowance, includes Contractor's overhead and profit in connection with such cash allowance.

.4 Contract Price will be adjusted by written order to provide for excess or deficit to each cash allowance. Cash Allowances will be adjusted to actual cost as defined hereunder and contract price will be amended accordingly by written order.

.5 Where costs under a cash allowance exceed amount of allowance, Contractor will be compensated for excess incurred and substantiated plus allowance for overhead and profit as set out in Contract Documents.

.6 Progress payments for work and material authorized under cash allowances will be made in accordance with contract terms of payment.

2 MATERIAL AND INSTALLATION ALLOWANCES

.1 The following cash allowances are included in the Lump Sum Bid Price.
.1 $ 30,000: for power, telephone and water and sewer utility connection charges.

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.
- .2 CAN/CSA-A23.1/A23.2-M2009, Concrete materials and methods of concrete construction/Test methods and standard practices for concrete

.4 HRSDC Fire Protection Engineering Section:
- .1 FCC No. 301-1982, Standard for Construction Operations.

.5 National Building Code of Canada (NBCC 2010):
- .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 The Contract may be terminated without liability to the department where the Contractor, in the opinion of the Departmental Representative, 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 (Registered Occupational Hygienist, Certified Industrial Specified Hygienist) 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.

9 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.

10 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.

11 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 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.

12 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.

13 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.

14 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.

15 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.

16 OVERLOADING

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

17 FALSEWORK

.1 Design and construct falsework for construction purposes in accordance with CSA S269.1 and reuse to CSA A23.1.

18 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.

19 CONFINED SPACES

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

20 POWDER-ACTUATED DEVICES

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

21 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.

22 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.

23 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.

24 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.

25 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.

26 MEETINGS

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

27 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 SUMMARY

.1 Section Includes:

.1 General requirements relating to commissioning of project's components and systems, specifying general requirements to Performance Verification of components, equipment, sub-systems, systems, and integrated systems.

.2 Related Work:

.1 Section 01 01 50 - General Instructions: training.
.2 Section 21 05 93 - Testing, Adjusting and Balancing for Fire Suppression.
.3 Section 21 08 00 - Commissioning for Fire Suppression.
.4 Section 22 05 93 - Testing, Adjusting and Balancing for Plumbing.
.5 Section 22 08 00 - Commissioning of Plumbing.
.6 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
.7 Section 23 06 04 - Subtrades.
.8 Section 23 08 00 - Commissioning of HVAC systems.
.9 Section 26 05 00 - Common Work Results - For Electrical

.3 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.

.4 Cx - a required program of tests, procedures and checks carried out systematically on systems and integrated systems of finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved.

2 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.

3 REFERENCES

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

4 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.

5 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.

6 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.

7 PREPARATION

.1 Provide instruments required for testing and adjusting operations.

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

.3 Retain possession of instruments and remove at completion of services.

.4 Verify systems installation is complete and in continuous operation.

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

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

.7 Test electronic system for proper operation and programming.

8 FINAL REPORTS

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

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

.3 Identify each instrument used and latest date of calibration of each.

9 COMPLETION OF COMMSSIONING

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

.2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.

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

.4 Submit the following deliverables to the Departmental Representative at the completion of Commissioning::
- .1 Updated Cx Plan and Schedule.
- .2 Accepted Shop Drawings.
- .3 Completed PI Forms.
- .4 Approved TAB Report.
- .5 Approved PV Forms.
- .6 Approved O&M Manual.
- .7 Approved System and Integrated System Test Report.
- .8 Approved Training and Attendance Form.
- .9 Accepted “As Built” Plans and Specifications.
- .10 Certificate of Interim Acceptance.
- .11 Final Certificate of Completion..

10 EXTENT OF CX

.1 Architectural:
- .1 All door hardware and controls: door hardware and electronic controls function.
- .2 Casework: door and drawer function.

.2 Mechanical systems and associated equipment verification:
- .1 Fire Suppression.
- .2 TAB for Plumbing.
- .3 TAB for HVAC.
- .4 DDC controls and sequence of operation for the various equipment and control devices.
- .5 Heating and cooling controls.
- .6 Balancing dampers.

.3 Electrical systems and associated equipment verification:
- .1 Motor control systems.
- .2 Fire alarm system.
- .3 Access control system.
- .4 Intrusion detection.
- .5 Video surveillance.
- .6 Emergency and exit lighting
- .7 Door signal system.
- .8 Lighting.
- .9 Receptacles.
- .10 Voice/data.
- .11 Electrical panels.
- .12 Grounding system.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 31 23 33 - Excavation, Trenching and Backfilling for under slab fill.

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International):
.1 CAN/CSA A3001-09 - Cementitious materials for use in concrete.
.2 CAN/CSA-A23.1/A23.2-M2009, Concrete materials and methods of concrete construction/Test methods and standard practices for concrete
.3 CSA G30.5-M1983(R1991), Welded Steel Wire Fabric for Concrete Reinforcement.
.4 CSA G30.18-M92, Billet Steel Bars for Concrete Reinforcement.
.5 CSA W186-M1090(R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.
.6 CSA O121-08, Douglas Fir Plywood.
.7 CSA O151-09, Canadian Softwood Plywood.
.8 CSA S269.1-1975 (R2003), Falsework for Construction Purposes.
.9 CAN/CSA-S269.3-M92 (R2008), Concrete Formwork.

.2 ASTM International (ASTM):
.1 ASTM C260-10a, Air-Entraining Admixtures for Concrete
.2 ASTM C494 / C494M - 11 Standard Specification for Chemical Admixtures for Concrete.
.3 ASTM D1751-04(2008), Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
.4 ASTM C618-08a - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
.5 ASTM A497 / A497M - 07 Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.

.3 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.4 ANSI/ACI 315-99, Details and Detailing of Concrete Reinforcement.

1.3 SUBSTITUTES

.1 Substitution of different size bars permitted only upon written approval of Departmental Representative.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 - General Instructions for Waste Management and Disposal.

.2 Ensure emptied containers are sealed and stored safely.

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

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

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

.6 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 Products

2.1 CONCRETE MATERIALS

.1 Cement: to CAN/CSA-A3001.

.2 Water, fine aggregates, normal density coarse aggregates: to CAN/CSA A23.1.

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

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

.5 Shrinkage compensating cementitious grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents.
- .1 Compressive strength: minimum 40 MPa at 7 days.
- .2 Properties (at 23 °C, RH 50% and water cement ratio of 0.18 by weight:
  - .1 Flowcone to CAN/CSA A23.2-1BM94 25- 35 seconds.
  - .2 Aggregate grading to ASTM C 136: 100% passing 2.5 mm.
  - .3 Set time: initial 5 and final 6. 5 hours.

.6 Surface sealers:
.1 Exterior pavement areas: to ASTM C309 Liquid Membrane-Forming Compounds for Curing Concrete, Type 1.

.7 Coloured hardener: natural, mineral aggregate type, non-metallic and colour dry shake surface hardener for wear and abrasion resistance, durable to freeze/thaw cycle, de-icing salts and resistant to oil and grease penetration, minimize surface dusting.

2.2 FORMWORK MATERIALS

.1 Formwork lumber: plywood and wood formwork materials to CAN/CSA A23.

.2 Form release agent: chemically active release agents containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing set of film of concrete in contact with form.

.3 Form ties: removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.

2.3 REINFORCING MATERIALS

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

.2 Welded steel wire fabric: to CSA G30.5. Provide in flat sheets only.

.3 Chairs, bolsters, bar supports, spacers: adequate for, strength and support of reinforcing construction conditions.

2.4 CONCRETE ACCESSORIES

.1 Polyethylene dampproof membrane:
.1 To CAN/CGSB 51.34, 0.15 mm polyethylene film.
.2 Joint sealing tape: air resistant pressure sensitive adhesive tape, type recommended by polyethylene film manufacturer, 50 mm wide for lap joints and perimeter seals.

.2 Premoulded joint fillers:
.1 Bituminous impregnated fibre board: to ASTM D1751.

2.5 CONCRETE MIXES

.1 Proportion normal density concrete to CAN/CSA A23.1, Clause 4, Alternative 1 – Performance Method, Type GU General use cement with minimum 10% fly ash content for concrete performance characteristics as follows:

Structural Member	Min 28 Day Strength (Mpa)	Max. Aggregate Size (mm)	Exposure Class	Air Content Category
Footings	25	25	N	-
Perimeter Foundation Walls	25	25	F-2	1
Suspended Slabs	25	20	N	-
Slabs on Grade - Interior	25	20	N	-
Slabs on Grade -Exterior	32	20	C-2	1

.2 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 but shall be 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.

.3 Air content: To CSA-A23.1 Table 2 & 4 to suit appropriate exposure class.

.4 Chemical admixtures: Non chloride based admixtures in accordance with ASTM C494M.

.5 Concrete mix designs shall be submitted to a material consultant for approval and to Departmental representative for review prior to any concrete work.

.6 Provide certification that mix proportions selected will produce concrete of specified quality and yield and that strength will comply with CAN/CSA A23.1, Clause 4. Site mixing equipment, truck or stationery type to conform to CAN/CSA.

.7 Obtain Departmental Representative's approval before using chemical admixtures other than those specified.

.8 Use of calcium chloride not permitted.

2.6 REINFORCING STEEL FABRICATION

.1 Fabricate reinforcing to CAN/CSA A23.1.

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

.3 Fabricated steel bar or rod mats welded together to CSA G30.5 using bars to CSA G30.18, grade 400.

.4 Ship bundles of bar reinforcement, clearly identified in accordance with bar list.

3 Execution

3.1 WORKMANSHIP

.1 Obtain Departmental Representative's approval before placing concrete. Provide seventy two (72) hours notice to approved testing agency prior to placing of concrete.

.2 Place concrete in accordance with CAN/CSA A23.1, Clause 19.

.3 Ensure reinforcement and inserts are not disturbed during concrete placement.

.4 Obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather, prior to placing of concrete.

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

.6 Do not place load upon new concrete until authorized by Departmental Representative.

.7 Pumping of concrete is permitted only after approval of equipment and mix.

.8 Anchor bolts/dowels:

.1 Use templates to place anchor bolts and dowels, tolerances associated with equipment or materials to be secured. Ensure anchor bolts and dowels remain vertical during concrete placing and finishing.

.2 With Departmental Representative's approval, grout anchor bolts in preformed holes or holes drilled after concrete has set. Formed holes to be at least 100 mm in diameter. Drilled holes to be minimum 25 mm larger in diameter than bolts used.

.3 Protect anchor bolt holes from water accumulations.

.4 Set bolts and fill holes with Hilti adhesive as noted in general Notes on Drawing.
.5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to temperature at time of erection.

3.2 FORMWORK INSTALLATION

.1 Verify lines, levels and wall locations before proceeding with formwork and ensure dimensions agree with drawings.

.2 Construct forms to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA A23.1.

.3 Leave formwork in place for following minimum periods of time after placing concrete.
.1 Three days for foundation walls and pedestals.
.2 Seven days for suspended slabs and stairs
.3 Fourteen days for suspended slabs, stair and other structural members or three days when replaced immediately with adequate shoring to standard specified for falsework.

.4 Re-use of formwork and falsework subject to requirements of CAN/CSA-A23.1. Be responsible for design, Engineering and construction of formwork.

.5 Place type 4 rigid polystyrene insulation under floor where indicated.

.6 Form concrete stairs to rise and run dimensions indicated. Concrete stairs to meet NBCC 2010 Part 3 for uniformity and tolerances: maximum 5 mm difference in risers between adjacent treads and landings, 10 mm between tallest and shortest riser in flight.

3.3 INSERTS

.1 Set sleeves, ties, anchor bolts and other inserts, openings and sleeves, in concrete floors and foundation walls, as required by other trades. Sleeves, openings, etc. greater than 100 x 100 mm not indicated on structural drawings must be approved by Departmental Representative.

.2 Check locations and sizes of sleeves, openings, etc. shown on structural drawings with architectural, mechanical and electrical drawings.

.3 If inserts cannot be located as specified, obtain approval of all modifications from Departmental Representative before placing of concrete.

3.4 JOINT FILLERS

.1 Locate and form isolation joints as indicated. Install joint filler to manufacturer's instructions.

.2 Unless otherwise indicated, use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces. Extend joint filler from bottom of slab within 12 mm of finished slab surface.

.3 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.

.4 Locate control joints in concrete slab to layout as indicated.

.5 Locate (expansion/contraction) joints in concrete slabs on grade at maximum 6 m oc. Fibreboard joints minimum 6 mm thickness.

3.5 DAMPPROOF MEMBRANE

.1 Install dampproof membrane under concrete slabs within building, lap 150 mm at joints and seal with mastic cement or tape.

.2 Seal punctures using dampproof membrane material extending 150 mm past all punctures and sealed with mastic cement or tape.

3.6 PLACING REINFORCEMENT

.1 Place reinforcing steel to CAN/CSA A23.1.

.2 Obtain Departmental Representative's approval of reinforcing steel and placing before placing concrete.

.3 Clean reinforcing before placing concrete.

.4 When field bending of reinforcement is approved by Departmental Representative, bend without heat, applying slow and steady pressure.

.5 Provide minimum rebar lap lengths as follows unless indicated otherwise on drawings:
- .1 10M bars: 400 mm.
- .2 15M bars: 450 mm.
- .3 20M bars: 500 mm.

.6 Provide bent bars at all corners.

3.7 FINISHING

.1 Finish concrete to CAN/CSA A23.1, Clause 24.

.2 Rub exposed sharp edges of concrete with Carborundum to produce 3 mm radius edges unless otherwise detailed.

.3 Floor slabs to be left exposed or to receive epoxy, carpet or applied flooring: finish as per Clause 3.9, paragraphs .1 and .2 and paragraphs .4 to .7.

.4 Equipment pads and interior stair treads: smooth troweled surface.

.5 Exterior paving: finish as per Clause 3.10, para. .2 and .3.
- .1 Finish the following areas as indicated below:
  - .1 Walkways: medium broom finish texture with tooled joints and edges in pattern indicated or as directed by Departmental Representative.

.6 Apply hardener to floors indicated as per Clause 3.9, paragraph .3.

3.8 DEFECTIVE CONCRETE

.1 Remove defective concrete and embedded debris and repair as directed by Departmental Representative.

.2 Fill all honeycombing or voids flush with adjoining surfaces.

3.9 PLAIN FLOOR FINISH - INTERIOR

.1 Roll or tamp concrete to force coarse aggregate into concrete mix and then screed.

.2 Float surface with wood or metal floats or with power finishing machine and bring surface to true grade.

.3 Apply coloured hardener to floor slabs where scheduled (CH&S) in accordance with manufacturer's written instructions. Apply in two (2) shakes at a maximum rate of 4 to 5 kg/m².

.4 Steel trowel to smooth and even surface.

.5 Follow with second steel troweling to produce smooth burnished surface to within 3 mm tolerance when measured in any direction using 3 m straight edge.

.6 Sprinkling of dry cement or dry cement and sand mixture over concrete surfaces is not acceptable.

.7 Saw cut crack-control joints to CAN/CSA A23.1, Clause 20.2.1 or use removable plastic insert strips.

.8 After curing and when concrete floors are dry, seal control joints and joints at junction with vertical surfaces with a self-leveling oil resistant sealing compound.

.9 Provide smooth, power trowel finish on all interior slabs unless noted otherwise.

3.10 EXTERIOR CONCRETE SLAB FINISH

.1 After completion of floating and when excess moisture or surface sheen has disappeared, complete surface finishing as follows.

.2 Brush finish to medium texture, perpendicular to the line of traffic with tooled edges at perimeter of slab and at joints. Finish stair treads same as for sidewalks.

.3 Do not remove forms within 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections of major honeycombing.

.4 Apply curing and sealing compound to exterior paving in accordance with manufacturer's instructions.

.5 Install extruded concrete curbs using motorized equipment, with construction joint every 6 m and control joints at 1.5 m maximum except as indicated otherwise.

3.11 INSPECTION AND TESTING

.1 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory approved by Departmental Representative.

.2 Include costs for testing. Refer to Section 01 01 50.

.3 Arrange with testing laboratory to do site testing from each batch of concrete placed or for each major days pour and as designated by Departmental Representative.

.4 If concrete is to be site mixed submit mix design, aggregate and sand to testing agency, three weeks prior to commencing work for complete analysis in accordance with CAN/CSA A 23.2

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 03 05 10 - Cast-in-Place Concrete.
.2 Section 05 41 00 - Structural Metal Stud Framing.
.3 Section 05 50 00 - Metal Fabrications.
.4 Section 07 27 10 - Air/Vapour barrier.
.5 Section 07 19 00 - Water Repellants.
.6 Section 07 62 00 - Metal Flashings.
.7 Section 08 11 14 - Steel Doors and Frames.
.8 Section 08 11 20 - Sliding Cell Doors, Frames and Hardware.
.9 Section 08 34 74 - Acoustic Steel Door and Frame Assemblies.
.10 Section 08 50 50 - Aluminum Windows.

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)
.1 CAN/CSA A165 SERIES-04(R2009), CSA Standards on Concrete Masonry Units covers: A165.1, A165.2, A165.3.
.2 CSA A179-04(R2009), Mortar and Grout for Unit Masonry.
.3 CSA-A370-04(2009), Connectors for Masonry.
.4 CSA-A371-04(R2009), Masonry Construction for Buildings
.5 CAN/CSA G30.18-09, Billet-Steel Bars for Concrete Reinforcement.
.6 CSA-S304.1-04, Masonry Design for Buildings.

.2 ASTM International (ASTM):
.1 ASTM A497 / A497M - 07 Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
.2 ASTM D2240 - 05(2010) Standard Test Method for Rubber Property - Durometer Hardness.
.3 ASTM C207 - 06(2011) Standard Specification for Hydrated Lime for Masonry Purposes.
.4 ASTM C144 - 11 Standard Specification for Aggregate for Masonry Mortar.

1.3 SUBMITTALS

.1 Submit Samples Product Data and Shop Drawings in accordance with Section 01 01 50 - General Instructions - Submittal Procedures clause.

.2 Submit duplicate samples of each type masonry unit.

.3 Product Data:
.1 Submit manufacturer's printed product literature, specifications and data sheets.
.2 Submit WHMIS MSDS - Material Safety Data Sheets and indicate VOC's for epoxy coatings and galvanized protective coatings and touch-up products.
.3 Indicate VOC's for mortar, grout, parging, colour additives and admixtures.

.4 Shop Drawings :
.1 Shop drawings consist of bar bending details, lists and placing drawings.
.2 On placing drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Ensure that materials are delivered to job site in dry condition.

.2 Keep materials dry until use.

.3 Store under waterproof cover on pallets of plank platforms held off ground by means of plank or timber skids.

1.5 COLD WEATHER REQUIREMENTS

.1 Comply with Clause 3.15 of CAN/CSA-S304.

.2 When air temperature is below 5° C take following precautions in preparing and using mortar:

.1 Heat sand slowly and evenly. Do not use scorched sand, having a reddish cast, in mortar.

.2 Heat water to 70° C maximum; 20 deg. C minimum.

.3 After combining heated ingredients maintain temperature of mortar between 5° C and 50 deg. C until used.

.4 Protect mortar from rain and snow.

.3 Maintain dry beds for masonry and use dry masonry units only.

1.6 HOT WEATHER REQUIREMENTS

.1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

.2 Comply with Clause 6.7 of CSA A371.

1.7 PROTECTION

.1 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until completed and protected by permanent construction.

.2 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

.3 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

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 packaging materials at appropriate recycling facilities approved by Departmental Representative.

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

2 Products

2.1 MASONRY UNITS

.1 Standard concrete block units: to CAN3-A165 Series (CAN3-A165.1).
.1 Classification: H / 15 / A / M.
.2 Size: modular, 190 mm wide for walls except as noted otherwise.
.3 Special shapes: bullnosed blocks with radiused corners where exposed. Provide purpose-made "H" shapes for lintels and bond beams. Provide additional special shapes as indicated. Provide bullnose corner blocks at interior areas as indicated.
.4 Exterior wythe veneer: 90 mm wide concrete block, split faced units with integral colour. Standard gray colour not acceptable. Provide outside corner blocks with split face block on two faces. Use 190 x 390 block with two faces split, cut to fit 90 mm wide wythe. Mitred joints at outside corners are not permitted.

.2 Glass blocks: solid glass units 200 x 200 x 76 mm thick, translucent surface one side (sand blasted finish), 6.8 kg mass per unit, impact strength 9-11 Nm and STC rating of 45. Acceptable Product: Pittsburgh Corning VISTABRIK.

2.2 REINFORCEMENT AND CONNECTORS

.1 Bar reinforcement: to CSA-A371 and CAN/CSA G30.18, Grade 400.

.2 Wire reinforcement: to CSA-A371 and ASTM A497, truss or ladder type.

.3 Reinforcing bar retainers: 3.7 mm φ formed wire, for positioning vertical reinforcing in concrete block cells. Dur-O-Wal # DA817 or similar.

.4 Connectors shall be corrosion resistant: hot dip galvanized to CSA-A370 and CSA-S304.

2.3 MORTAR MATERIALS

.1 Mortar and grout: to CSA A179.
.2 Lime: Type S to ASTM C207.
.3 Sand: clean white quartzite or silica type to ASTM C144.

2.4 MORTAR TYPES

.1 Mortar: to CSA A179M.
.1 For all interior concrete block masonry: type S based on mortar proportion by volume.
.2 For all exterior concrete block masonry: type S or N based on mortar proportion by volume. Special colour to match coloured exterior block as selected by the Departmental Representative.
.3 Exterior wythe of glass block: type M based on mortar proportion by volume.

2.5 GROUT

.1 Grout: to Table 3 of CAN/CSA A179, minimum compressive strength 20 MPa, 10 mm maximum sized aggregate and slump of 200 mm ± 20 mm.

.2 Concrete fill: minimum compressive strength 25 MPa, 14 mm maximum sized aggregate and slump of 150 mm ± 20 mm.

2.6 ACCESSORIES

.1 Masonry flashing and air barrier membranes:
.1 Base flashing and air barrier membrane specified in Section 07 27 10.

.2 Weep hole vents: purpose-made PVC, galvanized steel, polypropylene fibre filter, colour to blend with masonry.

.3 Weep Vent:
.1 Manufacturer and Type: CavClear Weep Vents by Archovations, Inc. (888) 436-2620.
.2 Fluid and air conducting, non-absorbent, mold and mildew resistant, non-woven, polymer mesh.
.3 100 percent post-consumer plastics with a flame-retardant binder.
.4 “M” notched bottom.

.4 Nailing Inserts: 0.5 mm minimum thickness, galvanized.

.5 Control joints: extruded PVC compound with 85 durometer hardness conforming to ASTM D 2240 and sized to fit in the standard sash of a masonry unit.

.6 Bolts: 12 mm diameter x 150 mm long with ends bent 50 mm at 90 degrees.

2.7 REINFORCING AND TYING

.1 Metal ties, wire and bar type reinforcement, bolts and anchors: to CSA-S304.

.2 Wire ties at stud walls:
.1 Option one: veneer anchor (plates and pintles), 2.6 mm thickness formed plate sized to accommodate rigid insulation and air space in wall cavity, with 5 mm φ wire pintle sized to accommodate masonry thickness, to fit plates with vertical adjustment. Plates with two holes for attachment to steel stud with two stainless steel self drilling/threading screws. All steel hot dip galvanized. Dur-O-Wal DA213 meets this specification.
.2 Option two: stud shear connector plate, Length to suit steel stud width and thickness of gypsum sheathing, insulation and cavity, hot dip galvanized to CAN/CSA A370.

.3 Horizontal reinforcement:
.1 Structural masonry at exterior wal:l steel wire, knurled, ladder type, to CAN3-A370.
.2 Veneer masonry at exterior wall: steel wire, knurled, ladder type, with integral wire eye extensions to suit insulation thickness and adjustable wire ties, to CAN3-A370.

.4 Corrosion protection: to Clauses 4.2.1 and Table 2 of CAN3-A370, for metal ties and horizontal reinforcing in exterior walls, walls in shower areas and other wet areas.

3 Execution

3.1 INSTALLATION

.1 Do masonry work in accordance with CSA-A371 except where specified otherwise.
.1 Bond: running stretcher bond with vertical joints in perpendicular alignment and centred on adjacent stretchers above and below alternating course.
.2 Coursing height: 200 mm for one block and one joint.
.3 Jointing: tool where exposed or where paint or other finish coating is specified to provide smooth compressed concave surface.
.4 Strike flush all joints concealed in walls and joints in walls to receive insulation, ceramic tile, or other applied material except paint or similar thin finish coating.
.5 Provide raked interior joint at 100 mm starter course in areas where epoxy floor finish will be terminated 100 mm above floor. Use double 100 mm block course at base of walls in rooms where epoxy flooring is scheduled.

.2 Build masonry plumb, level, and true to line, with vertical joints in alignment.

.3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

3.2 CONSTRUCTION

.1 Exposed masonry:
.1 Remove chipped, cracked, and otherwise damaged units, in exposed masonry and replace with undamaged units.
.2 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects. Make cuts straight, clean, and free from uneven edges.

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

.3 Concrete block lintels:
.1 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.
.2 End bearing: not less than 200 mm as indicated on drawings.

.4 Joining of Work:
.1 Where necessary to temporarily stop horizontal runs of masonry, and in building corners:
.2 Step-back masonry diagonally to lowest course previously laid.
.3 Do not “tooth” new masonry.
.4 Fill in adjacent courses before heights of stepped masonry reach 1200 mm.

.5 Support of loads:
.1 Use 20 MPa concrete to Section 03 05 10 - Cast-in-Place Concrete, where concrete fill is used in lieu of grout.
.2 Use grout to CSA A179.
.3 Install building paper below voids to be filled with concrete or grout; keep paper 25 mm back from faces of units.

.6 Provision for movement:
.1 Leave 6 mm space between top of non-load bearing walls and partitions and structural elements. Do not use wedges.
.2 Built masonry to tie in with stabilizers, with provision for vertical movement.

.7 Build in flashings in masonry in accordance with CSA-A371.
.1 Install flashings under exterior veneer masonry bearing on foundation walls. Install flashings under weep hole courses and as indicated.
.2 In cavity walls and veneered walls, carry flashings from front edge of masonry, under outer wythe, then up backing not less than 150 mm, and as follows:
.1 For masonry backing embed flashing 25 mm in joint.
.2 For gypsum board backing, bond to wall using manufacturer's recommended adhesive.
.3 Lap joints 150 mm and seal with adhesive.

.8 Glass Blocks:
.1 Install glass blocks using type M mortar, with sandblasted surface on outer wythe facing exterior.
.2 Install weep hole vents at base of every second vertical joint.

.9 Install weep hole vents in vertical joints immediately over flashings, in exterior wythes of cavity wall and masonry veneer wall construction, at maximum horizontal spacing of 600 mm on centre.

3.3 REINFORCING AND CONNECTING

.1 Install masonry connectors and reinforcement in accordance with CSA-A370, CSA-A371 and CSA-S304.1 unless indicated otherwise.

.2 Horizontal Reinforcing:
.1 Install in all masonry walls continuous in every second course beginning at 2nd course (400 mm above floor), horizontal truss or ladder type reinforcement comprising two 3.65 mm rods, each rod 25 mm from each face, and lapped 150 mm at each splice.

.3 Vertical Reinforcing:
.1 Place reinforcing bars in grout filled cores of all masonry walls, at intersections, corners and sides of openings.
.2 Rooms132, 133: In addition to the above, place one 10 M reinforcing bar grouted into each void in perimeter walls, full height and embed into concrete floor and ceiling 100 mm. Install 10M vertical bars at all openings, spaced at maximum 100 mm oc, and embed bars into wall 150 mm above and below opening.
.3 "Prior to erecting any reinforced masonry blockwork, the location of all wall base dowels placed in the foundations shall be paint marked on the main floor slab, vertical block reinforcing shall match up with these dowels."

.4 Refer to structural drawing for details and additional requirements for reinforcement in masonry walls.

.5 Install and retain vertical reinforcing bars in position using wire positioners at course joint 200 above floor, one course joint below top of wall or u/s of lintel and spaced at 200 times bar diameter (2000 mm oc for 10M bars).

.4 At Cell doors: install vertical 15 m reinforcing bar at first void at door frames, full height. Install horizontal 15 m reinforcing bar in lintel blocks with minimum 450 mm long bent ends to engage the blocks at each side of the door opening. Tie the horizontal and vertical bars together. Grout fill all wall voids extending 450 outward from the door frames (jambs and head). Position reinforcing to avoid conflict with cell door installation hardware penetrating wall.

3.4 BONDING AND TYING

.1 Tie masonry veneer to backing in accordance with NBCC2005, CSA-S304.1, CSA-A371 and as indicated.

3.5 REINFORCED LINTELS AND BOND BEAMS

.1 Reinforce masonry lintels and bond beams as indicated.

.2 Place and grout reinforcement in accordance with CSA-S304.1, CSA-A371, and CSA-A179.

3.6 GROUTING

.1 Grout masonry in accordance with CSA-S304.1, CSA-A371 and CSA-A179 and as indicated.

.2 Fill cores of masonry block walls with grout, surrounding prisoner/visitor room, and cell interview room, full height.

3.7 ANCHORS

.1 Supply and install metal anchors as indicated.

3.8 LATERAL SUPPORT AND ANCHORAGE

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

3.9 SITE TOLERANCES

.1 Tolerances in notes to Clause 5.3 of CSA-A371 apply.

3.10 FIELD QUALITY CONTROL

.1 Inspection and testing will be carried out by Testing Service approved by the Departmental Representative in accordance with Section 01 01 50.

.2 Notify inspection agency minimum of 48 hours in advance of requirement for tests.

.3 Pay costs for service:

.1 Manufacturer's Services:

.1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, and protection of its products, 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 to review work at stages listed:

.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 Twice during progress of work at 25% and 75% complete.

.3 Upon completion of work, after cleaning is carried out.

.4 Obtain reports within three days of review and submit immediately to Departmental Representative.

3.11 CLEANING

.1 Allow mortar droppings on concrete masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block and finally by brushing.

.2 Clean glass block masonry as work progresses using soft, clean cloths, within few minute after laying. Upon completion, when mortar has set so that it will not be damaged by cleaning, clean with soft sponge or brush, and plenty of clean water. Polish with soft, clean cloths.

3.12 PROTECTION

.1 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 03 05 10 - Cast-in-Place Concrete, Installation of anchors in concrete.
.2 Section 05 31 00 - Steel Decking.
.3 Section 05 41 00 - Structural Metal Stud Framing.
.4 Section 05 50 00 - Metal Fabrications.
.5 Section 09 91 23 - Painting.

1.2 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM)
.1 ASTM A 36/A 36M-08, Specification for Carbon Structural Steel.
.2 ASTM A325M-09 Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength Metric.

.2 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA).
.1 CISC/CPMA1-73b, Quick-Drying, One-Coat Paint for Use on Structural Steel.
.2 CISC/CPMA2 -75, Quick-Drying, Primer for use on Structural Steel.

.3 Canadian Standards Association (CSA)
.1 CAN/CSA-G40.20-04, General Requirements for Rolled or Welded Structural Quality Steel.
.2 CAN/CSA-G40.21-04(R2009), Structural Quality Steels.
.3 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.
.4 CAN/CSA-S136-07, North American Specification for the design of Cold Formed Steel Structural Members.
.5 CSA W47.1-03(R2008), Certification of Companies for Fusion Welding of Steel Structures.
.6 CSA W59-03(2008), 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.

.4 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 for Submittals clause.

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

.4 Dispose of unused paint material at official hazardous material collections site approved by Departmental Representative.

.5 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in other locations where it will pose health or environmental hazard.

2 Products

2.1 MATERIALS

.1 Structural steel: to CAN/CSA-G40.21 Grade 300W Class C for W, C, S and I shapes and 350W Class C for HSS members.

.2 Anchor bolts and fasteners: to CAN/CSA-G40.21 Grade 300W

.3 Bolts, nuts and washers: to ASTM A325M.

.4 Welding materials: to CSA W59-M and certified by the Canadian Welding Bureau.

.5 Shop paint primer: to CISC/CPMA 1, CISC/CPMA 2 for field painted steel.

.6 Hot dipped galvanizing: galvanized steel, where indicated, to CAN/CSA-G164 Minimum zinc coating of 600g/m².

2.2 FABRICATION

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

.2 Continuously seal members by welds. Grind smooth where exposed in final assembly.

2.3 SHOP PAINTING

.1 Clean, prepare surfaces and shop prime structural steel in accordance with CAN/CSA-S16 except where members to be encased in concrete.

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 2.1 of CSA W47.1 for fusion welding of steel structures.

3.2 MARKING

.1 Mark materials in accordance with CAN/CSA-G40.20. 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.

3.3 ERECTION

.1 Erect structural steel as indicated and in accordance with CAN/CSA-S16 and in accordance with shop drawings.

.2 Obtain written permission of Departmental Representative prior to field cutting or altering of structural members.

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

.4 Provide temporary bracing to structure for stability and safety until all Later resisting elements and diaphragms are installed.

.5 Grout for column base plates shall be approved material with minimum strength of 50 MPa @ 28 days mix to fluid consistency.

3.4 FIELD QUALITY CONTROL

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

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

.3 Pay all costs for tests in accordance with Section 01 01 50 General Instructions clause; Testing and Inspection Services paragraph.

3.5 FIELD PAINTING

.1 Paint in accordance with Section 09 91 23 - Painting.

.1 Touch up all damaged surfaces and surfaces without shop coat with primer to CISC/CPMA 2 except as specified otherwise. Apply in accordance with CGSB 85-GP-10.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 05 12 23 - Structural Steel for Buildings.
.2 Section 05 31 00 - Steel Decking.
.3 Section 05 50 00 - Metal Fabrications.
.4 Section 09 91 23 - Field Painting.

1.2 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM)
.1 ASTM A 36/A 36M-08, Specification for Carbon Structural Steel.
.2 ASTM A325M-09 Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength Metric.

.2 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA).
.1 CISC/CPMA1-73b, Quick-Drying, One-Coat Paint for Use on Structural Steel.
.2 CISC/CPMA2 -75, Quick-Drying, Primer for use on Structural Steel.

.3 Canadian Standards Association (CSA)
.1 CAN/CSA-G40.20-04, General Requirements for Rolled or Welded Structural Quality Steel.
.2 CAN/CSA-G40.21-04(R2009), Structural Quality Steels.
.3 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.
.4 CAN/CSA-S136-07, North American Specification for the design of Cold Formed Steel Structural Members.
.5 CSA W47.1-03(R2008), Certification of Companies for Fusion Welding of Steel Structures.
.6 CSA W59-03(2008), Welded Steel Construction (Metal Arc Welding).

1.3 QUALITY ASSURANCE

.1 Supply affidavit prepared by fabricator of structural steel joists stating that materials and products used in fabrication conform to this specification.

1.4 DESIGN OF STEEL JOISTS AND BRIDGING

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

.2 Design joists and anchorages for uplift forces as indicated.

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

.4 Limit roof joist deflection due to specified live load of 1/360 of span and camber all open web steel joists for full dead load and 25% live load unless specified otherwise.

.5 No drilling or cutting for hanger or support devised is permitted unless approved by the design engineer of the OWSJ supplier.

.6 Provide diagonal bracing.

.7 Joist fabricator to coordinate duct runs with mechanical engineer and architect. Opening in joists must line up to allow passage of mechanical ducting and other equipment.

.8 Joist shall bear on center lines of supporting members, unless noted otherwise on drawings or approved by Departmental Representative.

.9 Submit 2 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 SUBMITTALS

.1 Submit shop details in accordance with Section 01 01 50 - General instructions for Submittals clause.

.2 Submit drawings stamped and signed by qualified professional engineer licensed in BC.

.3 Indicate on erection drawings, relevant details such as joist mark, depth, spacing, bridging lines, bearing, anchorage and details.

.4 Provide particulars, on shop drawings, 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 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.

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

.4 Dispose of unused paint material at official hazardous material collections site approved by Departmental Representative.

.5 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in other locations where it will pose health or environmental hazard.

2 Products

2.1 MATERIALS

.1 Structural steel: to CAN/CSA-G40.21 Grade 300W.

.2 Welding materials: to CSA W59-M and certified by the Canadian Welding Bureau.

.3 Shop paint primer: to CISC/CPMA 1.

2.2 FABRICATION

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

.2 Weld in accordance with CSA-W59.

.3 Provide chord extensions where indicated.

.4 Provide diagonal and horizontal bridgings and anchorages as indicated.

2.3 SHOP PAINTING

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

.2 Clean members of loose mill scale, rust, oil, dirt and other foreign matter.

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

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

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

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 2.1 of CSA W47.1 for fusion welding of steel structures.

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

3.2 FIELD QUALITY CONTROL

.1 Inspection and testing of materials and workmanship will be carried out by testing laboratory approved 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 10 days after completion of inspection.

.4 Pay costs for tests as specified in Section 01 01 50 - General Instruction for Testing Laboratory Services clause.

3.3 ERECTION

.1 Erect steel joists and bridging as indicated in accordance with CAN/CSA-S16 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 that are not shown on shop drawings: to approval of Departmental Representative.

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

3.4 FIELD PAINTING

.1 Paint in accordance with Section 09 91 23 - Painting.

.1 Touch up all damaged surfaces and surfaces without shop coat with primer to CISC/CPMA 2 except as specified otherwise. Apply in accordance with CGSB 85-GP-10.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 05 12 23 - Structural Steel for Buildings.
.2 Section 05 21 00 - Open Web Steel Joist Framing
.2 Section 07 46 13 - Roof and Wall Cladding Assembly.
.3 Section 07 84 00 - Fire-stopping and smoke seals at fire separations.

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA)
.1 CAN/CSA-S136-07, North American Specification for the design of Cold Formed Steel Structural Members.
.2 CSA W47.1-03(R2008), 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 W59-03(R2008), 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)
.1 ASTM A 653/A653M-11, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

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

1.3 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.

1.4 DESIGN REQUIREMENTS

.1 Design steel deck using limit states design in accordance with CSA S136, CSSBI 10M and CSSBI 12M.

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

.3 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.

.4 Where vibration effects are to be controlled as indicated, dynamic characteristics of decking system to be designed to be in accordance with CAN/CSA-S16.1, Appendix 'G'.

1.5 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 01 50 General Instructions - Submittals clause.

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

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

.4 Submit design calculations of gravity loads only if requested by Departmental Representative.

.5 Indicate deck plan, profile, dimensions, base steel thickness, metallic coating designation, connections to supports and spacing's, projections, openings, reinforcement details and accessories.

.6 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.

1.6 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 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 Products

2.1 MATERIALS

.1 Zinc coated steel sheet: to ASTM A 653/A653M structural quality Grade A, with Z180 coating, for unpainted finish except where painted finish is indicated.

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

.3 Coverplates, deck flute closures and flashings: steel sheet with minimum base steel thickness of 0.76 mm. Metallic coating same as deck material.

.4 Primer: zinc rich, ready mix to CGSB 1-GP-181M.

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

.6 Firestopping: to Section 07 84 00 Firestopping.

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 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. Welding shall be performed by certified welders.

.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.

.4 Welders must present proof of their certification to the Departmental Representative or the designated testing laboratory agent before welding commences.

3.2 ERECTION

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

.2 Wherever possible, supply and install decking in length that will permit continuity over a minimum of three spans. Lap ends: to 50 mm minimum.

.3 Provide minimum 20mm dia. puddle weld spaced at 300mm with side laps button punched @ maximum 450mm for steel deck to steel beams and inserts or as indicated on structural drawings.

.4 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.

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

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

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

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

.9 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 beams, joists and shear connectors and weld deck to angles chords and structural members as shown on drawings or as indicated or as detailed by decking contractor.

3.3 FIELD QUALITY CONTROL

.1 Inspection and testing of materials and workmanship will be carried out by testing laboratory approved by Departmental Representative. Notify testing laboratory at least 72 hours prior to inspection.

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

.3 Inspect welds in accordance with CSA W59.

.4 The Departmental Representatives 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 deck has been fabricated, erected and finished in accordance with the contract specifications, and shall have been inspected in the field by the Professional Engineer responsible for the design of those steel deck (or his representative) all in accordance with paragraph 1.2 SUBMITTALS.

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

.6 Pay costs of welding inspection in accordance with Section 01 01 50 - General Instructions; Testing and Inspection Services paragraph.

3.4 CLOSURES

.1 Where steel deck extends over exterior walls, (including exterior masonry walls) fill upper and lower web spaces with neoprene closures as recommended by manufacturer.

.2 Where flutes are at right angles to exterior walls, and deck exposed on underside extends beyond these walls, caulk interlocking side lap of deck for 400 mm immediately over walls. Install interior and exterior closures. Caulk exterior closures to prevent air infiltration. Caulk interior closures to prevent water vapour exfiltration.

.1 In addition, provide roof insulation installer with sufficient quantity of closed cell neoprene closures to close off top-side flutes directly over face of wall, secure as recommended by manufacturer.

.3 Exposed roof decks in rooms with no ceilings:
.1 Where flutes run at right angles to interior partitions, fill web spaces with double run of steel closures or as recommended by manufacturer.
.2 Where flutes are parallel to interior partitions, install steel closure flashings to provide neat juncture between two materials or as recommended by manufacturer.

.4 Closures are not required between interior partitions and underside of deck in areas having suspended ceiling.

3.5 OPENINGS AND AREAS OF CONCENTRATED LOADS

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

.2 Unless noted otherwise, reinforce frame deck openings with steel angles 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	> 500 mm	L76x76x6.34 all around and extending to Structural members

3.6 CONNECTIONS

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

END OF SECTION

1 General

1.1 DESCRIPTION OF SYSTEM

.1 Wind load bearing steel studs includes:
.1 Wall studs, fascia and overhang framing subjected to lateral loads (no axial loads other than self-weight and the weight of applied finishes, windows etc).
.2 Metal soffit framing subjected to wind uplift loads.
.3 Steel bridging.
.4 Top and bottom track.
.5 Head, sill and jamb members for wall openings.
.6 Stud, bridging and track connections.
.7 Top and bottom connections to the main structure including detailing to accommodate floor and/or roof deflections.

1.2 RELATED WORK

.1 Section 01 01 50 - General Instructions for:
.1 Submittal Procedures.
.2 Construction/Demolition Waste Management And Disposal.

.2 Section 04 04 99 - Masonry, for CMU tie connectors.

.3 Section 05 12 23 - Structural Steel for buildings.

.4 Section 05 50 00 - Metal Fabrications for expanded metal mesh.

.5 Section 06 10 11 - Rough Carpentry for exterior plywood sheathing at fascia.

.6 Section 07 21 13 - Board Insulation.

.7 Section 07 27 10 - Air/vapour Barriers.

.8 Section 09 11 10 - Non-structural Metal Framing.

.9 Section 09 21 16 - Gypsum Board Assemblies.

1.3 REFERENCE STANDARDS

.1 ASTM International (ASTM)
.1 ASTM A 653/A653 M-11, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.2 ASTM A123 / A123M - 09 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
.3 ASTM A307 - 10 Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.

.2 Canadian Standards Association (CSA)
.1 CSA W47.1-03(R2008), Certification of Companies for Fusion Welding of Steel Structures.

.2 CSA W55.3-08, Certification of companies for resistance welding of steel and aluminum.
.3 CSA W59-03(R2008), Welded Steel Construction (Metal Arc Welding) (Metric Version).
.4 CAN/CSA-S136-07, North American Specification for the design of Cold Formed Steel Structural Members.

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

.4 Canadian Sheet Steel Building Institute (CSSBI)
.1 CSSBI 51-06, Lightweight Steel Framing Design Manual - 2nd Edition and Errata #1 & #2.

.5 National Building Code of Canada (NBCC 2010).

1.4 DESIGN CRITERIA

.1 Design shall be based on Limit States Design principles using factored loads and resistance.

.2 Loads and load factors shall be in accordance with the National Building Code of Canada. For wind load calculations, the reference velocity pressure, q, shall be based on a 1 in 50 probability of being exceeded in any one year.

.3 Resistances and resistance factors shall be determined in accordance with the National Building Code of Canada and CAN/CSA-S136.

.4 For wall studs supporting CMU veneer, the minimum thickness exclusive of coating shall be is minimum thickness 1.087 mm

1.5 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 01 50 - General Instructions, for Submittals clause.

.2 Submit shop drawings and design calculations stamped and signed by qualified professional engineer registered in Province of British Columbia for exterior wind load bearing steel framing for stud wall, overhang, soffits and connected framing.

.3 Indicate design loads, member sizes, materials, design thickness exclusive of coatings, coating specifications, connection and bracing details, screw sizes and spacing, and anchors.

.4 Indicate locations, dimensions, openings and requirements of related work.

.5 Indicate welds by welding symbols as defined in CSA W59.

.6 Submit samples of framing components and fasteners to Departmental Representative, if requested.

.7 The Professional Engineer responsible for the shop drawings will inspect the installation of the work for conformance with the design and the shop drawings. At 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.

1.6 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 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.

2 Products

2.1 MATERIALS

.1 Sheet steel: to ASTM A 653/A653M, grade D, core thickness to reviewed shop drawings, with minimum yield of 345 kN/m^2 and galvanized to Z180 zinc coating designation.
.1 Steel to conform to the requirements of CAN/CSA-S136. Identify specification, grade, mechanical properties and coating type and thickness.

.2 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.

.3 Screws: pan head, self-drilling, self-tapping sheet metal screws, corrosion protected to minimum requirements of CSSBI, length 6 mm plus steel thickness.

.4 Anchors: concrete expansion anchors or other suitable drilled type fasteners

.5 Bolts, nuts, washers: hot dipped galvanized to CAN/CSA-G164, 380 g/m² zinc coating.

.6 Touch up primer: zinc rich, ready mix to CGSB 1-GP-181M.

2.2 STEEL STUD DESIGNATIONS

.1 Colour code steel studs in accordance with CSSBI 50M.

2.3 METAL FRAMING

.1 Steel studs: to CSA S136, fabricated from zinc coated steel, depth as indicated. Minimum steel thicknesses and sizes to reviewed engineered shop drawings.

.2 Stud tracks: fabricated from same material and finish as steel studs, depth to suit.
.1 Bottom track: single piece.
.2 Top track: single piece and two piece telescoping at structures with deflection.

.3 Bridging: fabricated from same material and finish as studs, 38 x 12 x 1.22 mm minimum thickness.

.4 Angle clips: fabricated from same material and finish as studs, 38 x 38mm x depth of steel stud, 1.22 mm minimum thickness.

.5 Tension straps and accessories: as recommended by manufacturer.

.6 Overhang framing for fascias, soffits and all connected framing fabricated from same material and finish as steel stud framing.

2.4 SOURCE QUALITY CONTROL

.1 Prior to commencement of work, submit:
.1 One certified copy of mill reports covering material properties.

3 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 structural framing as indicated and to CAN/CSA-S136-M in accordance with reviewed engineered shop drawings.

.2 Erect components to requirements of reviewed shop drawings.

.2 Anchor tracks securely to structure at 800 mm oc maximum, unless lesser spacing prescribed on engineered shop drawings.

.3 Erect studs for walls, fascias, soffits and overhang framing plumb, aligned and securely attached with two screws minimum, or welded in accordance with reviewed engineered shop drawings and manufacturer's recommendations.

.4 Seat studs/framing into bottom tracks and top tracks.

.5 Install 50 mm minimum telescoping track at top of walls where required to accommodate vertical deflection. Nest top track into deflection channel a minimum of 30 mm and a maximum of 40 mm. Do not fasten tracks together. Stagger joints.

.6 Install studs at not more than 50 mm from abutting walls, openings, and each side of corners and terminations with dissimilar materials.

.7 Brace steel studs with horizontal internal bridging at 1200 mm maximum. Fasten bridging to steel clips fastened to steel studs with screws or by welding.

.8 Frame openings in stud walls to adequately carry loads by use of additional framing members, lintels and bracing as detailed on reviewed shop drawings.

.9 Touch up welds with coat of zinc rich primer.

3.3 ERECTION TOLLERANCES

.1 Plumb: not to exceed 1/500th of member length.

.2 Camber: not to exceed 1/1000th of member length.

.3 Spacing: not more than 3 mm from design spacing.

.4 Gap between end of stud and track web: not more than 4 mm.

3.4 CUTOUTS

.1 Maximum size of unreinforced cutouts for services as follows:

Member Depth (mm)	Across Member Depth (mm)	Along Member Length (mm)	Centre to Centre Spacing (mm)
92	40 max.	105 max.	600 min
102	40 max.	105 max.	600 min.
152	65 max.	115 max.	600 min.

.2 Limit distance from centerline of last unreinforced cutout to end of member to not less than 300 mm.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 03 30 00 - Cast-in-place Concrete for installation of anchors in concrete.
.2 Section 05 50 10 - Stainless Steel Fabrications.
.3 Section 08 11 20 - Sliding Cell Doors, Frames and Hardware for metal fabrications for cell doors, frames and hardware.
.4 Section 08 71 10 - Door hardware.
.5 Section 08 80 50 - Glazing for installation of plastic glazing in acoustical screens.
.6 Section 09 22 16 - Non-structural Metal Framing.
.7 Section 09 91 23 - Painting.
.8 Section 10 56 13 - Metal Storage Units
.9 Section 32 31 13 - Chain Link Fencing and Gates.

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)
.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-11, 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 Canadian Standards Association (CSA)
.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 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 and extra strong, galvanized finish for bollards.

.3 Aluminum extrusions: Aluminum Association alloy AA6063-T5 anodizing quality.

.4 Welding materials: to CSA W59.

.5 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.

.6 Security fasteners: screws and bolts with spanner type heads to prevent removal except with special tools; non-corrosive type.

.7 Security sheet steel: Sheets of carbon steel sheet to ASTM A 653/A653M, 1.52 mm thickness sheet steel, sized to suit 302 mm stud spacing and wall height. Self drilling/threading, or provide pre-drilled holes, pan head screws.

.8 Security 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.

.9 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.

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

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

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, CAPS, SHOES, BEAM SUPPORTS AND ANGLES

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

.2 Fabricate steel shelf angle to support masonry veneer at perimeter of building. Weld 12 mm φ steel hook anchor to back of angle at 600 mm oc. Hot dip galvanize finish.

.3 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 3 mm x 38 mm wide x 400 long masonry strap ties welded to back of jamb frames spaced at 600 oc maximum starting at 300 mm from floor level.

.2 Grind welds smooth.

.3 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 zinc plated anchors as indicated.

2.7 EMERGENCY PHONE BOX

.1 Fabricate phone box from 1 mm thickness sheet steel all welded as indicated. Weld all joints and grind smooth:

.1 Fabricate door of double wall construction 25 mm thickness with 6 mm tempered safety glass panel secured to door with interior removable stops.

.2 Mount door to housing with stainless steel piano hinge fastened with S.S. pop rivets.

.3 Fabricate box housing with return flange at top, sides and extend sill with double return at sides and leading edge.

.4 Latch door to housing with chrome plated slam latch with spring loaded pull ring.

.5 Finish cabinet and door with high gloss enamel as indicated or with polyester powder coat finish in colour to match General Paint "international orange".

.6 Provide adhesive applied vinyl lettering in style, size and colour indicated.

2.8 SECURE DUCT OPENINGS AT STUD WALLS

.1 Fabricate 3 mm x 50 steel plate frame fastened to interior side of room. Provide secure duct pass thru grill at duct openings in Exhibit rooms walls and where indicated.

.2 Weld expanded steel mesh to plate frame.

.3 Prime paint steel surfaces.

2.9 SAFETY BAR

.1 Description: 15 mm diameter steel bar, complete with hook on one end and steel eye hook on other end designed to hold safety bar in position. Provide 4.8 mm steel plate reinforcement plates to fit inside steel door frame and weld. Install on door 210.

.2 Prime paint.

2.10 VANITY COUNTER SUPPORTS

.1 Fabricate 150 steel 'C' channel support frame with end brackets for mounting to steel stud wall with plywood backing.

.2 Weld 100 mm wide x 6 mm thickness steel plate at leading edge of brackets to support long counter span. Drill holes to accommodate fasteners to wall and to counter.

.3 Prime paint.

2.11 BENCH SUPPORT

.1 Fabricate from 6 mm steel to support bench backrest. Drill holes to accommodate fasteners in wall and millwork.

.2 Stainless steel support legs specified in section 05 50 10.

.3 Prime paint steel surfaces.

2.12 PIPE GUARDRAIL AND HAND RAILING

.1 Handrails:
.1 Steel pipe: 38 mm φ 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 interior handrails and brackets and hot dip galvanized exterior handrails after fabrication.

.2 Exterior Guardrails:
.1 64 mm nominal outside diameter posts, with 10 mm base plates, and horizontal pipe of 64 mm φ weld to posts.
.2 Fabricate internal framing from 20 mm pipe spaced 100 mm apart as indicated.
.3 Fabricate guardrail in sections and install to cast in place retaining wall with four 12 mm φ galvanized purpose made expansion inserts drilled into concrete.
.4 Join guardrail together at horizontal members using slip connections.
.5 Hot dip galvanize after fabrication.

.3 Cap and weld exposed ends of handrail and guardrails.

.4 Provide self drilling/threading anchors to steel studs and expansion anchors for fastening to concrete.

2.13 TIRE RACK

.1 Fabricate main framework from 50 mm square HSS, with verticals spaced at 1500 oc and three cross frames welded to verticals. Drill verticals for 12 mm φ expansion anchors or anchor bolts set into concrete filled masonry wall x 100 mm deep embed.

.2 Weld 32 mm square HSS secondary framing to main framing members as indicated. Spacing of horizontal members to suit tire size.

2.14 BIKE STORAGE RACK - ROOM 137

.1 Specified in Section 10 56 13 metal Storage Units.

2.15 PRISONER/VISITOR COUNTER FRAME

.1 Fabricate support frame from welded steel angle framework with plate gussets for fastening through masonry wall and to end walls with expansion anchors as indicated.

2.16 BOLLARDS

.1 Bollards: 150 mm diameter extra strong pipe, galvanized finish, at locations as indicated.

2.17 ALUMINUM SPACER FOR LEXAN GLAZED PANEL (ACOUSTICAL WINDOW)

.1 Description:
.1 Construct glazing separator from 20 x 28 x 3 mm thick extruded aluminum channel.
.2 Pre-drill fastener holes for installation with screws at metal frame in masonry wall.
.3 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes - 1980:
.1 Clear anodic finish: designation AA31.
.4 Acoustical window specified in Section 08 11 25.

2.18 FINISHES

.1 Galvanizing: hot dipped galvanizing with minimum zinc coating of 600 g/m2 to CSA G164-M1992. 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.

2.19 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.

2.20 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 rivets, field welds, bolts and burnt or scratched surfaces after completion of erection using primer.

.6 Touch-up galvanized surfaces with zinc primer where burned by field welding.

3.2 MISCELLANEOUS STEEL BRACKETS, CAPS, SHOES, BEAM SUPPORTS AND ANGLES

.1 Supply to respective trades and install miscellaneous metal items in accordance with reviewed shop drawings and details.

3.3 SECURITY MESH AND SHEET WALL REINFORCEMENT

.1 Fasten security mesh to steel studs with fillet welds at each strand at maximum 300 mm oc along framing members.

.2 Fasten sheet steel to steel studs with fillet stitch welds at 300 mm oc along framing members.

3.4 OVERHEAD DOOR FRAMES

.1 Set frame structure in place plumb and level for installation by masonry trade.

.2 Touchup damaged galvanized surfaces with zinc rich primer.

3.5 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 withprimer.

3.6 OVERHEAD DOOR CHAIN PROTECTION

.1 Install door chain protection in accordance with reviewed shop drawings using zinc plated anchors.

3.7 EMERGENCY PHONE BOX

.1 Install phone box in accordance with reviewed shop drawings. Touch up damaged finish coating:

.1 Install peel and stick membrane to interior rough opening at telephone box and fasten telephone box to prepared blocking in wall using four security headed screws in accordance with reviewed shop drawings.

.2 Shim between telephone box housing and wall opening to permit installation of caulk joint at top and sides at flange.

.3 Insure clearance is provided at door perimeter where wall siding trim will occur at perimeter.

.4 Siding to sit proud of telephone box door when installed.

.5 Coordinate installation with wall siding installer for peel and stick membrane and placement of box in relation to siding, trim and flashing.

3.8 SECURE DUCT OPENING AT STUD WALLS

.1 Install secure grill at duct openings in Exhibit rooms walls and where indicated.

3.9 SAFETY BAR

.1 Install safety bar on door 210 in accordance with reviewed shop drawings.

.2 Secure eye hooks so that top of bar is 1000 mm from floor in front of door.

.3 Touch up damaged primed surfaces.

3.10 VANITY COUNTER SUPPORTS

.1 Install support channel in vanity counter and fasten to end walls. Coordinate installation with millwork fabricator and installer.

3.11 BENCH SUPPORT

.1 Install backrest support bracket and fasten to backing in wall. Coordinate installation with millwork fabricator and installer.

3.12 PIPE GUARDRAIL AND HAND RAILING

.1 Handrails: mount to wall backing in stud walls with purpose made fasteners at wall brackets.

.2 Exterior Guardrail:

.1 Secure brackets with expansion anchors to concrete retaining wall. Bolt guardrails to concrete using galvanized expansion anchors.

.3 Touch up damaged primed and galvanized surfaces after installation.

3.13 TIRE RACK

.1 Install metal framework to masonry walls with expansion anchors or anchor bolts set into concrete filled masonry wall x 100 mm deep embed.

.2 Touch up damaged primed surfaces after installation.

3.14 PRISONER/VISITOR COUNTER FRAME

.1 Install counter support frame fastened through masonry wall and to end walls with expansion anchors as indicated.

.2 Framework to fit tight to walls with top surface level to ± 1 mm tolerance.

.3 Grind exposed welds and edges smooth. Grind underside of exposed gusset plates with 3 mm radius edges. Sand smooth all ground surfaces.

3.15 BOLLARDS

.1 Supply to concrete trade for installation.

3.16 ALUMINUM SPACER FOR LEXAN GLAZED PANEL (ACOUSTICAL WINDOW)

.1 Supply to glazing trade for installation.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 05 55 00 - Metal Fabrications

.2 Section 06 11 01 - Rough Carpentry.

.3 Section 06 23 00 - Finish Carpentry and Laminated Plastic for cabinet work.

.4 Section 08 80 50 - Glazing, for stainless steel speaker ports.

.5 Section 12 50 00 - Institutional Furniture.

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)
.1 ASTM A123 / A123M - 09 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
.2 ASTM A167-99(2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
.3 ASTM A276-08a Standard Specification for Stainless Steel Bars and Shapes.
.4 ASTM A 269-08, Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
.5 ASTM A666 - 03 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

.2 CSA W59-03(R2008), Welded Steel Construction (Metal Arc Welding).

1.3 SUBMITTALS

.1 Provide submittals in accordance with 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 Stainless steel tubing: to ASTM A 269, Type Commercial grade Seamless welded with AISI No. 4 finish.

.2 Stainless steel sheet: to ASTM A666 type 302 or 304 with No. 4 finish.

2.2 PASS THROUGH (RECEPTION COUNTER)

.1 Custom fabricate from 1.5 mm thick stainless steel to minimum 400 mm long, 400 mm wide and 100 mm depth; No. 4 satin finish, and concealed fasteners to millwork counter.

.2 Ease edges and allow for flush mounting in plastic laminate counter-top.

.3 Seal edges between passthrough and counter, using specified sealant installed in accordance with Section 07 92 10.

2.3 CORNER GUARDS

.1 Stainless steel corner guards, minimum 75 x 75 mm x 2 mm thickness nominal size x 1500 mm high, smooth edges.

2.4 ACCESSORIES

.1 Fastening: construction adhesive and as recommended by manufacturer.

.2 Fasteners: stainless steel screws as indicated.

.3 HSS stainless steel legs 38 mm X 38 mm with top bracket plate and adjustable resilient foot at base of bench leg.

.4 Hardware and fastenings: stainless steel screws: flat head, concealed where practical.

.5 Sealant: to CAN/CGSB-19.13, aluminum coloured sealing compound, silicone adhesive/sealant, meeting National Sanitation Foundation (NSF) requirements for direct contact with food and stay flexible during long term exposure to temperatures ranging from minus 73°C to plus 232°C.

3 Execution

3.1 INSTALLATION

.1 Install units and erect with materials and components straight, tight and in alignment in accordance with reviewed shop drawings.

.2 Measure and cut openings for exact fit.

.3 Install deal tray as recommended by manufacturer in accordance with reviewed shop drawings.

.4 Install corner guards on walls indicated using self tapping oval head screws in stud walls and lead wedge anchors or approved adhesive for masonry walls.

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 (ASTM)
.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 74 19 - Waste Management And Disposal.

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

.3 Collect and separate for disposal packaging materialfor 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 Furring blocking, nailers and strapping: SPF, Hemlock or Douglas Fir species:
- .1 Board sizes: "Standard" or better grade.
- .2 Dimension sizes: "Standard" light framing or better grade.

.4 Log Facade Columns: yellow cedar, moisture content 19%, turned to a consistent diameter and cut to fit over steel HSS columns.

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, 16 mm thick, panel mounting boards and as indicated.

.2 Backing in walls: Plywood, DFP, sheathing grade, square edge, 19 mm thickness except where specified otherwise.

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 interior highly humid areas.

.5 Air barrier membrane: Specified in Section 07 27 10.

2.5 WOOD PRESERVATIVE

.1 Pressure preservative treated lumber to CSA 080.15 indicate commodity standard number using CCA or other approved preservative to obtain minimum net retention of 6.4 kg/m³ of wood.

.2 Treat material as indicated and as follows:
.1 Wood furring, blocking and nailers etc. on outside face of exterior wall in contact with masonry and metal flashing.
.2 Wood members in contact with concrete, masonry, exterior and soil.

3 Execution

3.1 INSTALLATION

.1 Comply with requirements of NBC, supplemented by the following paragraphs.

.2 Install plywood as required to space-out and support wall mounted fixtures, and other work as required.

.3 Align and plumb faces of furring and blocking to tolerance of 1:600.

.4 Install rough bucks, to rough openings as required to provide backing for frames and other work. Fasten bucks to jamb studs and masonry using screws and/or expansion anchors.

.5 Fasten blocking and nailers to steel stud framing using wood screws.

.6 Install log facade over steel HSS columns, as indicated, level, plumb and with aligned joints. Fasten in accordance with Section 05 50 00 para 2.1.5. Protect log facade surfaces from damage, using approved hoarding, until Substantial Completion.

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, cedar ceiling, facings, pipe chases, wall mounted door stops, electrical and mechanical fixtures and other items as indicated. Use solid blocking or 19 mm plywood securely nailed to framing members.

.2 Align and plumb faces of furring and blocking to tolerance of 1:600.

.3 Install 38 x 89 wood strapping at 400 oc for cedar ceiling.

3.3 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 manufacturers instructions

3.4 ELECTRICAL EQUIPMENT BACKBOARD

.1 Provide backboards for mounting electrical equipment as indicated. Install 16 mm thick plywood fastened through gypsum board panels into studs using screws at maximum 300 mm oc.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 05 50 10 - Stainless Steel Fabrications.

.2 Section 06 10 11 - Rough carpentry.

.3 Section 07 92 10 - Joint Sealing.

.4 Section 07 92 12 - Security joint Sealing

.5 Section 08 11 25 - Glazed Counter Barrier and Acoustical Window.

.6 Section 09 51 13 - Acoustic Panel Ceilings and Walls

.7 Section 09 91 23 - Painting.

1.2 REFERENCES

.1 Architectural Woodwork Manufacturers Association of Canada (AWMAC) 2003.

.2 American National Standards Institute (ANSI):
.1 ANSI/NPA A208.1-2009, Particleboard.
.2 ANSI A208.2-2009, Medium Density Fibreboard (MDF).

.3 ASTM International (ASTM):
.1 ASTM E 1333-96(2002), Test Method for Determining Formaldehyde Concentrations in Air and Emissions Rates from Wood Products Using a Large Chamber.
.2 ASTM A123 / A123M - 09 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
.3 ASTM F1667 - 05 Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

.4 Architectural Woodwork Manufacturers Association of Canada (AWMAC):
.1 AWMAC Quality Standards for Architectural Woodwork 2003.

.5 Canadian General Standards Board (CGSB):
.1 CAN/CGSB-11.3-M87, Hardboard.

.6 Canadian Standards Association (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 O151-M78 (R1998), Canadian Softwood Plywood.
.5 CSA-O112 Series M1977, Adhesive, Contact, Brushable.

.7 National Electrical Manufacturers Association (NEMA):
.1 NEMA LD3-2000, High Pressure Decorative Laminates.

.8 National Hardwood Lumber Association (NHLA):
.1 Rules for the Measurement and Inspection of Hardwood and Cypress January 2004.

.9 National Lumber Grades Authority (NLGA):
.1 Standard Grading Rules for Canadian Lumber 2007.

.10 Environmental Choice Program (EPC):
.1 CCD-045-95, Sealants and Caulking Compounds.
.2 CCD-046-95, Adhesives.
.3 CCD-047-05, Architectural Surface Coatings.

.11 UL 437 - The Standard of Safety for Key Locks.

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 WARRANTY

.1 For the work specified in this Section pertaining to Laminated Plastic, the twelve (12) months warranty period prescribed in GC3 Execution and Control of the Work, Subsection GC 3.13 Warranty and Rectification of Defects in Work, of General Conditions is extended to twenty-four (24) months.

1.5 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 AWMAC custom grade construction, select tight knot species for ceilings, D-fir species for all other areas.

.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 Exposed cabinet faces with P.Lam finish.
- .2 Interior semi-exposed surfaces: backing grade P.Lam finish.
- .3 Concealed areas: to 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 postforming 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-postformed 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 Drawbolts 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 Cabinet Locks: to ANSI A156.11, Grade 2, solid brass 6-pin cylinders , removable for rekeying. Cabinet lock zinc bodies, 29 mm diameter, with steel bolts with 25 mm throw. All locks keyed alike to building keying system. Door and drawer thickness 22 mm. Provide two keys for each cabinet with locks. All cabinet locks keyed alike. For pairs of doors provide one cabinet lock and one concealed heavy duty elbow thumb latch.

.5 Adjustable shelf hardware:

.1 Pilaster strips and four clips per shelf. Semi-recess mounted Finish in dull chrome. Clips to retain upper shelves in place (seismic clips).

.2 Plastic inserts for mounting in predrilled holes.

.3 Shelf brackets: of size indicated, dull chrome finish.

.12 Applied finish: water base, low sheen, clear acrylic lacquer, fast drying.

2.2 CASEWORK

.1 Fabricate caseworks to AWMAC custom quality grade.

.2 ROOM 102 COUNTER

.1 AWMAC custom grade.

.2 Construction: Birch plywood, 19 mm thickness, drawer fronts and faces. 12 mm ply for backs.

.3 Counter top and integral surfaces: plastic laminate on two layers of 19 mm plywood, with plastic laminate edging and backing grade plastic laminate on underside.

.4 Exposed drawer, door fronts and exposed faces: Birch veneered plywood solid matching Birch edging.

.5 Light valence trim: clear Birch to match birch plywood.

.6 Drawer interiors: Melamine faced MDF with pvc or Melamine thermally fused edging.

.7 Cabinet interior and shelves: Birch ply with solid birch edging and clear finish.

.8 Sliding glazed panel trim: clear Birch.

.9 Pass-thru specified in Section 50 50 10.

.10 Sliding glazed counter barrier specified in Section 08 11 25.

.11 Light cove acrylic lense specified in Section 09 51 13.

.12 Hardware: wire pulls, magnetic catches, drawer slides and pilaster strips with clips. Cabinet drawer locks and thumb latches as indicated.

.3 ROOM146 COUNTER

.1 AWMAC custom grade.

.2 Construction: D-Fir plywood, 19 mm thickness, drawer, door, fronts and faces. Frame support wall from 38 x 89 Hemlock studs at 400 oc. 12 mm ply for backs.

.3 Upper counter top and integral surfaces: plastic laminate on double layer 19 mm plywood, with plastic laminate edging.

.4 Lower counter top and back: plastic laminate on single layer 19 mm plywood, with plastic laminate edging.

.5 Exposed drawer fronts and exposed faces: laminated plastic with backing grade plastic lam on cabinet interior semi-exposed surfaces with plastic laminate edging.

.6 Interior drawers: Melamine faced MDF with pvc or Melamine thermally fused edging.

.7 Cabinet interior and shelves: Birch ply and solid Birch edging with clear finish.

.8 Hardware: wire pulls, magnetic catches, drawer slides and pilaster strips with clips. Cabinet drawer locks and thumb latches as indicated

.9 Gussets: 19 mm Birch ply with plastic laminate finish and edging.

.4 ROOM 118 COUNTERS

.1 AWMAC custom grade.

.2 Construction: birch plywood, 19 mm thickness, drawer, door, fronts and faces. Support outer counter on wall with 38 thick framing as indicated. Fasten outer counter fascia to wall with 100 mm long wood screws at each stud. Predrill holes. 12 mm ply for backs.

.3 Counter top and integral surfaces: plastic laminate on double layer 19 mm plywood, with plastic laminate edging.

.4 Exposed drawer fronts, doors and exposed faces: clear finish on exposed surfaces with solid birch edging.

.5 Trim and casing at metal shutter: Birch with clear finish, 19 mm casing and 11 mm trim.

.6 Interior drawers: Melamine faced MDF with thermally fused pvc or Melamine.

.7 Cabinet interior and shelves: Birch ply with solid Birch edging with clear finish.

.8 Hardware: wire pulls, magnetic catches, drawer slides and pilaster strips with clips. Cabinet drawer locks and thumb latches as indicated.

.9 Reveal edge: black thermally fused pvc or melamine.

.5 COUNTER AND CUPBOARD UNITS WITH SINKS

.1 AWMAC custom grade.

.2 Construction: Birch plywood, 19 mm thickness, drawer fronts doors and faces.

.3 Counter top and integral surfaces: post-formed plastic laminate on particleboard 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. Cabinet drawer locks and thumb latches as indicated.

.6 COUNTER AND CUPBOARD UNITS WITHOUT SINKS

.1 AWMAC custom grade.

.2 Construction: Birch plywood, 19 mm thickness, drawer fronts doors and faces.

.3 Counter top and integral surfaces: plastic laminate on 19 mm plywood, with plastic laminate edging and applied backsplash where indicated. Note: double layer 19 mm top where indicated.

.4 Exposed drawer fronts, doors and faces: 19 mm Birch plywood with solid birch edging and clear finish. 12 mm birch ply 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. Cabinet drawer locks and thumb latches as indicated.

.7 WASHROOM VANITIES WITH SINKS

.1 AWMAC custom grade.

.2 Construction: Birch plywood, 19 mm thickness, fronts and faces.

.3 Counter top and integral surfaces: post-formed plastic laminate on particleboard core with integral backsplash and wrap around laminate on leading edge.

.4 Access panel: stainless steel access hatch and frame with latch, maximum practical size for plumbing access.

.8 ROOM 144/145 COUNTER

.1 AWMAC custom grade.

.2 Construction: 19 mm thickness D-Fir plywood, double layer glued and screwed together, with plastic laminate top and solid birch edging. Dado ply top into edging as indicated.

.3 Countertop underside: clear finish.

.4 Installation: Top fastened to steel frame from below using wood screws with countersunk heads.

.5 Apply bead of security caulking at wall/counter gap in room 145, in accordance with Section 07 92 12.

.9 LIGHT VALENCE

.1 AWMAC custom grade.

.2 Construction: Birch plywood, 19 mm thickness front and 12 mm back with 38 x 38 bulkhead frames at 1200..

.3 Surface finish: plastic laminate exterior and painted white interior.

.10 ROOM 160/161 COUNTER

.1 AWMAC custom grade.

.2 Construction: D-FIR plywood, 19 mm thickness, drawer, door, fronts and faces.

.3 Counter top and integral surfaces: plastic laminate on with plastic laminate edge.

.4 Exposed door and drawer fronts and exposed faces: plastic laminate surface and edging, backing grade laminate on door interior.

.5 Interior shelves and surfaces: Birch plywood with clear finish.

.6 Interior drawers: Melamine faced MDF with thermally fused pvc or Melamine.

.7 Hardware: wire pulls, drawer slides, hinges, magnetic catch, pilaster strips and clips. Provide locks and thumb latches as indicated.

.8 Wiring grommets: 50 mm diameter pvc, black colour, designed for passage of computer wiring through countertop. Provide 2 grommets for location as directed.

.11 Rooms 118, 120 SHELVING UNITS,

.1 AWMAC custom grade.

.2 Construction: 19 mm thickness G2S Birch plywood, gables, facings, shelves, top, bottom and back.

.3 Doors 160 and 106a: Section 081410 - Wood Doors

.4 Shelves: 19 mm birch plywood.

.5 Edge banding: solid Birch edging.

.6 Adjustable shelves: with pilaster strips and clips.

.12 JANITOR & 104A/110 CLOSET SHELVING UNITS

.1 AWMAC custom grade.

.2 Construction: 38 x 89 support frame with 19 mm thickness G1S Birch plywood, shelf, and face with paint finish.

.3 Edge banding: solid Birch edging.

.4 Closet rod: Steel bracket spaced 900 mm oc supporting 32 mm φ solid wood rod or 32 mm chrome plated steel pipe.

.5 Shelves: 19 mm birch plywood.

.6 Adjustable shelves: with pilaster strips and clips.

.13 RUNNING TRIM

.1 AWMAC custom grade.

.2 Material and Finish:

.1 Birch species to match Birch plywood.

.2 Clear cedar to match cedar ceiling.

.14 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.

.15 BENCH

.1 AWMAC custom grade.

.2 Construction: 38 x 140 frame with two layers 19 mm thickness D-Fir plywood seat, glued and screwed together with plastic laminate top, fronts and faces.

.3 Seat frame fastened to wall and resting on stainless steel pipe leg.

.4 Seat back rest: 19 mm thickness with plastic laminate face and 38 x 38 mm solid birch edge/corners with 20 mm radius corners. Rabbet ply back into solid birch corner edging and miter edging at corners.

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 postforming 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 Other countertops:

.1 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions.

.2 Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 3000 mm.

.3 Use hardwood bullnose edging for countertops with flatwork to cover exposed edges of countertops as indicated.

.4 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.

.5 Comply with CAN3-A172, Appendix "A".

2.5 EDGE BANDING

.1 Melamine panels: thermally fused PVC.

.2 Plastic laminate edging for countertops, gables, fronts and facings.

.3 Clear birch trim/edging at countertops as indicated.

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 CEDAR CEILING

.1 Ceiling boards panelling T&G joint: maximum 15% moisture content, western red cedar, select tight knot saw texture flush surface one side and V-joint milled finish on opposite side, 17.5 x 150 mm nominal width.

.2 Fasten paneling boards straight, plumb, aligned lengths nailed into wood strapping, toe nailed into base of tongue (blind nailing) using 52 mm long spiral shank finishing head nails. Note: nails must penetrate solid wood to 38 mm depth.
.2 Stagger butt joins not less than 1200 mm at adjoining boards and distribute evenly over ceiling faces. Cut butt joints at 45° (scarf joints).
.3 Provide additional nail in face of each board at every third strapping member and at terminations. Conceal nail heads under trim where possible.

2.8 FINISHING

.1 Except as indicated otherwise Birch veneered and trim surfaces of cabinets: factory applied, low VOC clear acrylic lacquer in satin finish.

.2 Site finishing of wood window casing/stools specified in Section 09 91 23.

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 Use draw bolts at joints in countertops.

.4 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.

.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, tight, joint. 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° scarfe 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 drawbolts and splines in countertop joints. Maximum spacing 450 mm o.c., 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 CEDAR CEILING

.1 Fasten paneling boards straight, plumb, aligned lengths nailed into wood strapping, toe nailed into base of tongue (blind nailing) using 52 mm long spiral shank finishing head nails. Note: nails must penetrate solid wood to 38 mm depth.

.1 Stagger butt joins not less than 1200 mm at adjoining boards and distribute evenly over ceiling faces. Cut butt joints at 45° (scarf joints).

.2 Provide additional nail in face of each board at every third strapping member and at terminations. Conceal nail heads under trim where possible. Set exposed nail heads 0.5 mm below surface.

.3 Install trim in longest lengths practical. Cut butt joints at 45°. Trim at corners mitred tight.

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, epoxy and filler materials; clean cabinets and millwork.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 The requirements for the application of water repellents for exterior masonry surfaces.

1.2 RELATED WORK

.1 Section 04 04 99 - Masonry.

.2 Section 010150 - General instructions for Submittal Procedures. Construction/Demolition Waste Management And Disposal and Common Product Requirements.

1.3 REFERENCES

.1 ASTM International, (ASTM).
.1 ASTM D 2369-07, Test Method for Volatile Content of Coatings.
.2 ASTM D 2832-92(R2005), Guide for Determining Volatile and Non-volatile Content of Paint and Related Coatings.

1.4 SUBMITTALS

.1 Product Data:
.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section01 01 50 - General Instructions for Submittal Procedures.
.2 Submit copies of WHMIS MSDS - Material Safety Data Sheets in accordance with paragraph 1.4.1.1. Indicate VOC's for water repellent.

.2 Manufacturer's Instructions:
.1 Submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

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

.3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Section.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Storage and Protection:
.1 Deliver, handle, store and protect materials of this section in accordance with Section 01 01 50 General Instructions for - Common Product Requirements.
.2 Protect products from freezing.

1.7 WASTE MANAGEMENT AND DISPOSAL

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

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

.3 Collect and separate for disposal; paper, plastic, polystyrene and packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused waterproofing material from landfill to official hazardous material collections site approved by Departmental Representative.

.5 Do not dispose of unused waterproofing materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.

1.8 SITE CONDITIONS

.1 Site Environmental Requirements:
.1 Maintain substrate temperature at water repellent installation area in accordance with water repellent manufacturer's printed instructions.
.2 Apply coating during dry weather. Allow surfaces to dry minimum of 3 days after rainfall or cleaning before applying further coats.
.3 Protect plants and vegetation which might be damaged by water repellents.
.4 Protect surfaces not intended to have application of water repellents.

1.9 MOCK-UP

.1 Construct mock-up in accordance with Section 01 01 50 - General Instructions.

.2 Apply protective coatings to sample panel. Surfaces of sample to match surface to be treated.

.3 Allow 24 h for inspection of mock-up by Departmental Representative before proceeding with coating work.

2 Products

2.1 MATERIALS

.1 Water repellent clear coating for concrete block wall surfaces: low VOC (250 g/l), blend of water-borne silane modified siloxane solution to provide a clear water repellent surface through a chemical reaction by reacting with masonry alkalinity. Repellent sealer of penetrating type with breathable properties.

3 Execution

3.1 PREPARATION

.1 Prepare and clean substrate surfaces in accordance with water repellent manufacturer's printed instructions.

.2 Remove stains, dirt and efflorescence from surfaces to receive water repellent.

3.2 APPLICATION

.1 Apply water repellent coating using low pressure spraying apparatus, at coverage rate of 1.0 - 1.2 m²/ℓ (50-60sf/gal) after dispersion, (mist coat followed by flood coat) in accordance with manufacturer's printed instructions.

.2 Apply to exposed exterior concrete block masonry surfaces of building.

3.3 FIELD QUALITY CONTROL

.1 After water repellent coating has dried, spray coated surfaces with water with Departmental Representative in attendance.

3.4 CLEAN-UP

.1 Clean all over spray from adjoining surfaces immediately following application of repellent, in accordance with manufacturer's instructions.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 04 04 99 - Masonry

.2 Section 07 21 16 - Blanket insulation.

.3 Section 07 21 19 - Spray in Place Rigid Insulation.

.4 Section 07 27 10 - Air/Vapour Barriers for installation of rigid insulation.

.5 Section 07 62 00 - Metal Flashing and Trim.

.6 Sections 22 07 19, 23 07 13, 23 07 16, 23 07 19 - Insulation for mechanical work.

1.2 REFERENCES

.1 ASTM International (ASTM).
.1 ASTM C 1289-08, Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

.2 Underwriters Laboratories of Canada (ULC).
.1 CAN/ULC-S701-05, Thermal Insulation, Polystyrene, Boards and Pipe Coverings.
.2 CAN/ULC-S704-01, 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 Foundation wall: To CAN/ULC S701 Type 4, CFC free polystyrene insulation Type 4, and CAN/ULC S-770 with a LTTR (Long Term Thermal Resistance) of RSI 1.84 (R10.6), minimum 50 mm thickness with 10 mm latex modified concrete facing (on top 610 mm of wall and where insulated foundation is exposed to view), square ends and tongue and groove edges on long sides.

.2 Exterior insulation Above Grade:
.1 Rigid polyisocyanurate rigid insulation 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, faced on both sides with manufacturer's purpose made facing for wall application, thickness as indicated.

2.2 ACCESSORIES

.1 Tape for sealing joints as recommended by manufacturer.

.2 Fastening: self drilling wood screws with minimum 25 mm dia washers, corrosion resistant types suitable for substrates encountered and capable of retaining insulation in place.

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 Membranes.

2.4 COMPATIBILITY

.1 Ensure insulation is compatible with other materials in contact with insulation.

.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 furring/framing, blocking and nailers, plumbing pipes and ducts, around exterior doors and windows and other protrusions.

.4 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.

.5 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 fasteners as recommended by insulation manufacturer. Apply panels horizontally to foundation wall as indicated. Concrete topped insulation is required on top 610 mm of wall and where insulated foundation is exposed to view. Continue 50 mm rigid insulation on foundation wall to top of footing.

.2 Fit insulation tight to underside of perimeter flashing and/or shelf angle.

3.3 INSULATED STUD WALL

.1 Install isocyanurate insulation boards to exterior wall behind emergency telephone and as indicated. Fasten panels in place using adhesive.

3.4 INSULATED CAVITY WALLS

.1 Install rigid insulation boards to exterior surfaces of masonry and sheathed 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 wood nailers and blocking.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 07 21 13 - Board insulation.

.2 Section 07 21 19 - Spray in Place Rigid Insulation.

.3 Section 09 21 16 - Gypsum Board Assemblies.

.4 Sections 22 07 19, 23 07 13, 23 07 16, 23 07 19 - Insulation for mechanical work.

1.2 REFERENCES

.1 Underwriters Laboratories of Canada (ULC).
.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.

.2 Canadian General Standards Board (CGSB)
.1 CAN/CGSB 19.13M-84(R1987) - Sealing Compound, One Component, Elastomeric Chemical Curing.
.2 CAN/CGSB 51.34M-86 - Vapour Barrier, Polyethylene Sheet for Use in Building Construction

.3 ASTM International (ASTM)
.1 ASTM C665 - 06 Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
.2 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 - Genweral 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 - 1.94 (89 mm thickness batts) for exterior steel stud wall areas, and as indicated. Batt width to suit stud spacing.

.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 Acceptable Product: Fibrex SAFB.

2.2 ACCESSORIES

.1 Spray foam adhesive: component polyurethane expanding foam in an aerosol can, aerosol propelled expanding foam for attachment of insulation to inside face of exterior sheathing.

3 Execution

3.1 INSULATION INSTALLATION

.1 Install insulation to maintain continuity of thermal and sound protection to building elements and spaces.

.2 Install thermal insulation in exterior stud walls, tight to inside face of exterior sheathing board using expanding foam strips, 150 mm long, applied to sheathing, centered between studs at 600 mm oc to retain batt insulation in place tight to sheathing.

.3 Install sound attenuation batts to walls and ceiling spaces in rooms indicated with sound rating of STC 46. Insulation in fire and sound rated partitions specified in Section 09 21 16 Gypsum Board Assemblies.

.4 Fill pressed steel door frames with mineral fibre insulation in walls with sound attenuation batts.

.5 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.6 Do not compress insulation to fit into spaces, except around window frame shim space.

.7 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures.

.8 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 (2004) 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 Departmental Representative.

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 manufacturers 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 overhangs:

.1 Apply polyurethane sprayed foam insulation to minimum 50 mm thickness. Apply in several applications to build up to thickness.

.2 Apply sprayed insulation to all structural steel joist chords and deck surfaces penetrating exterior wall within building overhangs. Spray underside of steel deck, exposed surfaces of joist chords in overhang area. In large soffit areas spray metal surfaces to 900 mm from exterior wall.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 04 04 99 - Masonry.

.2 Section 07 21 13 - Board Insulation.

.3 Section 07 46 13 - Roof and Wall Cladding Assembly for roof vapour barrier membrane.

1.2 WORK INCLUDED

.1 Sheet membrane applied to gypsum sheathing board and CMU walls from main floor line to underside of steel roof deck.

.2 Sheet air/vapour barrier membrane applied to base of wall, as through wall flashing, over joints at transition between different substrates and at perimeter of wall openings at windows, doors and other openings.

.3 Rigid insulation applied to air/vapour barrier membranes with compatible adhesive to retain insulation panels in place in conjunction with furring channels.

1.3 REFERENCES

.1 ASTM International (ASTM)
.1 ASTM E154-99(2005) 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-05 Standard Test Methods for Water Vapor Transmission of Materials.
.3 ASTM E283-91(1999) 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 D882-02 Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
.5 ASTM D1004-07 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.

1.4 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 manufacturers requirements.

1.5 SUBMITTALS

.1 Submit product data and samples in accordance with Section 01 01 50 - General Instructions for Submittals clause.

.2 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Departmental Representative will review product data and samples for conformance with specifications and suitability of use for site conditions.

.4 Mock-Up:
.1 Construct mock-up in accordance with Section 01 01 50- General Instructions, paragraph 8.7.
.2 Provide mock-up area, at new wall construction, minimum 3 m wide, full height of wall. Mock-up to include one framed window opening to demonstrate application of primers, air/vapour barrier membranes, transition and flashing membranes.

2 Products

2.1 MATERIALS

.1 Sheet membrane (Self-Adhering) for application over gypsum sheathing board, CMU and at wall openings:
.1 SBS modified bitumen, self-adhering sheet membrane complete with a cross-laminated polyethylene film, and having the following physical properties:
.1 Thickness: 1mm (40 mils) .
.2 Air leakage: <0.0001 CFM/ft² @ 75 Pa to ASTM E2178;
.3 Vapour permeance: 49 ng/Pa.s.m² 0.86 perms to ASTM E96 water method;
.4 Low temperature flexibility: @ -30°F , Pass, to CGSB 37-GP-56M;
.5 Elongation: 200% to ASTM D412-modifed;
.6 Acceptable products: BlueSkin® SA Air Barrier Membrane by Henry.

.2 Flashing membrane(Self-Adhering) for application at base of wall:
.1 SBS modified bitumen, self-adhering sheet membrane complete with a cross-laminated polyethylene film, having the following physical properties:
.1 Thickness: 1 mm (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;
.7 Acceptable Product; Blueskin® TWF by Henry.

.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;
.5 Acceptable Product: Blueskin® Primer by Henry.

.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 Air leakage: 0.0026 CFM/ft2 @ 2.1 lbs/ft2 to ASTM E283;
.3 Water vapour permeance: 0.03 perms to ASTM E96
.4 Long term flexibility: CGSB 71-GP-24M;
.5 Chemical resistance: Alkalis and salt.
.6 Acceptable Product: Air-Bloc 21 Insulation Adhesive by Henry.

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, free of water, frost, dirt, oil, grease, curing compounds or other deleterious to adhesion of damproofing membrane.

.3 Seal exterior cracks and around penetrations through waterproofing with compatible sealing compound:
.1 Seal cracks in masonry and concrete with a strip of transition 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, as recommended by the manufacturer, prior to the application of air barrier membrane.
.3 At joints between panels of exterior grade gypsum wider than 6 mm apply transition membrane 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 self-adhering air/vapour barrier Membrane:
.1 Apply primer for self-adhering membranes at rate recommended by manufacturer.
.2 Apply primer to all areas to receive sheet membrane and through-wall flashing membrane, by roller or spray and allow minimum 30 minute open time. Primed surfaces not covered by sheet membranes during the same working day must be re-primed.

3.3 MEMBRANE APPLICATION

.1 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 or self angles, 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 masonry veneer. Trim off excess as directed by the Departmental Representative.

.5 Apply through-wall flashing membrane along the base of masonry veneer walls, at framed openings for windows, doors and other wall openings. Membrane to form continuous flashing and extend up a minimum of 200 mm up the back-up wall.

.6 Complete detail work in accordance with manufacturer's instruction to ensure continuous air tightness of the membrane. Provide mechanical attachment of membrane at all window and doorframes, or use an approved sealant joint.

.2 Air/vapour Barrier Membrane (Self-Adhering Type):

.1 Align and position self-adhering membrane, over walls indicated, remove protective film and press firmly into place. Ensure minimum 50 mm overlap at all end and side laps.

.2 Position membrane for alignment; remove protective film and press firmly in place. When membrane is entirely in place, roll membrane including seams with an approved roller to ensure full contact. When using membrane with brick ties, position membrane, press in place and cut for ties or projections. Seal around any openings and at leading edge at the end of the days work with approved sealant.

.3 Tie-in to flashing membranes at window frames, hollow metal door frames, and at the interface of dissimilar materials as indicated in drawings.

.4 Promptly roll all laps and membrane with a counter top roller to effect seal.

.5 Ensure all preparatory work is complete prior to applying sheet air/vapour barrier membrane.

.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 barrier membrane has cured prior to installation of insulation.

.2 Co-ordinate wall insulation installation with metal furring specified in Section 07 46 13 Roof and Wall Cladding Assembly.

.3 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.

.4 Fully butter all joints of insulation panels with adhesive during installation, except at expansion joints.

3.5 PROTECTION OF FINISHED WORK

.1 Air barrier membranes are not designed for permanent exposure. Cover membranes as soon as possible as dictated by the manufacturers instructions..

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 33 46 20 - Footing & RWL Drainage.
.2 Section 06 11 01 - Rough Carpentry for plywood sheathing on fascia.
.3 Section 07 27 10 - Air/vapour Barrier Membranes on walls.
.4 Section 07 21 13 - Rigid insulation on walls.
.5 Section 23 34 00 - HVAC Fans for roof mounted exhaust fan flashing.
.6 Section 23 51 00 - Breeching Chimneys and Stacks for flue vent flashing:
.7 Division 23 37 00 - Air Outlets and Inlets for weather louvres.

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 (ASTM).
.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 standard test Method for film Hardness by Pencil Test.
.5 ASTM D2794-93(2004) Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid deformation (Impact).
.6 ASTM D3359-09 Standard Test Methods for measuring Adhesion by Tape Test.
.7 ASTM D2247-02 Standard Practice for Testing water Resistance of Coatings in 100% RH.
.8 ASTM E96/E96M-05 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.
.11 ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
.12 ASTM D1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
.13 ASTM D5147 - Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material.

.4 International Code Council (ICC): AC 48 - Acceptance Criteria For Roof Underlayment For Use In Severe Climate Areas.

.5 Roofing Contractors Association of BC (RCABC)

.6 AAMA 2605 - 05 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

1.3 DESIGN CRITERIA

.1 Design preformed roof and 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 Ensure air tightness of roof system is continuous, is sealed at openings and terminations and is overlapped at changes in wall structure and where roof and wall meet.

.3 Roof panel description:

.1 Snap-in friction fit ribbed panel system with concealed anchor clips, minimum 38 mm high, spaced 200 - 250 mm oc with concealed fastening clip screwed directly to either purlin framing or structural deck through rigid insulation.

.2 Panels manufactured from sheet steel with galvanized coating and prefinished with factory-applied, oven-baked finish of polyvinylidene fluoride resin.

.3 Air infiltration: to ASTM E-283 no air leakage at 2.86 lbs/sf.

.4 Water penetration: no leakage at 20 lbs/sf when tested to ASTM E-331.

.5 Approved product profiles and support system:

.1 KlipRib System by AEP Span - Tacoma WA - http://www.aepspan.com.

.2 Rib-Roof By Mercury Metals Ltd.- Delta, BC.

.3 Nordic Clip by Westform - Chilliwack, BC - http://www.westform.com.

.6 Design members to withstand dead load, live loads from foot traffic, roof snow load as indicated and positive and negative wind loads for locality, in accordance with NBCC 2010 and notes listed on structural drawings. Maximum allowable deflection is 1/180th of span. Design members to accommodate building movement, local temperature extremes and to be watertight.

.7 Make allowance for additional snow drifting load at elevated walls and extra fastening where required.

.8 Panels factory formed. Panels formed by portable forming machines on site are not acceptable.

.9 Snow retention system specified in this clause must be approved by the roof panel manufacturer for installation on selected roof panel.

.4 Snow retention system:

.1 Rib clamps: fastens directly to the standing seams without penetrating the metal roof panels and damaging the prefinished coating.

.2 Coordinate snow retention system with roof panel system.

.3 All loads incurred by snow retention system are transferred to the roof panel system and must be designed to accept these additional loads.

.4 Design to meet snow load, climatic conditions for locality, length of roof panel and spacing of ribs. Provide addition rows of snow retention to meet these requirements.

.5 Submit manufacturer's specifications and detail drawings for installation onto roof panel system.

.5 Corrugated wall panel description:

.1 Prefinished galvanized sheet steel, 0.76 m thickness x 22 mm deep corrugated profiled panel by 726 ± mm wide, lapping side joints, exposed fastening, with polyvinylidene fluoride resin coating in colour as selected by Departmental Representative from manufacturer's standard range.

.6 Roof and Wall Panel factory finish:

.1 Panels manufactured from sheet steel: with galvanized coating and prefinished with factory-applied, oven-baked finish of polyvinylidene fluoride resin (Kynar 500) meeting the performance criteria of AAMA 2605 specification, with weathering test -10 yrs Florida 5 ΔE max. color change 50% gloss retention min. 8 chalk min. (6 on whites) 10% film erosion max.

.7 Soffit panel:

.1 Prefinished sheet aluminum ribbed profile panels 400 mm wide, with perforations, residential type, baked enamel finish in colour selected by Departmental Representative.

.8 Prefinished Architectural Panels:

.1 Prefinished architectural panels : aluminum facing 0.25 mm thickness thermally adhered to both sides of high density polypropylene core, nominal thickness 8 mm, complete with PVC and extruded aluminum two piece batten trim in matching colour for concealed fastening:

.1 Exposed face with prefinished textured finish and backer sheet with smooth primed surface.

.2 Acceptable Product: Citadal ProCore™. Other manufactured panels meeting the performance requirements of specification are acceptable for use on this project.

.2 Panel finish: Acrylic Urethane in colour selected by the Departmental Representative from manufacturer's standard range.

.3 Panels are furnished with a strippable film (or interleafed microfoam) on the painted surfaces to protect the finish during shipment and installation.

.4 Warranty: panel delamination for five years, Acrylic Urethane panel finish for five years.

1.4 QUALIFICATIONS OF INSTALLERS

.1 Installation of preformed metal roofs to be performed by manufacturer approved installers having at least five years experience in metal roofing 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.

.3 Conform to the latest Guarantee Standards of the Roofing Contractors Association of British Columbia (RCABC), as published in the "**RGC Roofing Practices Manual"** for a ten (10) year Guarantee, unless modified by the contract documents to exceed those minimums.

.4 Qualification of Workers: Employ skilled applicators certified by the Provincial Apprenticeship Board as being 'enrolled in' or 'having completed' appropriate training in the fabrication and installation of metal roofing.

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, 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 roof and wall panel assembly, fascia panels and snow retention system.

.3 Submit duplicate samples of representative prefinished panel materials and sealant for colour selection by Departmental Representative.

.4 Prefinished composite fascia panels:
.1 Submit two samples of each colour of finish to be selected. Submit along with manufacturers standard literature. Shop drawings to show all elevations along with fasteners, details, and location of all joints.

1.6 WARRANTY

.1 For the Standing Rib Steel Roofing work in this Section 07 46 13, the 12 month warranty period specified in General Conditions GC 3.13 is extended to 60 months.

.2 Provide Departmental Representative with manufacturer’s written guarantee stating the extended warranty time period indicated in paragraph 1.6.1. Provide inspection services and include costs for this work.

.3 Fascia panel paint system: provide manufacturer's warranty for twenty (20) years against peeling and blistering, flaking, cracking or chipping, checking. Warranty for loss of adhesion - 5 years.

1.7 COMPATIBILITY

.1 Compatibility between components of structural insulated standing seam roof system is essential. Provide written declaration to Departmental Representative stating that materials and components, as assembled in system, meet this requirement.

.2 Provide written declaration to Departmental Representative stating that the Manufacturer/Distributor for the materials, accessories and components, as assembled in system, for the structural insulated standing seam roof system, will use one Manufacturer/Distributor only for this system.

1.8 SOURCE QUALITY CONTROL

.1 At least 2 weeks prior to fabrication of steel roof 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.

1.9 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, structural quality, grade 230, maximum stress 207 Mpa, with galvanized Z275 zinc coating.

.2 Coating systems:

.1 Roof and wall panels and flashing: factory finish coating of, factory-applied, oven-baked finish based on Kynar 500® polyvinylidene fluoride resin, meeting the performance criteria of AAMA 2605 specification, in colour selected by Departmental Representative.

.2 Architectural Composite aluminum panels: Acrylic Urethane.

.3 Soffit panels: Baked enamel finish.

.4 Snow retention system: to match roof panels.

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.

.3 Screws for sheathing board of self drilling/threading threads with countersunk head.

.4 All other screws galvanized except as specified above.

.2 Rigid Insulation for sloped metal roofs: polyisocyanurate rigid insulation to meet CAN/ULC-S704 and CAN/ULC S-770 with a LTTR (Long Term Thermal Resistance) of RSI 1.05 (R6), faced both sides with foil-kraft paper, thickness as indicated. Total Insulation thickness 100 mm applied in two 50 mm layers, staggered joints, except as noted otherwise.

.3 Rigid Insulation for walls: rigid Isocyanurate panels as specified in Section 07 21 13.

.4 Sealants:

.1 Sealant in roof panels at overlapping joints: factory applied to manufacturer's standard to meet design criteria.

.2 Exposed sealant: as recommended by manufacturer.

.3 Tape: butyl tape to manufacturer's standard, to meet design criteria.

.5 Closures: laminated, semi-rigid cross linked polyethylene foam to fit panel profile without gaps.

.6 Exterior gypsum sheathing board: in accordance with paragraph 2.1.2 in Section 09 21 16, minimum 12.7 mm thickness for roof and wall sheathing, panel sizes 1220 mm wide x maximum practical length.

.7 Roof Vapour Barrier membrane: water barrier membrane high temperature/low temperature and ice damming membrane: Synthetic polymer surfaced self-adhered membrane roofing underlayment for sloped roofs equal to or greater than 2:12 pitch, subject to the effects of ice damming and wind driven rain.

.1 Color: Gray.

.2 Surface: Synthetic Polymer - slip resistant Nodular.

.3 Release Liner: Silicone Treated, Poly Split Release.

.4 Weight per square: 10.8 kg.

.5 Minimum Thickness: ASTM D5147, 1.1 mm.

.6 Tensile: ASTM D1970, MD 17.5 kN/m

.7 Thermal Stability: ASTM D1970, 115 degrees C - Pass.

.8 Low Temp Flexibility: ICC AC 48, Pass.

.9 Tear Resistance: ASTM D1970, MD 140/ CD 622/445 N.

.10 Adhesion to Plywood: ASTM D903, 700 N/m.

.11 Self Seal Ability: ASTM D1970, Pass.

.12 Temperature Range: 115 degrees C to 4.4 degrees C.

.13 Roll Size: 914mm x 21945mm, 20 sm.

.14 Acceptable Product:

.1 InterWrap - TITANIUM PSU-30.

.8 Rain gutter and down pipes:

.1 Gutter: formed aluminum or galvanized sheet steel, compatible with roof panels, prefinished paint coating, minimum size 125 x 125 mm profile gutter.

.1 Provide leaf screens fastened to top of gutter, fabricated from perforated soffit material cut to fit gutter width. Fasten screens using sufficient screws to prevent wind blow-off.

.2 Provide flanged ABS or PVC coupling for adhesive welded connection to down pipe.

.2 Down pipes: 75 mm diameter ABS plastic down pipes, complete with adhesive welded elbows and couplings conforming to:

.1 Acrylonitrile-Butadiene-Styrene (ABS) Drain Waste and Vent Pipe Fittings conforming to CSA B181.1.

.2 Polyvinyl Chloride (PVC) Drain Waste and Vent Pipe and Pipe Fittings conforming to CSA B181.2.

.3 Strap anchors: 1 mm thickness PF sheet aluminum 75 mm wide, custom fabricated, with anchors for fastening to steel siding and masonry wall.

.3 Apply plastic primer to down pipe surfaces prior to installation.

.9 Snow retention system:

.1 System to meet design criteria:

.1 Clamps: structural aluminum or stainless steel.

.2 Fasteners: Stainless steel set screws and machine bolts.

.3 Snow retention bars: aluminum or stainless steel to manufacturer's standard to meet design criteria.

.4 Finish; colour to match roof panels. Coloured insert from prepainted galvanised sheet steel or aluminum sheet.

2.3 COMPONENTS

.1 Roof assembly:

.1 Preformed sheet steel ribbed roof panels of minimum 0.6 mm thickness conforming to Design Criteria in Clause 1.2, with self-locking standing ribs, ribs spaced 200 to 250 mm oc and minimum 40 mm high, secured by panel clip fasteners full width of each panel and spaced to meets loads and manufacturer's recommendations.

.2 Form roof panels in one continuous length of roof slope.

.3 Thermal spacers : foamed rigid insulation 40 mm thick, type as recommended by manufacturer. (Used where girt framing is incorporated in system).

.4 Panel clips: fabricated from galvanized sheet steel designed to accommodate thermal movement and loads from roof panels, and for attachment to subgirts OR directly to steel deck through rigid insulation.

.5 Subgirts: cold formed galvanized sheet steel 'Z' section anchored to top chord of steel joists through steel deck, vapour retarder and sheathing. (Used where required by system to meet design criteria).

.6 Form flashings from 0.6 mm thickness prefinished sheet steel; at ridge, roof edge-eave closure, gable edge, profile closures, curb flashings for roof penetrations and trim to match roof panel finish.

.7 Provide all fabricated and proprietary flashings, of size to accommodate roof penetrations. Prefinished where exposed in final assembly and described as follows:

.1 Pipe and stack flashing: flexible neoprene or EPDM flashing, adjustable hole size, resistant to ozone and UV, with collar clamp and integral fastening ring at base of 1 mm thick aluminum alloy A1100-0 or stainless steel, and stainless steel screws. Acceptable Product: Buildex Dektite.

.2 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: horizontal '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, gutter/fascia, wall penetrations and openings; and trim at doors, windows and fascia panels, 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.

.3 Architectural panel system:
.1 Prefinished aluminum composite material: conforming to Design Criteria.
.2 Battens and trim: two piece extruded aluminum, sections, finished to match panels.
.3 Fabricate panels under controlled shop conditions. Field fabrication only when necessary. Maximum deviation for panel flatness maximum 3mm. in 2 meter, in any direction for assembled units.

.4 Soffit panels:
.1 Formed PF aluminum or galvanized sheet steel soffit panels with perforations and in colour selected by Departmental Representative. Use metal furring for intermediate soffit support.

2.4 METAL FLASHINGS AND TRIM - GENERAL

.1 Form flashings, trim and sheet metal work to profiles, finishes and thicknesses specified for sloped roof areas, wall and soffit panels. Include cap flashings and trim for masonry.

.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. All fasteners in roof system flashings concealed from view except as approved otherwise.

.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.

.6 Accessories:
.1 Plumbing stack vent and pipe flashing for sloped roofs: flexible neoprene adjustable for various pipe sizes, aluminum clamping ring and ss screws and stainless steel clamps.

3 Execution

3.1 PREPARATION

.1 Install roof, wall, fascia and soffit panel assembly following completion and approval of structural deck and 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 ROOFING SYSTEM INSTALLATION

.1 Installation of roof system in accordance with reviewed shop drawings and manufacturer's instructions.

.2 Install gypsum sheathing board over steel roof deck in accordance with manufacturer installation instructions.

.3 Over gypsum sheathing board, install self-adhering sheet membrane for a continuous vapour seal in accordance with manufacturer's instructions. Prime gypsum board sheathing and allow to cure before installing membrane. 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 membrane and stagger end laps at least 915 mm apart:

.1 Vent Pipes and Field Penetrations: Apply a 610 mm square sheet of weather barrier around the penetration. Lap over underlayment beneath and at the sides of the penetration and beneath underlayment above the penetration. Apply sealant to the seam above the penetration.

.2 Sidewalls, Headwalls and Chimneys: Apply weather barrier extending at least 203 mm up the wall and 305 mm on to the roof surface. Lap over roof deck protection.

.3 Hips and Ridges: Apply weather barrier over the length of the hips and ridges.

.4 Rake Edges: Apply weather barrier prior to installation of any rake edge flashing. Apply sealant to the edge prior to installation of metal flashing.

.5 Mechanical equipment curbs: Apply weather barrier up the sides of the curb frame and 305 mm on to the roof surface on all sides, laping over roof weather barrier beneath and at the sides of the curb and beneath weather barrier above the penetration. Apply sealant to the seam above the curb.

.4 Install insulation in two layers, top layer with foil facing, stagger joints and tape top layer joints. Butt insulation boards tight to ensure continuity of thermal protection in roof spaces. Use manufacturer approved tape. Install thermal spacer with girts, where applicable, between subgirt and concealed clips to reduce condensation on panel.

.5 Apply a kraft paper slip sheet over rigid insulation only where recommended by roof panel manufacturer.

.6 Fasten concealed panel retainer clip through insulation panels and sheathing to steel deck using minimum 4 screws per clip at maximum 1220 mm intervals in accordance with manufacturer's instructions.

.7 Install roof panels in position and seal all joints in accordance with manufacturer's instructions.

.8 Install prefinished sheet metal roof curbs and flashings for all roof penetrations in accordance with reviewed shop drawings and manufacturer's instructions.

.9 Commence installation of panels on one end and arrange panels symmetrically so that roof penetrations will not intersect ribs and rib spacing is equal from end walls. Break form end panels to form flashing at end walls as indicated on shop drawings.

.10 Flash roof ridges and valleys. Install all vent flashing, vents and counter flashing in accordance with reviewed shop drawings.

.11 Snow retention System:

.1 Install snow retention system at sloped roof as indicated, in accordance with reviewed shop drawings.

.2 Snow retention clamps to rest on top of roof panel ribs perpendicular to slope, in single/double row configuration to meet design requirements.

.3 Fasten clamps with set screws or machine bolts in accordances with reviewed shop drawings. Provide one clamp per rib, in linear layout perpendicular to roof slope.

.4 Install linear retention strip to clamps with treaded hex bolts in accordance with reviewed shop drawings.

3.3 GUTTER ASSEMBLY

.1 Install continuous length gutters or gutters in minimum 3 m lengths to roof eaves as indicated. Fasten gutter clips or straps at 762 mm oc.

.2 Install down pipes with minimum three straps each fastened to wall siding and masonry.

.3 Connect down pipes to underground storm piping system.

.4 Fasten gutter screens to all gutters using stainless steel screws.

3.4 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 barrier membrane, in accordance with Section 07 27 10, over primed gypsum board and plywood sheathing full height of wall/fascia and to underside of deck and seal to deck closures with approved sealant.

.1 Reinforce corners and joints with additional layer of membrane minimum 100 mm beyond each side of joint and corners.

.2 Lap membrane minimum 150 mm over adjoining wall air barrier membrane.

.3 Overlap end laps of membranes and at juncture with vapour barrier, a minimum of 50 mm and tape joints, to provide a continuous air barrier seal.

.4 Install horizontal steel girts to wall 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

.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.

.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.

.7 Coordinate flashing installation with masonry and window trades specified in other sections.

.8 Install and seal notched and formed closures, to arrest direct weather penetration behind panels at all openings.

3.5 COMPOSITE PANEL ASSEMBLY

.1 Install architectural alum composite wall panels with two piece trims etc., in accordance with manufacturer's instructions and reviewed shop drawings.

.2 Ensure wood or metal strapping is applied over air barrier membrane to steel stud framing on fascias at the appropriate spacing. Wood strapping specified in Section 06 10 11.

.3 Apply panels after air barrier and strapping is in place and approved by Departmental Representative.

3.6 SOFFIT PANEL ASSEMBLY

.1 Installation of soffit panel system to configuration indicated in accordance with manufacturer's instructions.

.2 Attach perforated soffit panels to metal furring/framing using concealed fastening system. Conceal fasteners at trim where possible. Install soffit panels starting from one corner or termination point and insure installation is tight fitting with no exposed edges. Install break formed trim at exposed edges.

3.7 CLEANING

.1 Remove excess sealant using recommended solvent.

.2 Clean prefinished metal panels flashings and trim.

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 - Metal Roof and Wall Cladding Assembly for associated flashings.

.3 Section 07 92 10 - Joint Sealing.

1.2 REFERENCES

.1 ASTM International (ASTM)
.1 ASTM A 653/A653M - 09a, 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 CAN/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.

2.2 PREFINISHED STEEL SHEET

.1 Finish: factory applied coating to match factory paint coating for wall cladding, in colour(s) selected by Departmental Representative 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 0.6 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 in sloped metal roof: specified in Section 07 46 13.
- .2 Supply and exhaust air duct penetrations through roof: to Division 23.

2.7 GUTTERS AND DOWNSPOUTS

.1 Specified in Section 07 46 13.

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 Division 23, 26 and 27 - Fire stopping and smoke seals within mechanical assemblies (i.e inside ducts, dampers) and electrical assemblies (i.e. inside cable trays).

1.2 DESCRIPTION OF WORK

.1 Apply firestop sealant and systems around all penetrations through openings in fire rated walls and ceilings.

.2 Seal around ducts and conduits penetrating fire separations.

.3 Seal over exposed sprayed urethane insulation at top of exterior wall exposed to interior and at top of fire rated walls.

1.3 REFERENCES

.1 Underwriter's Laboratories of Canada (ULC):
.1 CAN/ULC-S115-05, Standard Method of Fire Test of Firestop Systems.

1.4 SUBMITTALS

.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.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50 - Genweral 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 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.
.3 Approved fire stopping caulking for Rooms 132 and 133:
.1 Metacaulk MC-150+

.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 cm²: 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.

.4 Top of fire rated walls: fire stopping to consist of rated mineral fibre fill between steel deck and wall with firestop sealant both sides.

.5 Seal over exposed sprayed urethane insulation at top of exterior wall exposed to interior with spray-on fire protection film. Acceptable Product 3M Fire Dam 200 spray applied to 3 mm thickness.

3.5 CLEAN UP

.1 Remove excess materials and debris and clean adjacent surfaces immediately after application.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 07 92 12 - Security Joint Sealing.

1.2 SUMMARY

.1 This Section specifies caulking and sealants not specified in other Sections.

.2 Refer to other sections for other caulking and sealants.

1.3 REFERENCES

.1 ASTM International (ASTM)
.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.

1.4 SUBMITTALS

.1 Submit duplicate samples of each type of material and colour to be used in accordance with Section 01 01 50.

1.5 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.

1.6 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 Departmental Representative.

.8 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.

1.7 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 Pick-proof sealant: specified in Section 07 92 12.

.7 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: acrylic latex sealant.

.6 Concealed joints in sound attenuated walls and ceilings: acoustic Sealant.

.7 Colour of sealants: selected by Departmental Representative 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 07 84 00 - Firestopping.

.2 Section 07 92 10 - Joint Sealing.

1.2 SUMMARY

.1 This Section specifies pickproof caulking in the cell block area including:
- .1 Rooms 160 & 161.
- .2 Cell rooms 150 to 152 and 156 to 158.
- .3 Rooms 144 & 149
- .4 Rooms 146 & 164.

1.3 SUBMITTALS

.1 Submit duplicate samples of each type of material and colour to be used in accordance with Section 01 01 50 - General Instructions, Submittals clause.

.2 Submit duplicate samples to Departmental Representative for colour selection.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Deliver and store materials undamaged, in original containers, with manufacturer's labels and seals intact.

1.5 JOB CONDITIONS

.1 Ensure substrate is sound, dry, free of dust, dirt, paint, grease, oil or other foreign substances.

.2 Ensure substrates are installed in accordance with referenced standards in other sections prior to start of this work.

.3 Ensure surfaces and ambient air temperature are maintained at least 10°C for a minimum of 72 hours before, during and after caulking application and for storage areas.

.4 Ensure adequate ventilation required is provided during installation.

.5 Protect adjacent surfaces from damage resulting from work of this trade. If necessary, mask and/or cover adjacent surfaces, fixtures, equipment, etc. by suitable means. Make good such damage.

1.6 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.

2 Products

2.1 SEALANT MATERIAL DESIGNATIONS

.1 Pick-proof sealant: two component 100% solids epoxy gel, high strength, fast drying, self priming, non-sag for use on horizontal and vertical services. Colour of sealants as selected by Departmental Representative from manufacturer's standard range to match adjacent surfaces or paintable.

.2 Approved Products: (no exceptions)
- .1 BASF Epolith G.
- .2 Anchorfix3 by Sika.
- .3 Tremco Permaquik 2252 Security Sealant.
- .4 Pecora - Dynapoxy EP 1200 OR Dynapoxy EP 430 fast.

2.2 SECURITY SEALANT LOCATION

.1 For rooms as noted in paragraph 1.2.1: pick-proof sealant.
.1 Rooms 150 - 152 & 156 - 158: joints at toilet fixtures to wall / floor juncture, perimeter of grilles, light fixtures, detector housing, surface mounted equipment, door frames and other joints in wall surfaces within these rooms.
.2 Rooms 144, 146, 149, 160, 161 & 165: joints around surface mounted equipment, door frames, glazing frames and counters and other joints in wall surfaces within these rooms.

2.3 JOINT CLEANER & PRIMER

.1 Joint cleaner: xylol, methyl ethyl ketone or non-corrosive type recommended by sealant manufacturer and compatible with joint forming materials.

.2 Primer: as recommended by manufacturer.

3 Execution

3.1 PREPARATION OF JOINT SURFACES

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

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound 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.

3.2 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.3 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.

.4 Seal joints in rooms indicated.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 04 04 99 - Masonry, for building-in frames in exterior masonry walls

.2 Section 05 41 00 - Structural Metal Stud Framing for building-in frames in exterior metal framed framed walls.

.3 Section 05 50 00 - Metal Fabrications

.4 Section 07 92 10 - Caulking of joints between frames and other building components.

.5 Section 08 11 20 - Cell doors, Frames and Hardware, (for Door Viewport)

.6 Section 08 11 25 - Glazed Counter Barrier and Acoustical Window.

.7 Section 08 34 74 - Acoustic Steel Doors and Frame Assemblies

.8 Section 08 71 10 - Finish hardware, including weatherstripping.

.9 Section 08 80 50 - Glazing.

.10 Section 09 22 16 - Non-structural Metal Framing for for building-in frames in interior walls.

.11 Section 09 91 23 - Painting.

.12 Section 28 13 00 - Access Control.

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM):
.1 ASTM A 653/A653M-11, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.2 ASTM A794/-09 - 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, 2009.
.2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Doors, 2009.

.4 Canadian Standards Association (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(R2008), 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-S104M-80, rev. 1985.
.3 CAN4-S105M-1985 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: 1.6 mm base thickness steel.

.2 Doors: 1.2 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 and strap or wire anchors for frames in masonry 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 Cell Doors: specified in Section 08 11 20.

.2 Sound retardant doors specified in Section 08 34 74.

.3 (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.

.4 (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. Ref DA-1 following section 08 11 25 for PS frame at observation windows.

.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 in administration areas and security fasteners in secure areas. Security fasteners specified in Section 05 50 00.

.6 Prepare doors for cylinder, thumbturn 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 with SCM 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 Provide 13 mm φ steel electrical conduits in frames to accommodate electronic hardware specified in Section 08 71 10.

.10 Fill frames in exterior walls and interior frames with insulated doors, 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 Sidelights and glazed screens: 1.2 mm base metal thickness commercial grade steel, screw fixed.
.2 Commercial interior doors: 1 mm cold rolled steel, primed, with provision for 6 mm glazing.
.3 Acoustic observation window: aluminum stops specified in section 08 11 25.

.4 Make provision for view-ports as specified in para 2.2.4, Section 08 11 20 and hardware as indicated and as specified in Section 08 71 10.

.5 Spot weld longitudinal door edges, fill continuously and grind smooth to conceal edge seams. Lock seam exposed edges are permissible for HCM doors.

.6 Equip exterior doors with flush steel top caps to prevent water accumulation.

.7 Provide wiring raceway in exterior doors with electric locks.

.8 Astragals specified in Section 08 71 10.

.9 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 interior and exterior door/frame assemblies specified with weatherstripping and sound seals.

.7 Caulk perimeter of frames between frame and adjacent material in accordance with Section 07 92 10.

.8 Maintain continuity of air barrier and vapour retarder 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, top of carpet, noncombustible sill and thresholds: 13 mm except as noted for sound regardant doors.

.3 Adjust operable parts for correct function.

.4 Install louvers, view-ports and steel glazing stops.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 01 01 50- General Instructions for:
- .1 Submittal Procedures.
- .2 Waste Management And Disposal.
- .3 Closeout Submittals.

.2 Section 07 92 10 - Joint Sealing.

.3 Section 08 11 25 - Glazed Counter Barrier and Acoustical Window

.4 Section 08 50 50 - Aluminum Windows.

.5 Section 08 71 10 - Finish Hardware (except as specified otherwise in this section).

.6 Section 08 80 50 - Glazing.

.7 Section 28 13 00 - Access Control.

1.2 REFERENCES

.1 Aluminum Anodizers Council (AAC)
- .1 Aluminum Association Designation System for Aluminum Finishes.

.2 Aluminum Association (AA).
- .1 DAF 45-03, Designation System for Aluminum Finishes.
- .2 Aluminum Alloys and Tempers - 2000.

.3 American Architectural Manufacturers Association (AAMA).
- .1 AAMA 609-09, Voluntary Guide Specification for Cleaning and Maintenance of Architectural Anodized Aluminum.
- .2 AAMA 1503.1 Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.

.4 ASTM International (ASTM).
- .1 ASTM A123 / A123M - 09 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- .2 ASTM B221 - 08 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- .3 ASTM C1363 - 05 Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.
- .4 ASTM E283 - 04 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- .5 ASTM E 330-02, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

.5 Canadian General Standards Board (CGSB).
- .1 CGSB 1.40-97, Primer, Structural Steel, Oil Alkyd Type.
- .2 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.

.3 CAN/CGSB-12.20-M89, Structural Design of Glass for Buildings.

.6 Canadian Standards Association (CSA International).

.1 CAN/CSA-G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

1.3 DESIGN CRITERIA

.1 Design frames and doors in exterior walls:

.1 Air Infiltration: for single acting offset pivot or butt hung entrances in the closed and locked position, the test specimen shall be tested in accordance with ASTM E 283 at a pressure differential of 300 Pa for single doors. A single 915 x 2134 entrance door and frame shall not exceed 0.50 cfm per square foot.

.2 Structural: Corner strength tested per manufacturer's dual moment load test procedure and certified by an independent testing laboratory to ensure weld compliance and corner integrity. Submit testing procedure and certified test as requested.

.3 Thermal Transmittance Coefficient (U-factor): When tested to ASTM C1363 and AAMA Specification 1503.1, the conductive thermal transmittance (U-factor) shall not be more than 0.72 BTU/hr/sf/°F.

.2 Design frames and door in vestibule walls: to meet paragraph 1.3.1.2 Structural.

.3 Size glass thickness and glass unit dimensions to limits in accordance with CAN/CGSB-12.20.

.4 Provide continuous air barrier and vapour retarder through door system. Primarily in line with inside pane of glass and heel bead of glazing compound.

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 for Submittals.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 01 50 - General Instructions for Submittals.

.2 Indicate materials and profiles and provide full-size, scaled details of components for each type of door and frame. Indicate:

.3 Interior trim and exterior junctions with adjacent construction.

.4 Junctions between combination units.

.5 Elevations of units.

.6 Core thicknesses of components.

.7 Type and location of exposed finishes, method of anchorage, number of anchors, supports, reinforcement, and accessories.

.8 Location of caulking.

.9 Each type of door system including location.

.10 Arrangement of hardware and required clearances.

.3 Samples:

.1 Submit samples in accordance with Section 01 01 50 - General Instructions for Submittal Procedures.

.4 Manufacturer's Instructions:
.1 Submit manufacturer's installation instructions.

1.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for door closers, locksets and door holders for incorporation into manual specified in Section 01 01 50 - General Instructions for closeout Submittals.

.2 Brief maintenance staff regarding proper care of hardware such as lubrication of locksets, adjustments of door closers, cleaning, and general maintenance.

1.6 QUALITY ASSURANCE

.1 Qualifications:
.1 Installer Qualifications: Installer experienced (as determined by contractor) to perform work of this section who has specialized in the installation of work similar to that required for this project and who is acceptable to product manufacturer.
.2 Manufacturer Qualifications: Manufacturer capable of providing structural calculations, applicable independent product test reports, installation instructions, a review of the application method, customer approval and periodic field service representation during construction.
.3 On access control installations, all wiring to be coordinated with a licensed electrical installer.

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

.3 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

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

.5 Source Quality Control:
.1 Source Quality: Provide aluminum entrances specified herein from a single source.
.2 When aluminum entrances are part of a storefront sidelight framing, and related products, provide products from a single source manufacturer.
.3 Fabrication Tolerances: Fabricate aluminum entrances in accordance with entrance manufacturer’s prescribed tolerances.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Comply with manufacturer's ordering instructions and lead- time requirements to avoid construction delays.

.2 Packing, Shipping, Handling, and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

.3 Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle entrance doors and components to avoid damage. Protect entrance doors against damage from elements, construction activities, and other hazards before, during and after entrance installation.

1.8 WASTE MANAGEMENT AND DISPOSAL

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

.2 Dispose of packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

.3 Separate and recycle waste materials in accordance with Section 01 01 50 - General Instructions for Waste Management And Disposal.

.4 Place materials defined as hazardous or toxic waste in designated containers.

.5 Divert unused metal to metal recycling facility approved by Departmental Representative.

.6 Unused or damaged glazing materials are not recyclable and must not be diverted to municipal recycling programs.

2 Products

2.1 MATERIALS

.1 Material Standard: ASTM B 221; 6063-T6 alloy and temper.

.2 Sheet aluminum: Aluminum Association alloy AA 1100, AA 5005 - anodizing quality to manufacturer's standard.

.3 Steel reinforcement: to CAN/CSA-G40.20/G40.21, grade 300 W.

.4 Door bumpers: black neoprene.

.5 Isolation coating: bituminous paint or epoxy resin solution.

.6 Glass: laminated safety glass to Section 08 80 50.

.7 Other glazing materials: to Section 08 80 50.

.8 Sealants: as recommended by manufacturer, matching colour approved by Departmental Representative.

2.2 ALUMINUM DOORS AND SIDELIGHTS

.1 The stile and rail face nominal dimensions for the entrance doors and sidelights:

	Door	Vertical Stile	Top Rail	Mid Rail	Bottom Rail:
.1	101	130	130	152	190
.2	102	130	130	152	190
.3	Sidelights			152	190

.2 Major portions of the door members 3 mm nominal thickness and glazing moulding of 1.3 mm thickness.

.3 Tolerances: for wall thickness and other cross-sectional dimensions of entrance members in compliance with Aluminum Standards and Data, published by The Aluminum Association.

.4 Glazing gaskets: either EPDM elastomeric extrusions or a thermoplastic elastomer.

.5 Thermal separators for exterior entrance door cladding: rigid polyvinylchloride (PVC) extrusions.

.6 Provide adjustable glass jacks to center the glass in the door opening.

.7 Accessories:
.1 Fasteners: Where exposed, shall be aluminum, stainless steel or plated steel.
.2 Perimeter Anchors: Aluminum. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action

.8 Entrance Hardware:
.1 Weatherstripping:
.1 Thermoplastic elastomer weathering on a tubular shape with a semi-rigid polymeric backing.
.2 Sill Sweep Strips: EPDM blade gasket sweep strip in an aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners to meet specified performance tests.
.2 Pivot hinges: for door 102, sized to suit door weight and size.
.3 Hardware specified in Section 08 71 10:
.1 Threshold.
.2 Butt Hinges for door 101.
.3 Power door operators.
.4 Mortised lock.
.5 Electric Strike/Strike Keeper.

2.3 ALUMINUM FRAMES

.1 Exterior entrance and sidelight:
.1 Construct thermally broken insulated frames of aluminum extrusions with minimum wall thickness of 3 mm. Non-thermally broken frames for door stiles is permissible.
.2 Frame members 50 x 114 mm nominal size, for flush double glazing.
.3 Dormer windows specified in Section 08 50 50.

.2 Interior vestibule and screens:
.1 Construct non-thermally broken frames of aluminum extrusions with minimum wall thickness of 2.5 mm.
.2 Frame members 45 x 102 mm nominal size, for flush single glazing.

2.4 FINISHING

.1 Factory finish: all exposed surfaces treated with caustic etch and clear anodic oxide treatment to AA-M12C22A31, AAMA 611, Architectural Class I.

2.5 FABRICATION

.1 Entrance door 101 and sidelight:
.1 Door corner construction: to consist of mechanical clip fastening, SIGMA deep penetration plug welds and 29 long fillet welds inside and outside of all four corners. Glazing stops of hook-in type with EPDM glazing gaskets reinforced with non-stretchable cord.
.2 Exposed portions of door cladding mouldings: 2.4 thick.
.3 PVC separators: applied to the interior side of door structure with screws spaced not more than 247 on centers. Interlock aluminum cladding with PVC separators at both edges and mechanically secured to door without adhesives with no metal to metal contact, direct or indirect, between the cladding or the cladding attachments and the door structure.
.4 Accurately fit and secure joints and corners. Make joints hairline in appearance.
.5 Prepare components with internal reinforcement for door hardware.
.6 Arrange fasteners and attachments to conceal from view.

.2 Entrance vestibule door 102, sidelights and screens:
.1 Door corner construction: to paragraph 2.5.1.1.
.2 Accurately fit and secure joints and corners. Make joints hairline in appearance.
.3 Prepare components with internal reinforcement for door hardware.
.4 Arrange fasteners and attachments to conceal from view.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 EXAMINATION

.1 Site Verification of Conditions:
.1 Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer’s instructions.
.2 Verify openings are sized to receive entrance system and sill plate is level in accordance with manufacturer’s acceptable tolerances.

.2 Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

3.3 INSTALLATION

.1 General: Install entrance systems and screens in accordance with manufacturer’s instructions and AAMA storefront and entrance guide specifications manual.

.2 Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

.3 Provide alignment attachments and shims to permanently fasten system to building structure.

.4 Align assembly plumb and level, free of warp and twist. Maintain assembly dimensional tolerances aligning with adjacent work.

.5 Set thresholds in bed of mastic and secure.

.6 Adjusting: Adjust operating hardware for smooth operation.

.7 Related Products Installation Requirements:
- .1 Sealants (Perimeter): Refer to Joint Treatment (Sealants) Section 07 92 10.
- .2 Glass: Refer to Glass and Glazing Section 08 80 50.
- .3 Reference: ANSI Z97.1, CPSC 16 CFR 1201 and GANA Glazing Manual.

3.4 CLEANING AND PROTECTION

.1 Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

.2 Protection: Protect installed product's finish surfaces from damage during construction. Protect aluminum entrances from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants. Remove and replace damaged aluminum entrances at no extra cost to contract.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 05 50 00 - Metal Fabrications.

.2 Section 08 11 14 - Metal Doors and frames.

.3 Section 08 34 74 - Acoustic Steel Door and Frame Assemblies.

.4 Section 08 71 10 - Door hardware.

.5 Section 09 96 59 - High Build Epoxy Coating.

1.2 REQUIREMENTS

.1 Examine plans and finish schedule and details to determine full extent of work required.

.2 Carry out all work to assure that the complete area is vandal proof and that no items can be removed without special equipment, and there shall not be sharp materials, rough jagged items or material exposed within the cell area.

.3 Sliding door and track assembly installed by manufacturer approved personnel with minimum five years experience.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 01 50.

.2 Clearly indicate materials, core, thickness, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details and accessories.

.3 Indicate hardware, including make, model, material, function, finish and other pertinent information.

1.4 REFERENCE STANDARDS

.1 ASTM International (ASTM).

.1 ASTM A1008 / A1008M 11 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

.2 ASTM A924/A924M10a - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

.3 ASTM A653/A653M11 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM A1011/A1011M10 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Form ability, and Ultra-High Strength.

.5 ASTM C66511 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

.2 Canadian Standards Association (CSA International).
.1 CAN/CSA-G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
.2 CSA W59-03(R2008) - Welded Steel Construction (Metal Arc Welding).

.3 ANSI/NAAMM/HMMA 863-04 Guide Specifications For Detention Security Hollow Metal Doors & Frames

2 Products

2.1 MATERIALS

.1 Sheet Steel (WGCS): tension leveled steel to ASTM A924M) galvanized to ASTM A653M-, commercial steel (CS), type B, coating designation ZF120 (paintable Galvaneal).

.2 Hot Rolled Carbon Steel Sheet (HRCS): commercial quality to ASTM A1011, for concealed reinforcement for materials, 2.7 mm minimum thickness.

.3 Cold rolled carbon steel sheet (CRCS) commercial quality to ASTM A1008, shop prime coated.

.4 Glazing:
.1 Plastic glazing: to CAN 2-12.12M, clear, polycarbonate sheet, thickness indicated.
Acceptable Products:
.1 Lexan, 6 mm thickness with Margard anti-scratch finish on inside sheet.
.2 Plastic spacers: 6 mm thickness x 25 mm.

.5 Glazing sealant: One component, fast skinning sealant which cures to a high modulus silicone rubber on exposure to atmospheric moisture at room temperature an is a neutral cure sealant. General Electric, GlasSil. SilGlaze* N10-One component, fast skinning, neutral cure silicone sealant. Provides excellent adhesion to glass, metal, concrete, masonry, stone and numerous materials.

.6 Glazing tape: preformed butyl tape, 10-15 durometer hardness, paper release, thickness and width to suit.

.7 Shop paint primer: primer compatible with epoxy finish coat specified in Section 09 96 59.

.8 Fasteners: security screws and bolts with security heads (five lobe and centre post) to prevent removal except with special tools; non-corrosive type. Approved Product: Torx-Plus Tamper Resistant.. Those that are not required to be removed shall be flat head, having an extra head that will twist off when fully secured, leaving the main head countersunk flush without slots, so that screw cannot be backed out by means of a screw driver or wrench. Where thickness of metal will not allow screws to be countersunk, use round head security screws with hexagonal break-off heads.

.9 Fabrication
.1 Form metal true in accordance with reviewed shop drawings, free from defects impairing strength, durability and appearance.
.2 Components shall be fabricated with required structural properties to safely withstand or abstain strain and stresses to which they will be subjected.
.3 Steel plates: free from buckles and waves.

.4 Supply anchoring devices required for fabrication and erection of this Section.
.5 After fabrication remove mill scale, scrape and clean all ferrous metals and apply 1 coat of primer.

.10 Welding: grind exposed welds smooth and flush. Fill open joints, seams and depressions with filler or by continuous brazing or welding. Grind smooth to true sharp arises and profiles, and sand down to smooth, true, uniform finish.

2.2 CELL DOOR & FRAME

.1 Supply and install sliding cell doors, frames and hardware as noted on drawings.

.2 Frame: Fabricate from 2.6 mm thick steel and to profiles indicated in drawings for installation of steel door frames in masonry walls. Prime paint.

.3 Door: Detention Type, 50 mm thickness hollow steel vertically stiffened with steel ribs and all voids filled with sound deadening semi-rigid fibrous insulation conforming to level 3 ANSI/NAAM 863 and ASTM F1450 performance criteria for static load, rack, impact and edge crush tests. Door skins 2.0 mm thickness steel sheet. Doors with 2.6 mm steel channel reinforcement at perimeter and at all openings. Door to incorporate food pass door of flush design and sliding viewport as indicated. Arrange steel ribs to frame openings in door. Provide 6 mm thick steel plate reinforcing for door locks. Provide cutout on guard side of door for lock, complete with 4.8 mm thick steel cover plate secured to door face with security screws (Part of lock mounting hardware). Prime paint.

.4 Door Viewport shutter: (for cell doors and prisoner shower door)
.1 Fabricate glazing assembly with outer light (room side) of 6 mm thickness Margard notched on cell side to have glazing sit flush with inside cell door face.
.2 Provide 6 mm Lexan with 6 mm x 25 mm spacers separating double glazing. Construct window shutter of 3.6 mm thick stainless steel, satin finish, with radiused corners.
.3 Fabricate perimeter shutter frame of steel with radiused perimeter edges.
.4 Provide Teflon coating at top and bottom shutter tracks.
.5 Install stainless steel finger pull, screwed to shutter door with security screws. Provide door pull attached to shutter frame.

.5 Food Pass Assemblies:
.1 Lock: Fabricate flush mounted Food Pass Assembly with security lock incorporating a bevel latch, surface mounted on food pass door, Southern/Folger 1017 snap lock. Note: spot weld mogul key blank to cylinder to act as thumb turn.
.2 Hinge; welded continuous 2.28 mm steel piano hinge x 50 mm wide with 6 mm φ brass pin, Faucher # 751-0113.
.3 Weld 2 mm sheet metal skin to food pass door on cell side to provide a maximum 2 mm gap between interior door skin perimeter of food pass.

.6 Door trackset, receiver and door guide:
.1 Door trackset, receiver and door guide: Custom fabricated as per details attached to specification following this section.

.7 Door Hardware:
.1 Lockset: non-slam lock, operated by paracentric key on secure side, with lock mounting/plate and escutcheon x 32D with fixed knob mounted to door on secure side and no trim on cell side. Acceptable Products Southern Steel 1030-D1, Folger Adam 32D, Chubb 1030-D1, RR Brink 7030D.
.2 Door pulls: custom fabricated pull, integral with sliding shutter frame.

.8 Keying: All cell door locks to be keyed alike.

.9 Approved Cell Door and frame manufacturer's:
.1 Kach Inc. 1439 Speers Rd. Oakville, Ontario, L6L 2X5 905 827-9901, Fax 905 827-9971.
.2 CP Distributors Ltd. 2311 Faithful Ave. Saskatoon, Sask. S7K 1T9 306 242-3315, Fax 306 933-4940.
.3 Apex Industries Inc. Att'n Don Gallant 100 Millenium Drive, Moncton, NB E1E 2G8 Phone: 506-857-1600/ 1-800-268-3331, Fax: 506-857-1672.
.4 CP Distributors Ltd Att'n: Kevin Suppes, #133, 2634 45th Ave. SE Calgary, Alta. T2B 3M1, Phone: 403-253-2006, Fax: 403-255-3345:
.5 CP Distributors Ltd, #5-15050 54A Ave, Surrey BC (604)575-2525
.6 Weizel Security robw@securitycosmos.com:
.7 SWS Detention Group Inc. Att'n: Kelvin Syrnick 751 Wall Street, Winnipeg, Manitoba R3G 2T6 Phone: 1-877-797-1999, Fax: 1-877-797-2097:
.8 Steelgate Security Products Att'n: Dennis Ruscoe, 7456 Tranmere Drive, Mississauga, Ontario. L5S 1K4

2.3 CLEANING AND PAINTING

.1 All steel work to be thoroughly cleaned of all loose mill scale, rust, spatter, slag, oil, dirt and other foreign materials.

.2 All welds to be ground smooth.

.3 Apply one (1) coat epoxy compatible primer to all steel.

.4 Touch up any damaged primer coat.

3 Execution

3.1 ERECTION

.1 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.2 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.3 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

.4 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.

3.2 DOOR INSTALLATION

.1 Install doors and hardware in accordance with templates, and manufacturer's instructions.

.2 Adjust operable ports for correct function.

3.3 DOOR FRAME INSTALLATION

.1 Install frames plumb, level and square. Install frames within a tolerance +/- 2mm maximum.

.2 Frames solidly braced at time of installation both vertically and horizontally and solidly blocked within the frame opening to prevent bowing of the frame when it is grout filled.

3.4 GLAZING OF VIEWPORT

.1 Remove protective coatings and clean contact surfaces with solvent and wipe dry.

.2 Cut glazing tape to proper length and set against permanent stops 1.5 mm below sightline. Install horizontal strips first, extend over entire width of opening before applying vertical strips.

.3 Install glass, ensure full contact and adhesion at perimeter.

.4 Place glazing tape on free perimeter of glass in manner described above.

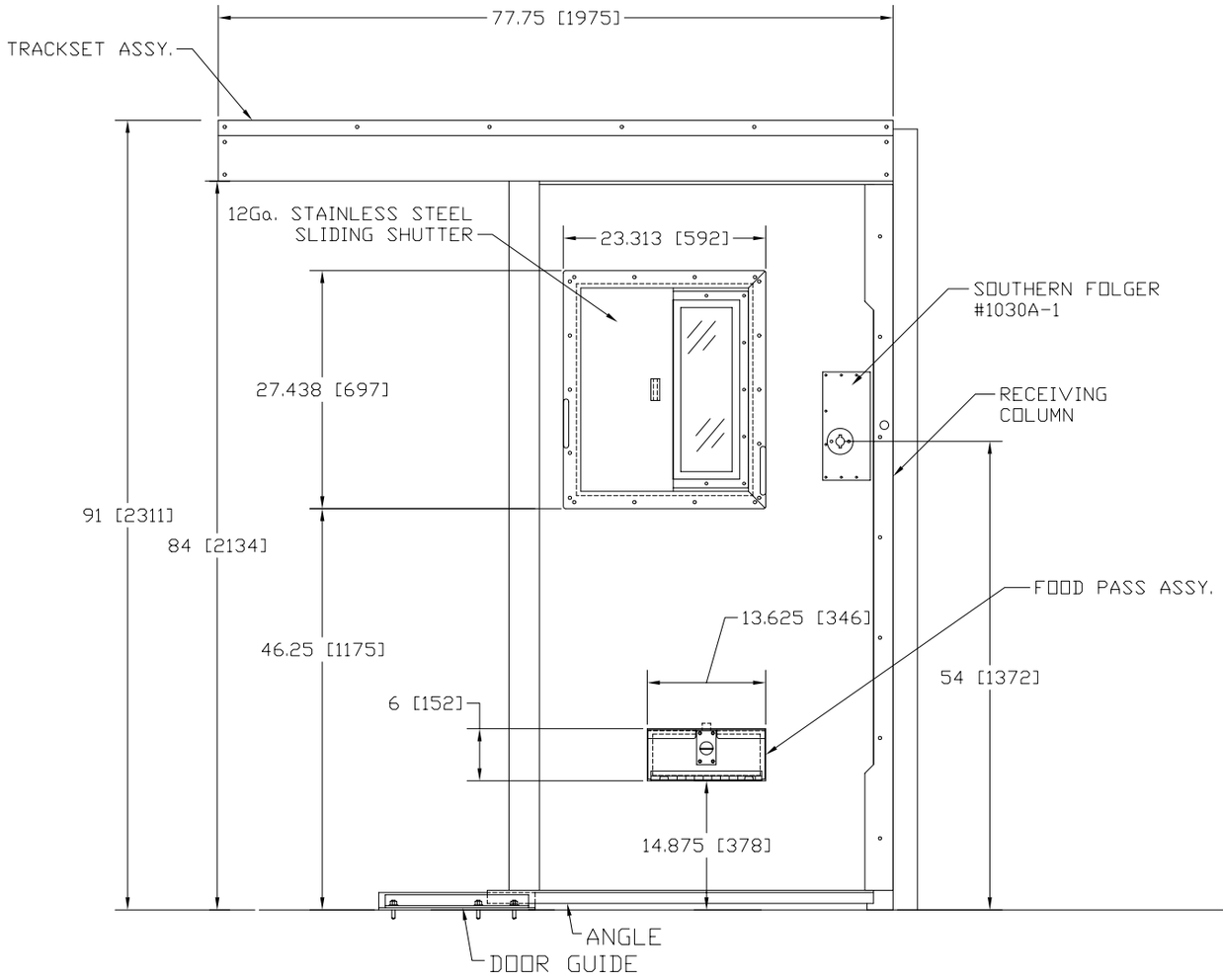
.5 Install removable stops without displacing tape or sealant.

3.5 CLEANING AND TOUCH UP

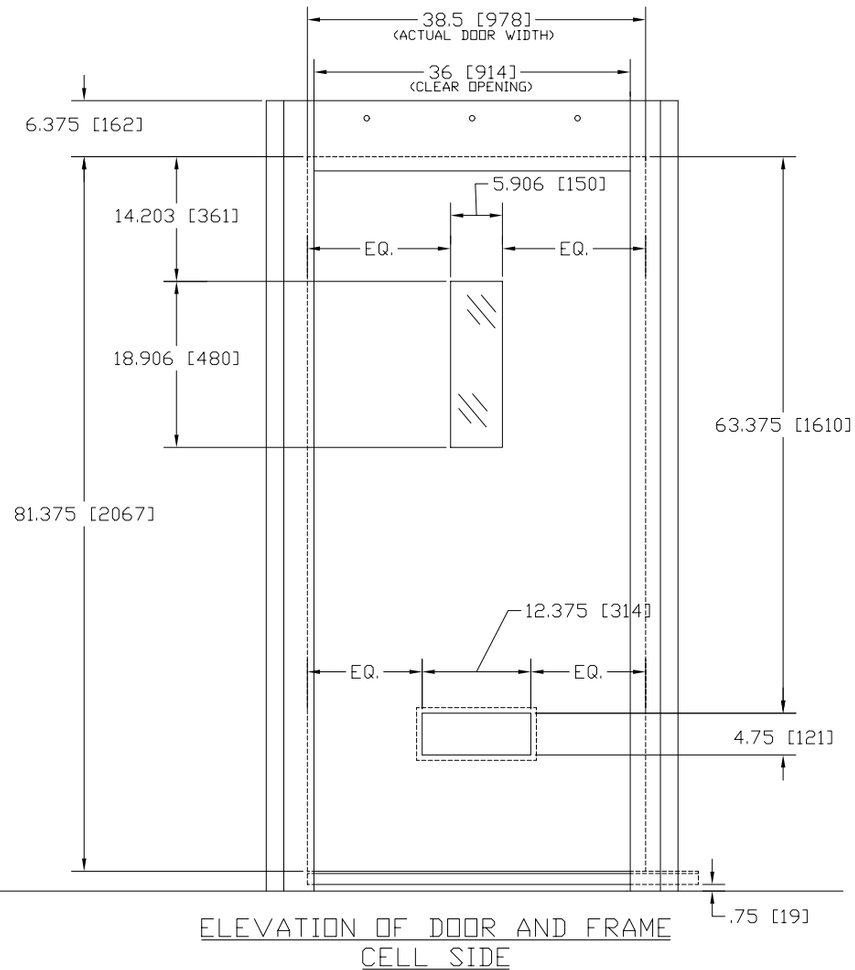
.1 Clean all steel work to remove all loose dirt, oil and other foreign materials.

.2 Touch up any damaged primer coat.

END OF SECTION

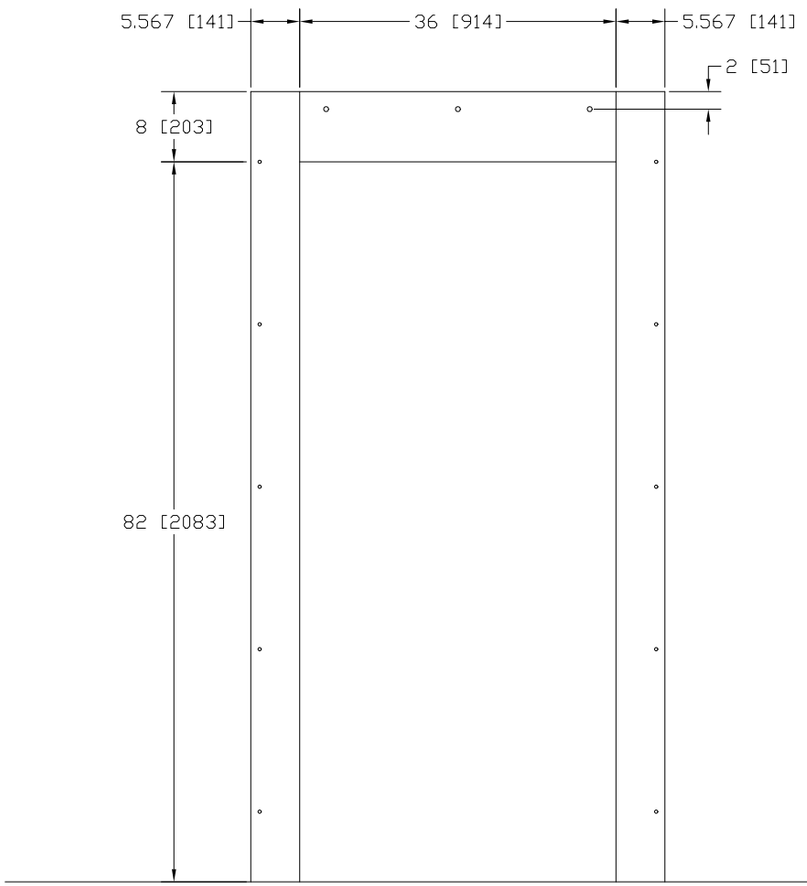


ELEVATION OF DOOR AND FRAME
CORRIDOR SIDE

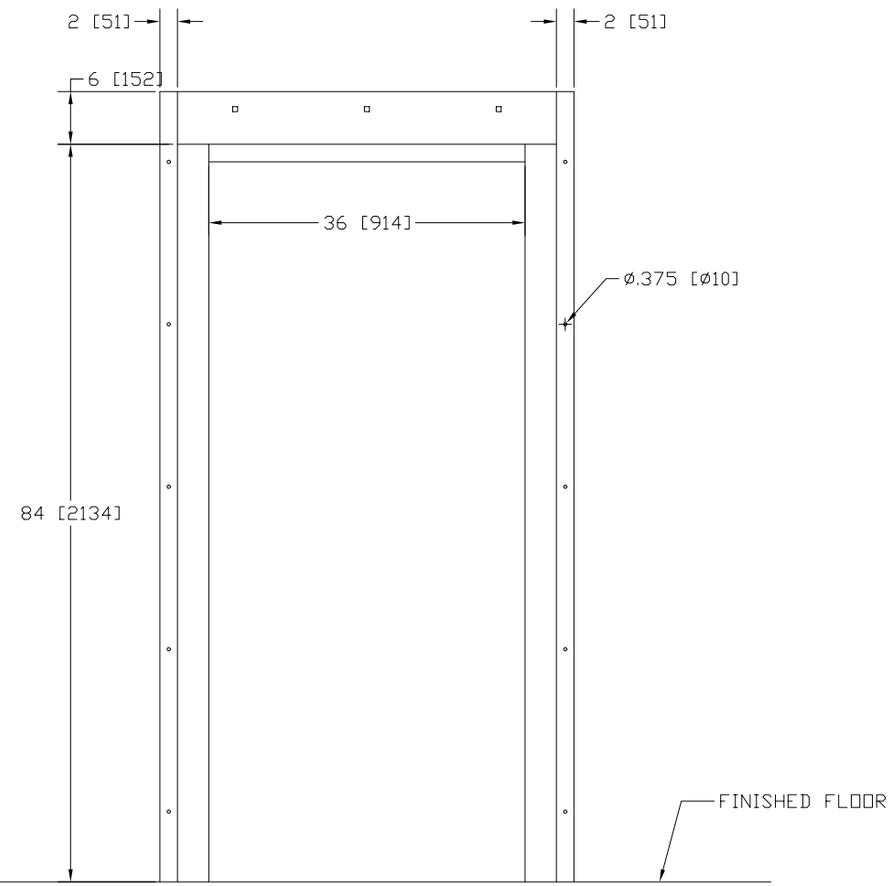


ELEVATION OF DOOR AND FRAME
CELL SIDE

KACH INC. DETENTION EQUIPMENT		TEL: (905) 827-9901 FAX: (905) 827-9971 1439 Speers Road Oakville, Ontario L6L 2X5	
SCALE: 1:20		PART DESCRIPTION: ELEVATION OF SLIDING CELL DOOR RH DOOR SHOWN / LH DOOR IS OPPOSITE	
DATE:			
DRAWN BY:	APPROVED BY:	PROJECT: POLICE BUILDING 100 MILE HOUSE, BC	REV: DRAWING DA-2



CORRIDOR SIDE



DETAINEE SIDE

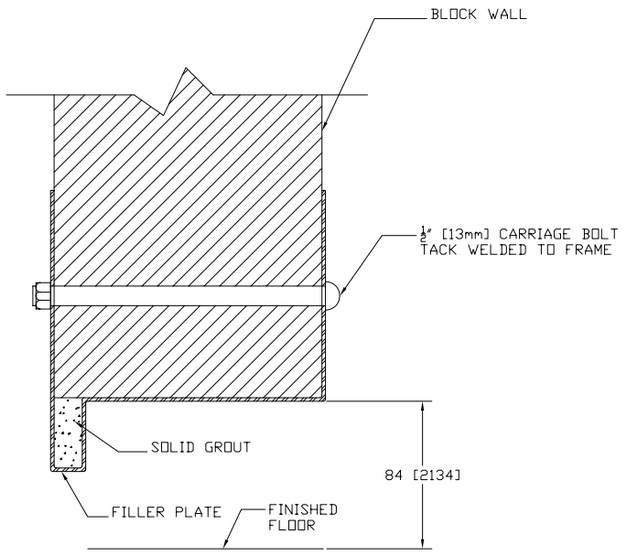
KACH INC.
DETENTION EQUIPMENT

TEL: (905) 827-9901 FAX: (905) 827-9971
1439 Speers Road
Oakville, Ontario
L6L 2X5

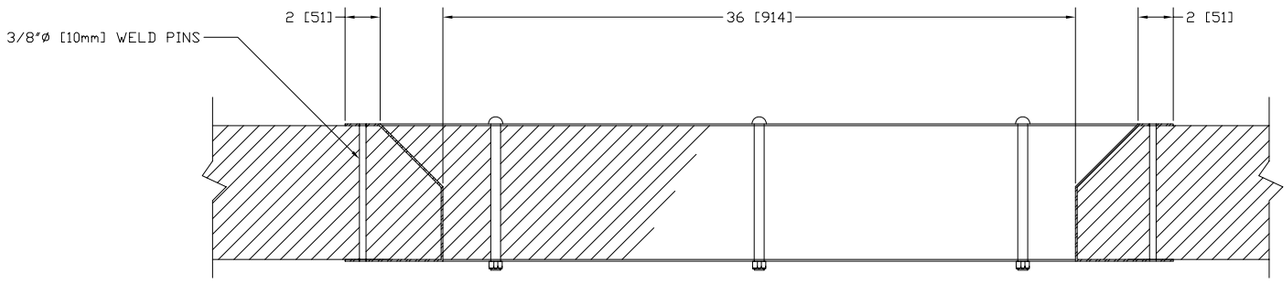
SCALE: 1:20	PART DESCRIPTION: 12Ga. FRAME FOR SLIDING CELL DOOR
DATE:	
DRAWN BY: / APPROVED BY:	PROJECT: POLICE BUILDING 100 MILE HOUSE, BC
REV:	DRAWING DA-3

NOTE: FRAME MUST BE FULLY GROUTED FOR PROPER SLIDING ASSY. INSTALLATION.

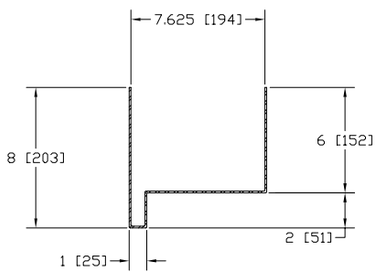
NOTE: OPTIONAL 2" L X 3/16" [51X5mm] FILLER PLATE CONTINUALLY WELDED TO HEADER AND JAMBS

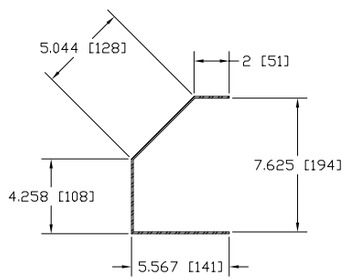


SECTION THROUGH FRAME



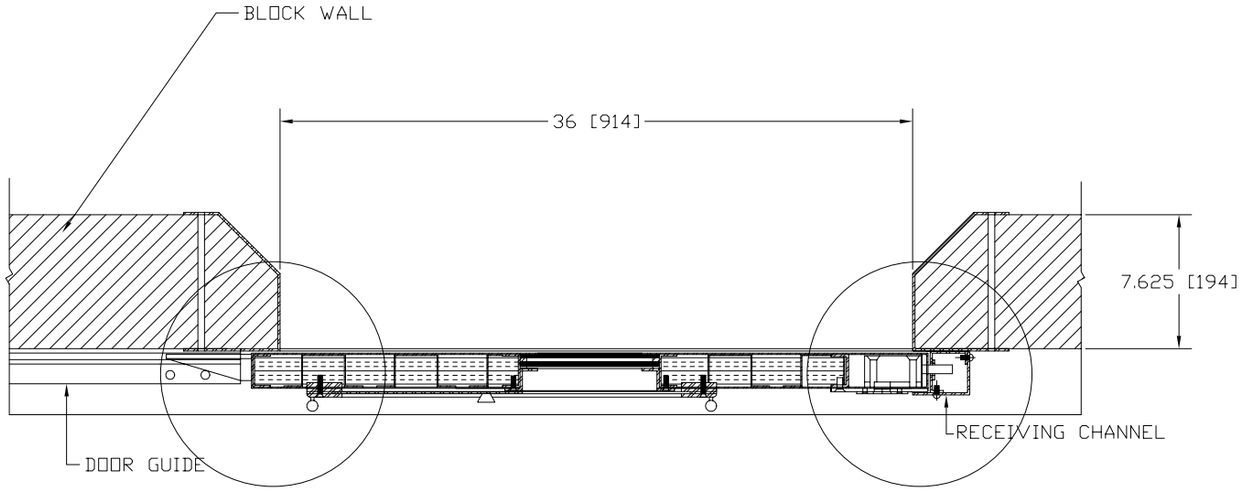
HORIZONTAL CROSS THROUGH JAMBS AND HEADER



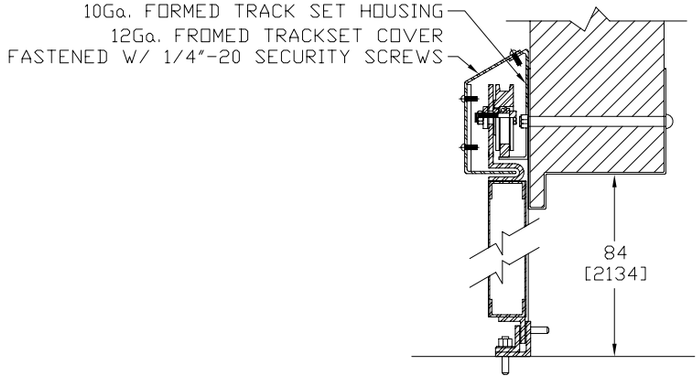


JAMB AND HEADER PROFILES

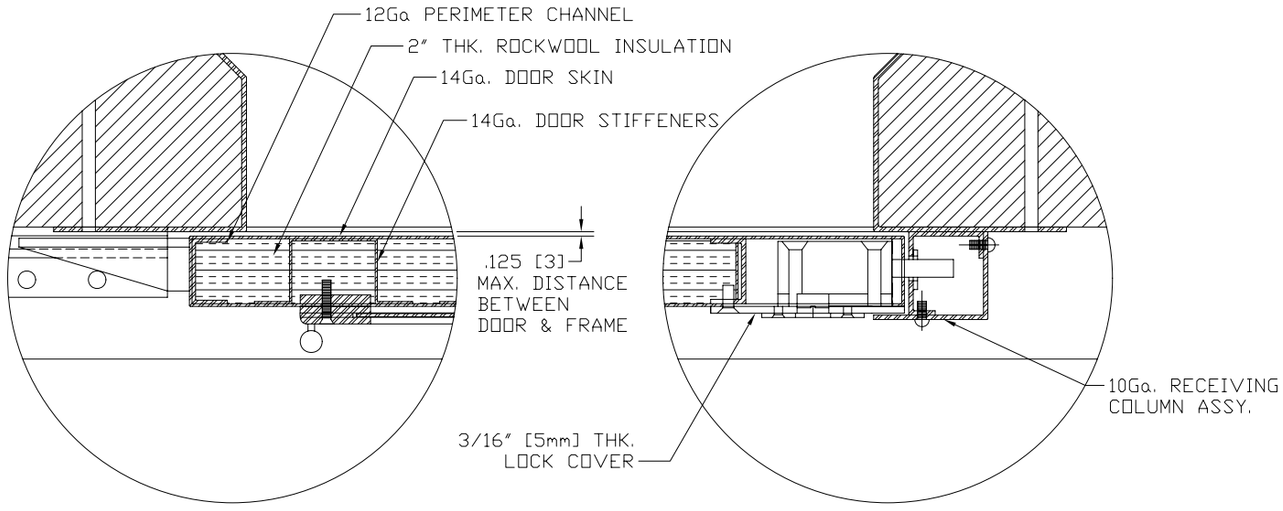
KACH INC. DETENTION EQUIPMENT		TEL: (905) 827-9901 FAX: (905) 827-9971 1439 Speers Road Oakville, Ontario L6L 2X5	
SCALE: 1:10		PART DESCRIPTION: 12Ga. FRAME DETAILS FOR SLIDING CELL DOOR	
DATE:			
DRAWN BY:	APPROVED BY:	PROJECT: POLICE BUILDING 100 MILE HOUSE, BC	REV: DRAWING DA-4



HORIZONTAL CROSS
THROUGH DOOR, FRAME AND RECEIVER

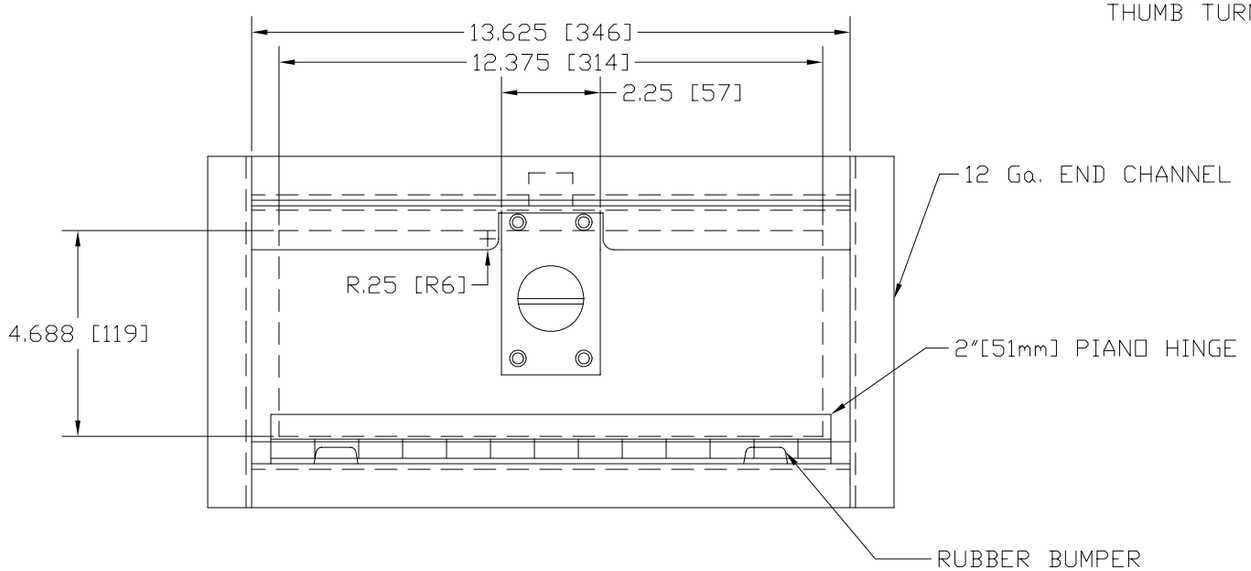


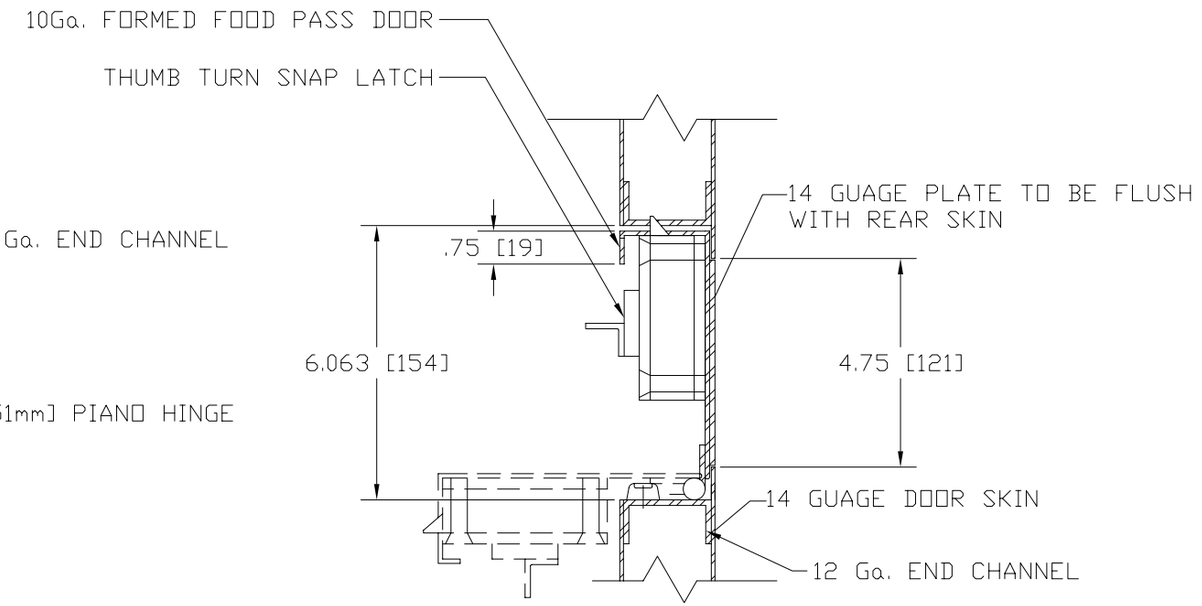
NOTE:
MAX. ALLOWABLE DISTANCE BETWEEN DOOR AND FRAME IS .125" [3mm]



VERTICAL CROSS
THROUGH DOOR, FRAME AND TRACKSET

KACH INC. DETENTION EQUIPMENT		**TEL: (905) 827-9901 FAX: (905) 827-9971** 1439 Speers Road Oakville, Ontario L6L 2X5	
SCALE: 1:10		PART DESCRIPTION: HORZ. CROSS OF SLIDING CELL DOOR AND FRAME	
DATE:			
DRAWN BY:	APPROVED BY:	PROJECT: POLICE BUILDING 100 MILE HOUSE, BC	REV: DRAWING DA-5

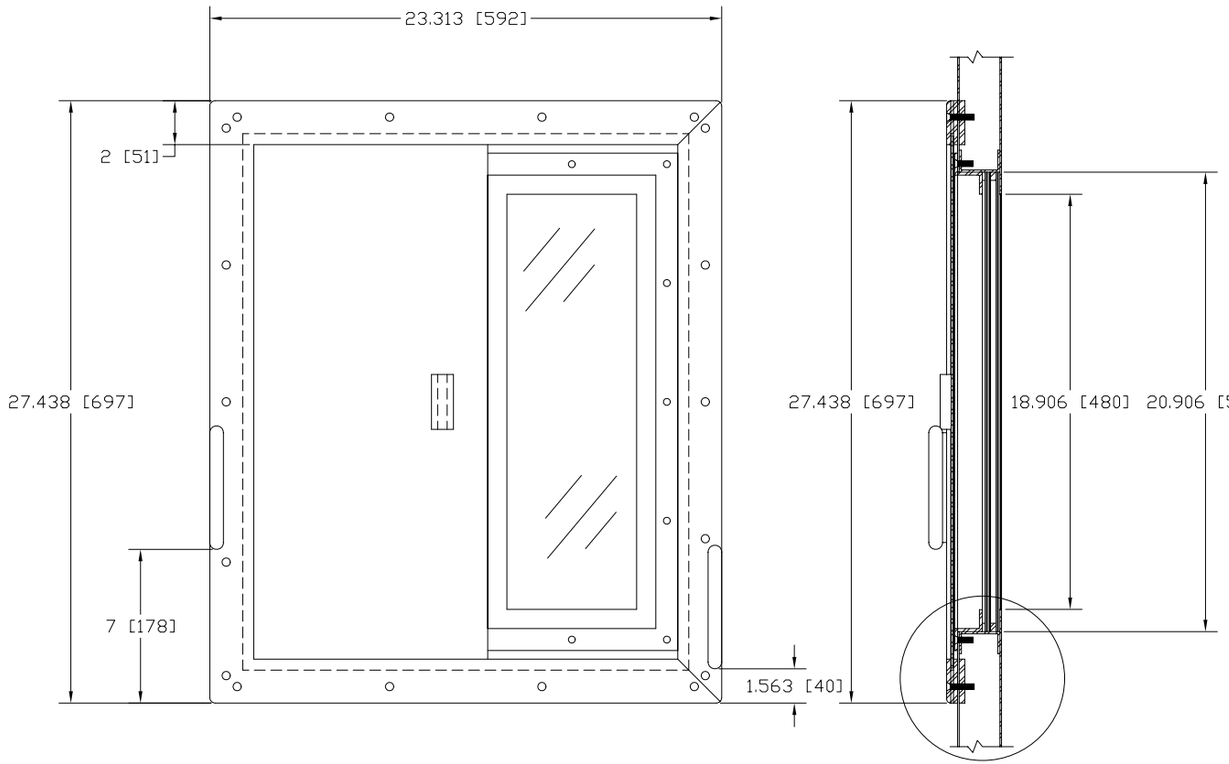


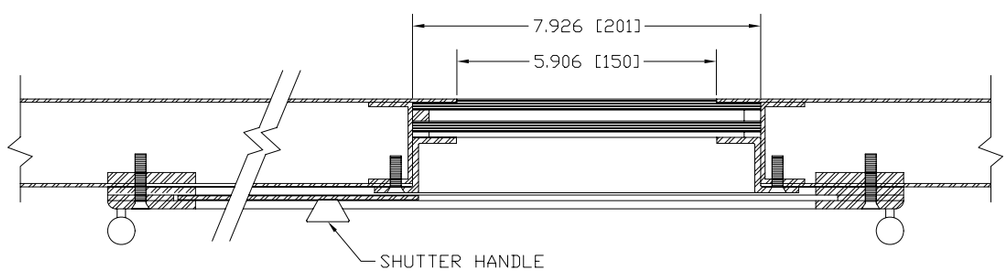


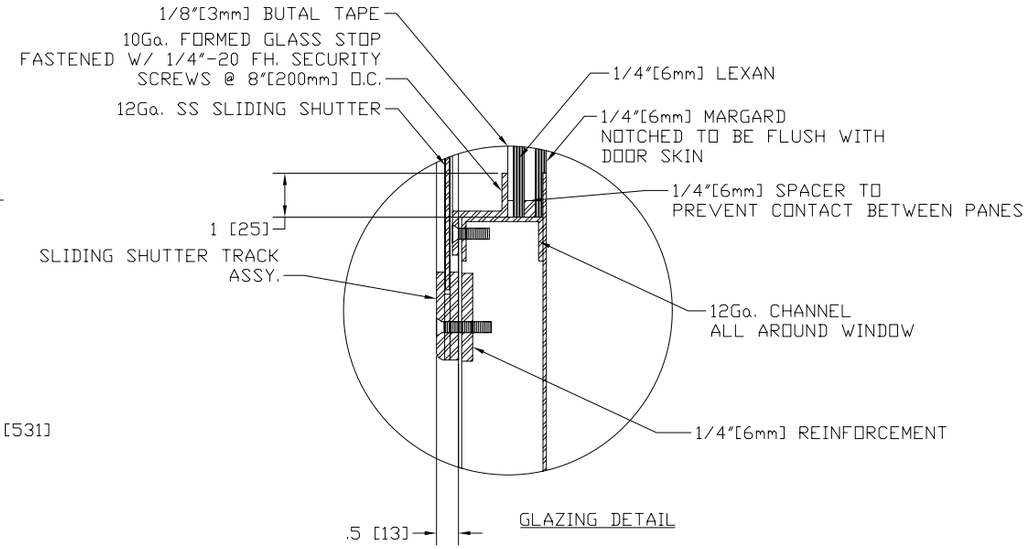
KACH INC.
DETENTION EQUIPMENT

TEL: (905) 827-9901 FAX: (905) 827-9971
1439 Speers Road
Oakville, Ontario
L6L 2X5

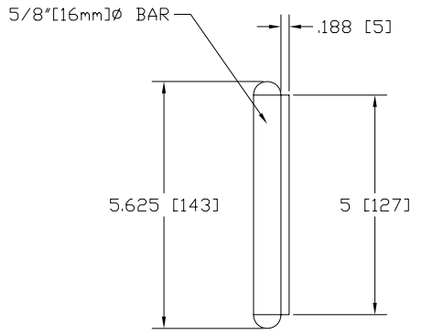
SCALE: 1:4		PART DESCRIPTION: SLIDING CELL DOOR FOOD PASS DETAIL	
DATE:			
DRAWN BY:	APPROVED BY:	PROJECT: POLICE BUILDING 100 MILE HOUSE, BC	REV:
			DRAWING DA-6



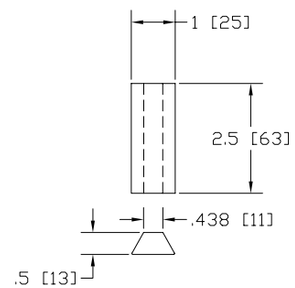




GLAZING DETAIL



SLIDING DOOR HANDLE DETAIL

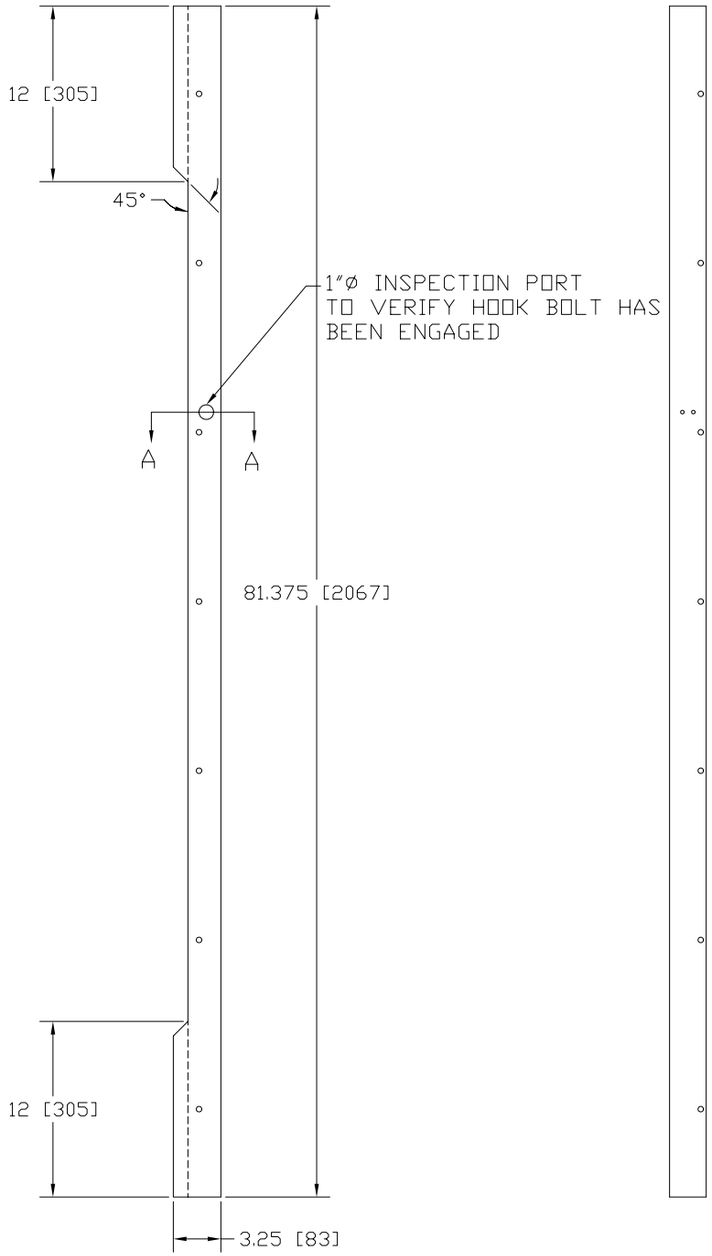


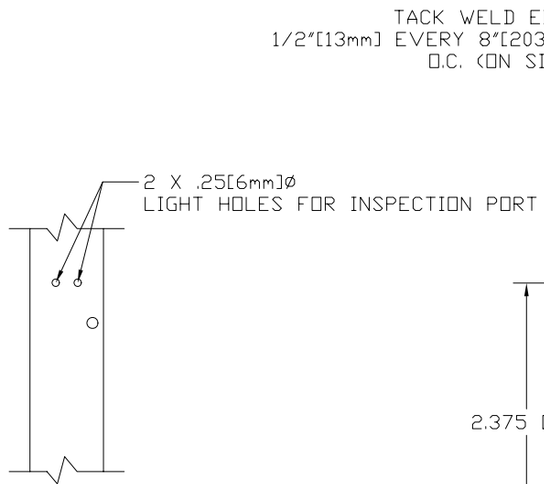
SHUTTER HANDLE DETAIL

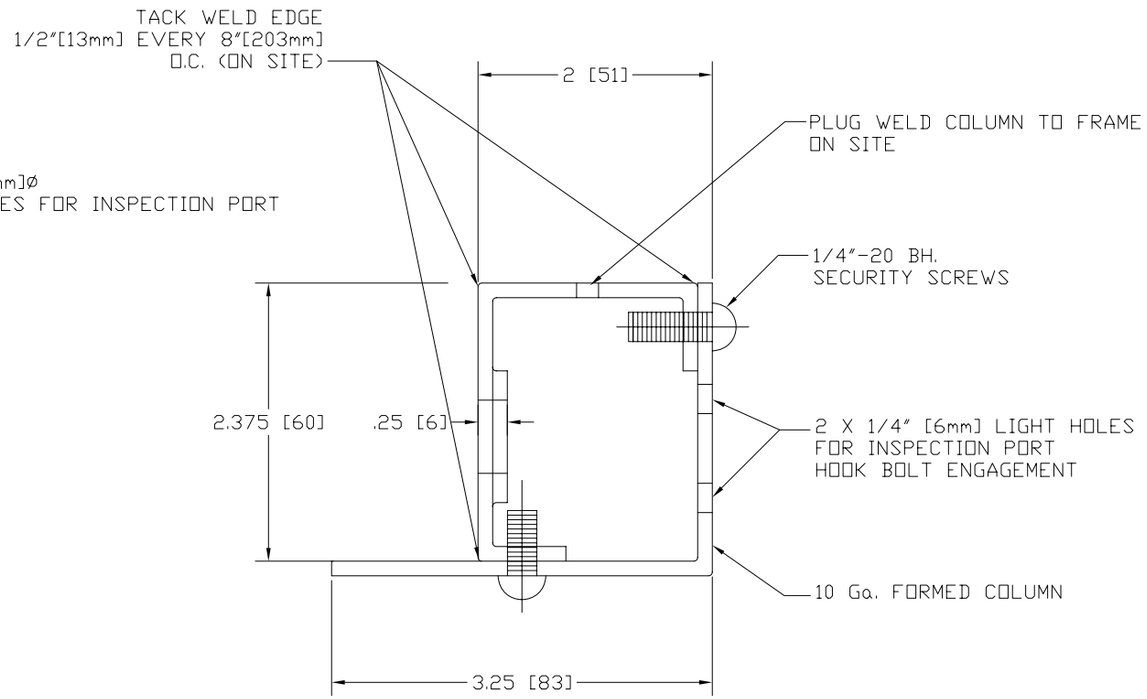
KACH INC.
DETENTION EQUIPMENT

TEL: (905) 827-9901 FAX: (905) 827-9971
1439 Speers Road
Oakville, Ontario
L6L 2X5

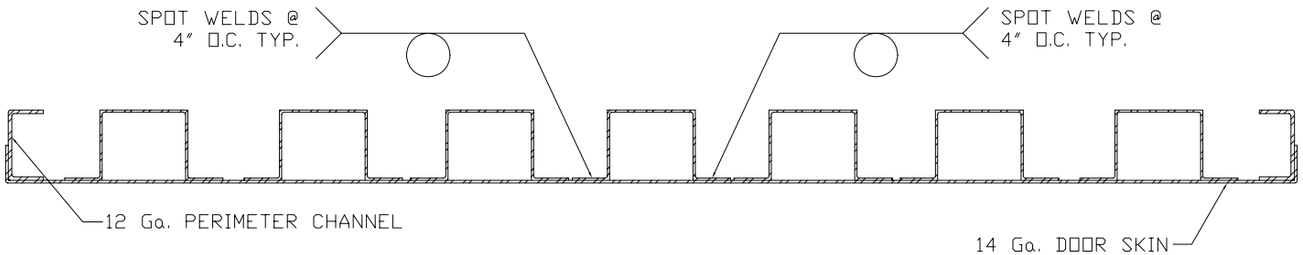
SCALE: 1:8	PART DESCRIPTION: SLIDING CELL DOOR WINDOW AND SLIDING SHUTTER DETAIL
DATE:	
DRAWN BY: / APPROVED BY:	PROJECT: POLICE BUILDING 100 MILE HOUSE, BC
REV:	DRAWING DA-7



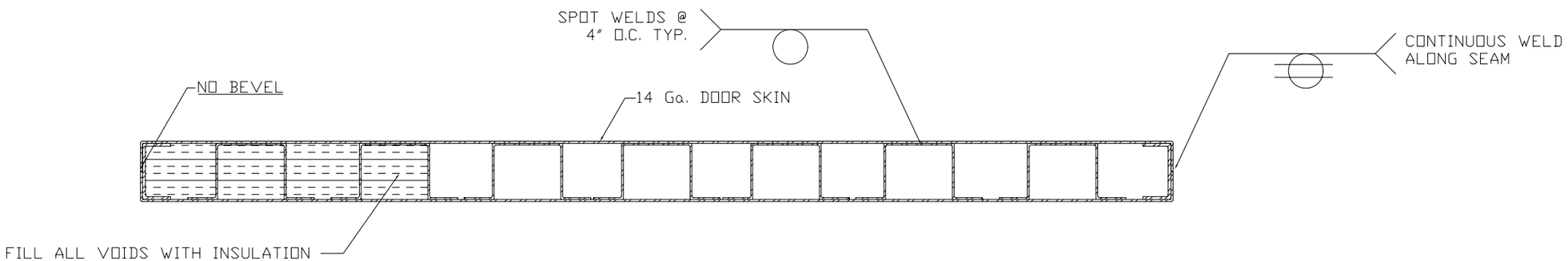




KACH INC. DETENTION EQUIPMENT		**TEL: (905) 827-9901 FAX: (905) 827-9971** 1439 Speers Road Oakville, Ontario L6L 2X5	
SCALE: 1:12		PART DESCRIPTION: SLIDING CELL DOOR RECEIVING COLUMN DETAIL	
DATE:			
DRAWN BY:	APPROVED BY:	PROJECT: POLICE BUILDING 100 MILE HOUSE, BC	REV: DRAWING DA-8



TOP SKIN PROFILE

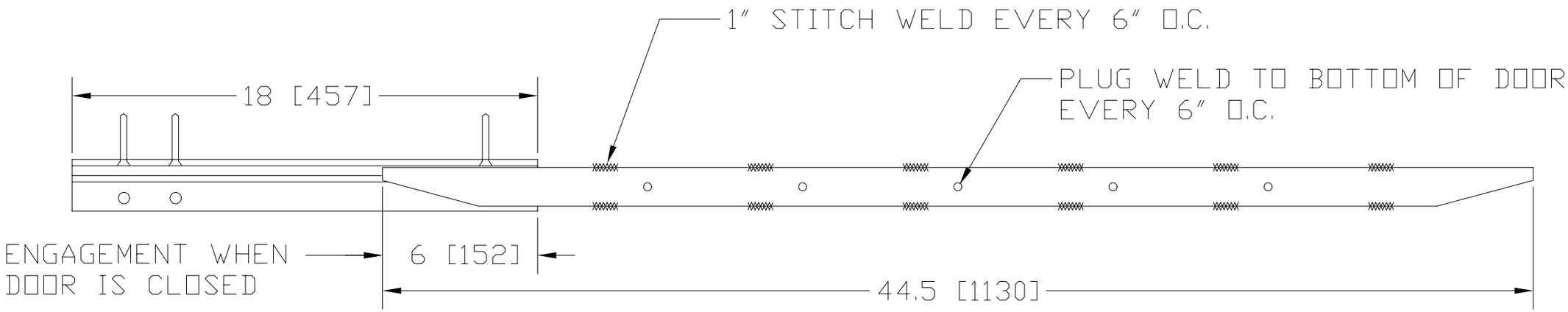


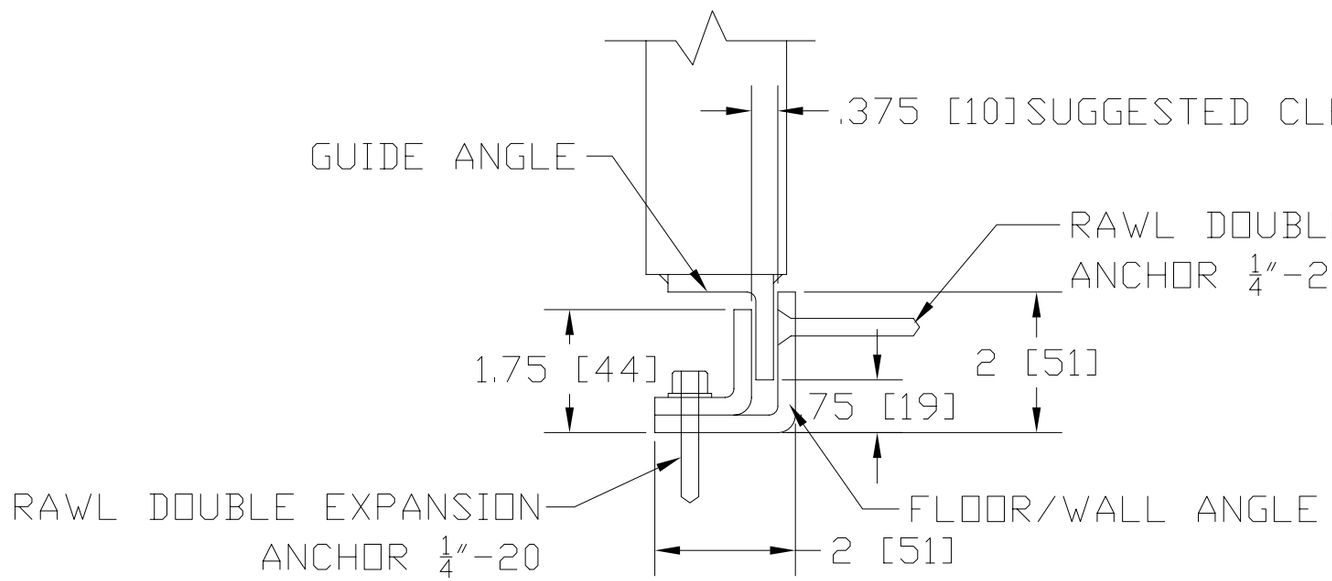
TOP AND BOTTOM SKIN
ASSEMBLY PROFILE

KACH INC.
DETENTION EQUIPMENT

TEL: (905) 827-9901 FAX: (905) 827-9971
1439 Speers Road
Oakville, Ontario
L6L 2X5

SCALE: 1:5	PART DESCRIPTION: SLIDING CELL DOOR SKIN ASSEMBLY
DATE:	
DRAWN BY: / APPROVED BY:	PROJECT: POLICE BUILDING 100 MILE HOUSE, BC
REV:	DRAWING DA-9





KACH INC. DETENTION EQUIPMENT		TEL: (905) 827-9901 FAX: (905) 827-9971 1439 Speers Road Oakville, Ontario L6L 2X5
SCALE: 1:5		PART DESCRIPTION: BOTTOM GUIDE DETAILS
DATE:		
DRAWN BY:	APPROVED BY:	PROJECT: POLICE BUILDING 100 MILE HOUSE, BC
		REV:
		DRAWING DA-10

1 General

1.1 RELATED WORK

.1 Section 01 01 50 - General Instructions for final cleaning.

.2 Section 07 92 10 - Sealants for caulking between frames and adjacent building components.

.3 Section 08 11 14 - Metal Doors and Frames

.4 Section 08 50 50 - Aluminum windows.

.5 Section 08 80 50 - Glazing (except for observation unit).

1.2 REFERENCED STANDARDS

.1 ASTM International (ASTM)
.1 ASTM E90-09 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
.2 ASTM E 413-10 - Classification for Rating Sound Insulation.

.2 Canadian Standards Association (CSA International)
.1 G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 01 50.
.1 Indicate type of frame, stiles and track extrusion profiles, internal steel reinforcing requirements, elevations of units, profiles of components, anchorage details, required clearances, methods of assembly and operating hardware for glazed counter barrier, location of manufacturer's nameplate.

.2 Provide maintenance data for cleaning and maintenance of aluminum finishes and glazing for incorporation into maintenance manual specified in Section 01 01 50.

1.4 DESIGN CRITERIA

.1 Fabricate acoustic observation window unit forming part of assembly to meet sound isolation rating specified, tested to ASTM E90.

1.5 SOURCE QUALITY CONTROL

.1 Submit to Departmental Representative manufacturer's written verification that:
.1 Acoustic observation window unit meets sound isolation and acoustical rating specified in paragraph 2.3.3.1.2.
.2 Submit verification three (3) weeks prior to site installation of unit in accordance with Section 01 01 50.

1.6 PROTECTION

.1 Apply temporary protective coating to finished surfaces. Remove coating after erection. Do not use coatings that will become hard to remove, leave residue or damage painted surfaces or glazing.

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 Aluminum extrusions: Aluminum Association alloy AA6063-T.5 (aluminum frames) and AA6061.T6 (sliding tracks), anodizing quality.

.2 Sheet aluminum: Aluminum Association alloy, to barrier manufacturer's standard, anodizing quality.

.3 Steel reinforcement: to CAN/CSA-G40.21, Grade 300 W.

.4 Fasteners: to manufacturer's standard for installation of glazed counter barrier framing in steel studs and millwork countertop, and acoustic observation window framing members in masonry walls. Exposed glazing stop fasteners to be tamper resistant type, finished to match adjacent materials.

.5 Glass materials and speaker ports: in accordance with Section 08 80 50.

.6 Internal louvre system (integral with acoustic observation window unit):
.1 Slats made of aluminum alloy, horizontal pivoting, size and spacing to suit sealed glazed unit.
.2 Manually operated tilting mechanism concealed in frame with louvre control crank handle, frame mounted from room 164/146.

.8 Lock bolt: to ANSI/BHMA Type E8291 (Grade1):
.1 Mortised sliding door lock/latch with spring-loaded hook bolt latch of laminated steel with latch operator handle on secure side only. No provision for hardware on public side. Install lock in leading stile of sliding panel where shown.

.2 Acceptable Product: Adams Rite 4570 latch operator with MS1847-11-630 slam lock hook bolt and flat face plate with radius ends. Slam lock feature locks door. Lever unlocks latch bolt. Mount lever in down position. Provide strike plate/lock pocket.

2.2 FINISHES

.1 Finish exposed surfaces of aluminum components for glazed counter barrier with natural anodized aluminum finish.

.2 Finish reinforcing steel with steel primer.

2.3 FABRICATION

.1 General:
.1 Construct protection barrier assembly window to profiles, configuration and maximum face sizes as shown.
.2 Make allowances for deflection of structure. Ensure that structural loads are not transmitted to aluminum work.

.2 Glazed Counter Barrier at Room 102 Counter:
.1 Construct frames of aluminum porthole extrusions with minimal wall thickness of 3 mm;
.2 Frame Members (Fixed):
.1 Main frame: 45 x 120 mm storefront section, flush glazed.
.3 Horizontal Sliding sash:
.1 Jamb and head rail nominal 60 mm including applied glazing stops;
.2 Bottom rail height: nominal 190 mm, including glazing stops;
.3 Sash thickness: 45 mm.
.4 Track and Roller Assembly:
.1 Provide aluminum top track, pre-cut to two times length of sliding sash opening width, with guides and accessories for surface installation on office side of counter.
.2 Provide fastening system to support roller assemblies to allow smooth and quiet operation of sliding panels.
.4 Mount two (2) friction reducing slide buttons of die cast nylon at the head of each vertical stile of sliding panels.
.5 Provide for thumbturn locking of sliding panel from General Office side; no locking mechanism to be shown on Reception side.
.6 Acceptable Products:
.1 Framing and top track assembly to meet type of construction and operation similar to Kawneer 1010C aluminum sliding door fronts.
.2 Other products are acceptable provided they meet the minimum requirements indicated and are of equal to better quality of product specified and as approved by Departmental Representative.
.6 Glazing: 13.5 mm thickness laminated tempered safety glass specified in Section 08 80 50

.3 Acoustical Glazed Observation Window:
.1 Engineered acoustically sealed double glazed unit with integral horizontal pivoting aluminum louvres; factory glazed and sealed with following make-up:
.1 Perimeter frame: extruded aluminum 35 mm nominal depth, width to suit glazing thicknesses as shown with 50 mm clear air space.

.2 Sound transmission class for complete unit: minimum STC 46.

.3 Horizontal pivoting louvre system, operated by hand crank handle in accordance with paragraph 2.1.6.

.4 Finish of exposed aluminum components: anodized aluminum to paragraph 2.2.1.

.5 Glazing: two laminated glass panes each consisting of 3 mm annealed glass plus 1.5 mm polyvinyl butyral (PVB) plus 3 mm tempered glass, separated by 50 mm air space and sealed as one unit.

.6 Polycarbonate interior protection sheet specified in Section 08 80 50 with aluminum spacer specified in Section 05 50 00. Provide snap-in glazing stop to retain acoustic window and polycarbonate protection sheet assembly to pressed steel frame.

.2 Standard of Acceptance: Unit as manufactured by Unicel Inc., Vision Control Products.

.3 Acoustical observation window designed for mounting in pressed steel frame as detailed on drawing DA-1 following this section.

3 Execution

3.1 INSTALLATION

.1 Install work plumb, square, level, free from warp, twist and superimposed loads.

.2 Secure work in required position in strict accordance with manufacturer's written installation instructions to suit adjoining wall construction.

.3 Adjust operable parts for correct function.

.4 Acoustic observation window:

.1 Install acoustic observation window in pressed steel frame, in accordance with window manufacturer’s instructions.

.2 Install, 6 mm mar resistant polycarbonate glazing on room side of observation window unit using aluminum channel spacer and aluminum snap-in stops. Glazing tape specified in Section 08 80 50. Aluminum channel spacer and snap-in glazing stops provided by acoustic observation window supplier.

.3 Center assembly in pressed steel frame.

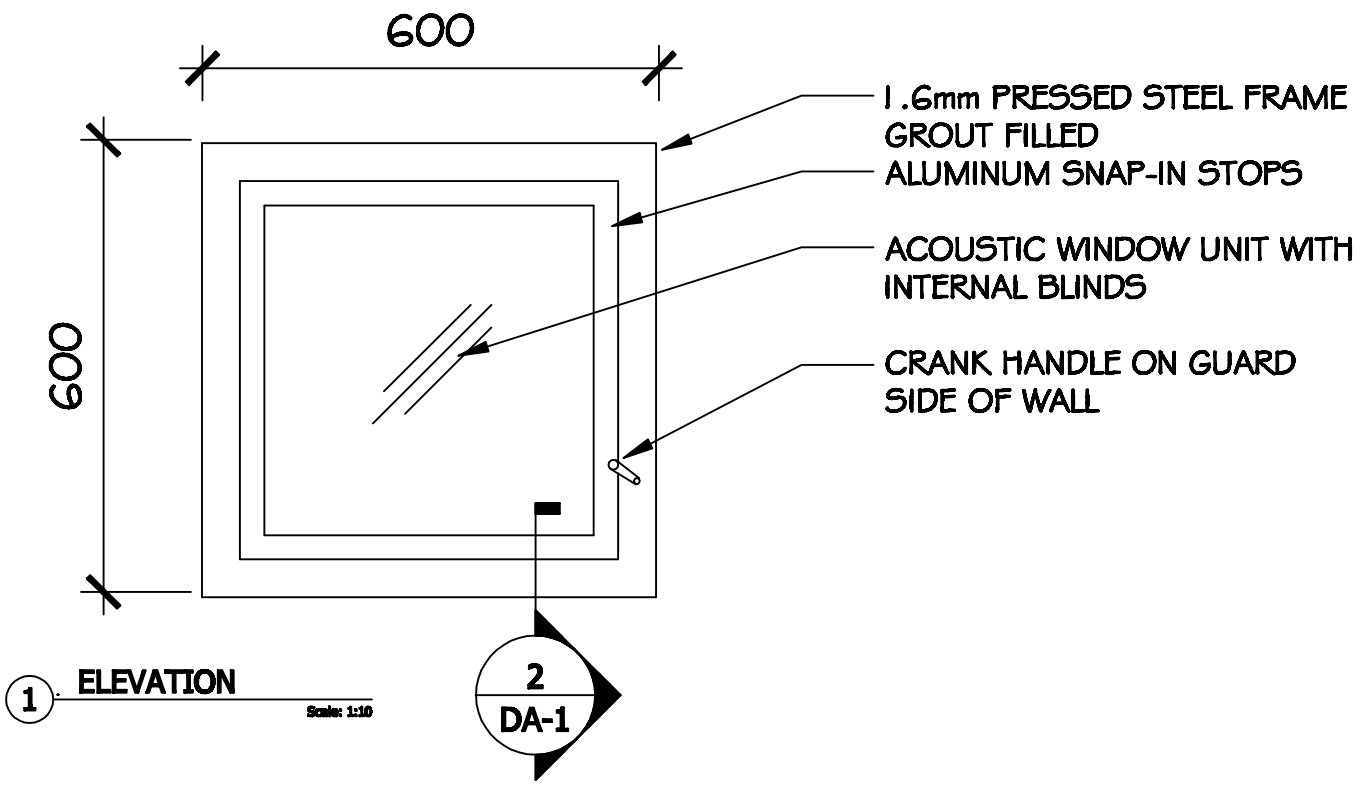
3.2 CAULKING

.1 Caulk perimeter of both sides of reception counter glazed barrier frame at adjoining building construction.

.2 Seal full perimeter of both sides of observation control window frame with approved caulking, prior to installation of polycarbonate glazing screen as detailed on drawing DA-1.

.3 Where required seal between members of aluminum work.

END OF SECTION



1 ELEVATION
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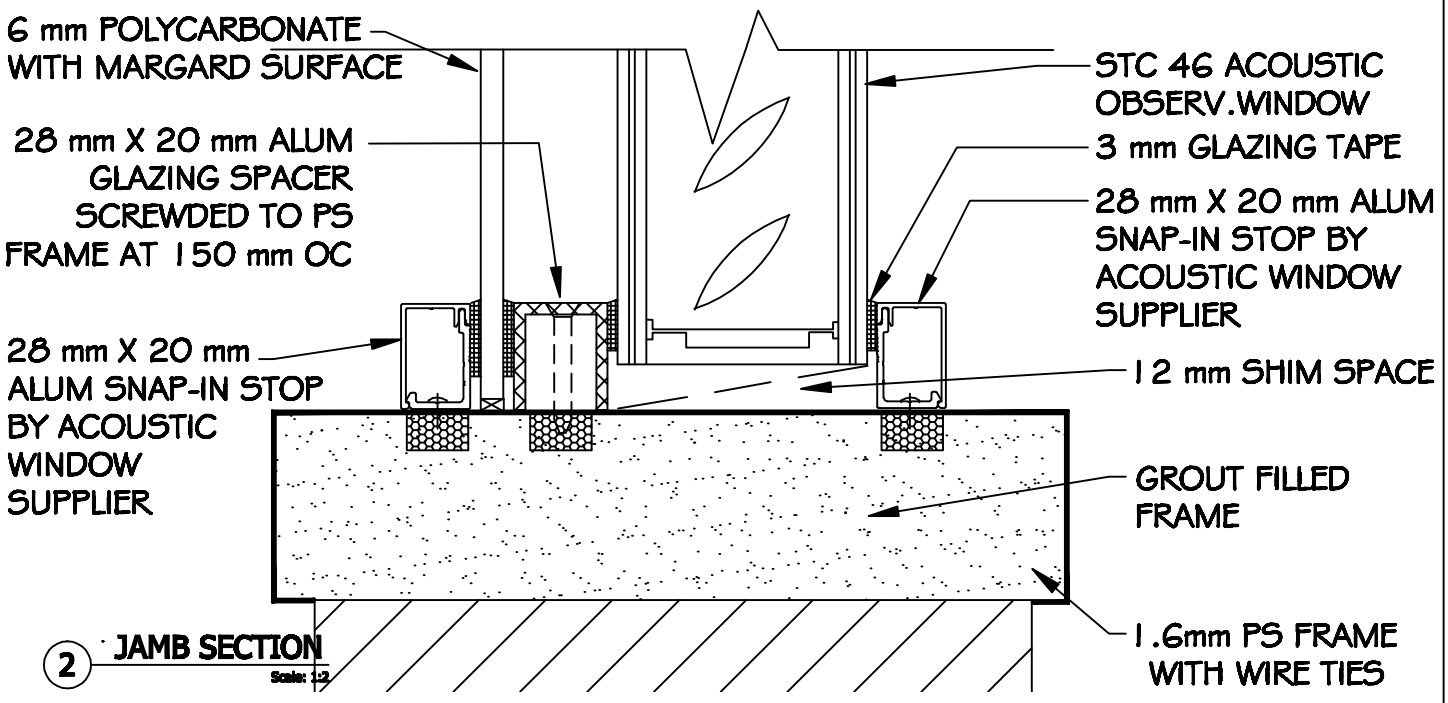

2 JAMB SECTION
Scale: 1:2

Project title/Titre du projet **POLICE BUILDING** **100 MILE HOUSE BC**	Drawing title/Titre du dessin **ACOUSTIC OBSERVATION WINDOW**

Consultant Signature Only	[redacted] Project Manager/Administrateur de Projets TPSGC	Scale/Echelle 1:2	
Designed by/Concept par SRS	[redacted] Regional Manager, Architectural and Engineering Services/ Gestionnaire régionale, Services d'architectural et de génie, [redacted]	Date/Date February 2012	
Drawn by/Dessine par MB 2012/02/24	Project No./No. du projet	Sheet/Feuille DA-1	Revision/ Revision

[redacted] – ANSI A–P– 8.5 X 11

1 General

1.1 RELATED WORK

.1 Section 08 71 10 - Door Hardware for mounting heights.

.2 Section 09 91 23 - Painting.

1.2 REFERENCE STANDARDS

.1 AWMAC – Architectural Woodwork Manufacturers Association of Canada – Quality Standards for Architectural Woodwork, 2003.

.2 NWWDA – National Wood Window and Door Association, “Industry Standard I.S. for Architectural Wood Doors”.

.3 AWI – Quality Standards of The Architectural Woodwork Institute Edition 6, Version 1.1-94, Section 1300.

.4 CAN/CSA-O132.5-M1992(R1998), Stile and Rail Wood Doors.

.5 CAN/CSA O132.2 Series-90(R2003), Wood Flush Doors.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 01 50.

.2 Indicate door types and cutouts for lights and louvres.

1.4 PROTECTION

.1 Deliver, store, handle and protect products at site under provisions of NWWDA publication “How to Store, Handle, Finish, Install and Maintain Wood Doors”.

2 Products

2.1 MATERIALS

.1 Door materials: to CAN/CSA-O132.2, minimum.

2.2 INTERIOR FLUSH DOORS

.1 Flush SCW solid core door: fabricate interior flush doors to AWWDA bonded sanded core/frame assembly, Architectural grade:

.1 Faces for clear finish: ANSI/AHA A135.4, type S2S, white birch, VG veneer surface, slip matched.

.2 Core construction: solid particle board core to NWWDA PC-7.

.3 Door vertical edges: to AWMAC No. 3 edge to manufacturer’s standard.

.4 Door thickness:
.1 Swing doors: 44 mm.
.2 Sliding doors: 44 mm.

.5 Guarantee: 36 months.

.2 Adhesives (facing): Type 1 waterproof.

2.3 FABRICATION

.1 Fabricate doors and panels in accordance with AWMAC Standards for institutional doors.

.2 Vertical edge strips to match face veneer.

.3 Bevel vertical edges of single acting doors 3 mm in 50 mm on lock side, 1.5 mm in 50 mm on hinge side. Sliding doors square cut.

.4 Undercut doors where scheduled.

.5 Prepare doors for hardware.

3 Execution

3.1 INSTALLATION

.1 Install doors and hardware in accordance with manufacturer's instructions.

.2 Adjust hardware for correct function.

3.2 ADJUSTMENT

.1 Re-adjust doors and hardware just before completion of building to function freely and properly.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 09 22 16 - Non-Structural Metal Framing.

1.2 REFERENCES

.1 Aluminum Association (AA).
- .1 DAF 45-03, Designation System for Aluminum Finishes.
- .2 American Architectural Manufacturers Association (AAMA).
  - .1 AAMA 609.1-02, Voluntary Guide Specification for Cleaning and Maintenance of Architectural Anodized Aluminum.

.2 American Society for Testing and Materials International, (ASTM)
.1 ASTM A 653/A653M-11, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process.

.3 CAN/CGSB-1.105-M91 Quick-Drying Primer.

1.3 SUBMITALS

.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.
.2 Shop Drawings:
.3 Submit shop drawings in accordance with Section 01 01 50 - General Instructions for Submittal Procedures.
.4 Indicate each type of coiling counter door, arrangement of hardware, operating mechanism and required clearances.

.2 Submit samples in accordance with Section 01 01 50 - General Instructions for Submittal Procedures].

.3 Submit duplicate 300 mm long pieces of slats guides.

.4 Manufacturer's Instructions:
- .1 Submit manufacturer's installation instructions.

.5 Manufacturers' Field Reports: submit copies of manufacturers field reports.

1.4 MAINTENANCE DATA

.1 Provide operation and maintenance data for overhead coiling door, and hardware for incorporation into 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, 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.

2 Products

2.1 MATERIALS

.1 Aluminum sheet metal: plain finish utility sheet.

.2 Aluminum extrusions: Aluminum Association alloy AA6063-T5.

.3 Galvanized steel sheet: commercial quality to ASTM A653/A653M, with Coating Designation Z275 mill phosphatized.

.4 For non-anodized aluminum: CGSB 1-GP-121, vinyl wash primer or CAN/CGSB-1.132, zinc chromate primer.

2.2 COILING COUNTER DOOR

.1 Assemble coiling counter door curtain of 60 mm wide x 1.5 mm thick, flat extruded aluminum interlocking slat sections. Slats and hood with natural aluminum anodized coating.

.2 Rivet alternate end locks to slat ends.

.3 Provide bottom bar of heavy extruded aluminum tubular section equipped with bumper strip.

.4 Form guides of extruded aluminum sections 64 mm x 37 mm with upset shoulders fro curtain retention, fitted with vinyl stripping to protect curtain.

.5 Construct counterbalance assembly of heat treated torsion spring with 25% overload factor. Enclose spring in steel pipe to support door curtain and counterbalance mechanism with maximum deflection of 2.5 mm per 1000 mm of opening width. Provide ball bearings at rotating points. Provide spring tension adjusting wheel, accessible for setting.

.6 Support counterbalance assembly and hood on 4.76 mm minimum thickness steel plate brackets, forming end enclosures.

.7 Enclose counterbalance assembly with aluminum sheet formed hood.

.8 Equip door for locking
  .1 Double slide bolt with provision for padlocking.

2.3 OPERATION

.1 Equip door for operation by crank handle.

3 Execution

3.1 INSTALLATION

.1 Install counter door in accordance with manufacturer's printed instructions and reviewed shop drawings.

.2 Adjust counter door operating components to ensure smooth operation of movement and locking function.

END OF SECTION

1 General

1.1 WORK INCLUDES

.1 STC 46 rated acoustic pressed steel frames and hollow metal door assemblies.

.2 Perimeter and bottom acoustic seals and threshold,.

1.2 RELATED WORK

.1 Section 04 04 99 - Building-in frames in masonry walls and masonry mortar fill of metal frames.

.2 Section 07 92 10 - Caulking of joints between frames and other building components.

.3 Section 08 11 14 - Metal Doors and Frames

.4 Section 08 11 20 - Cell Doors, Frames and Hardware.

.5 Section 08 71 10 - Finish hardware, excluding perimeter sound seals and threshold.

.6 Section 09 22 16 - Building-in frames in steel stud walls.

.7 Section 09 91 23 - Painting.

.8 Section 28 13 00 - Access Control.

1.3 REFERENCES

.1 ASTM International (ASTM)
.1 ASTM A480/A480M-11b - General Requirements for Flat-Rolled Stainless Heat-Resisting Steel Plate, Sheet, and Strip.
.2 ASTM A653/A653M-11 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.3 ASTM E90-09 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
.4 ASTM E413-11 - Classification for Rating Sound Insulation.

.2 AWS D1.1/D1.1M:2006, Structural Welding Code - Steel.

.3 CSDMA Selection and Usage Guide for Steel Doors and Frames, 2006.

.4 HMMA 802-07 - Manufacturing of Hollow Metal Doors and Frames.

.5 HMMA 840-07 - Installation and Storage of Hollow Metal Doors and Frames.

.6 HMMA 865-03 - Guide Specifications For Swinging Sound Control Hollow Metal Doors and Frames.

1.4 PERFORMANCE REQUIREMENTS

.1 Acoustic Performance: Minimum Sound Transmission Class (STC) 46 tested to ASTM E90. Label indicating sound transmission class shall be applied to the door and door frame.

1.5 SUBMITTALS

.1 Section 01 01 50: General Instructions for Submission procedures clause.

.2 Product Data: Provide product data on door and frame construction.

.3 Shop Drawings: Indicate door and frame elevations, anchor types and closure methods and location of cut-outs for hardware.

.4 Test Data:
.1 Submit test data indicating compliance with the Sound Transmission Class (STC) requirements. Include laboratory name, test report number, and date of test.
.2 Submit certification from test laboratory qualified under the National Voluntary Accreditation Program (NVLAP) of the U.S. Bureau of Standards.

.5 Installation Instructions: Submit manufacturer's installation instructions.

1.6 QUALITY ASSURANCE

.1 Perform work to requirements of CSDMA (Canadian Steel Door Manufacturers Association), HMMA (Hollow Metal Manufacturers Association) standards.

.2 Manufacturer: Minimum 5 years documented experience manufacturing acoustic steel door and frame assemblies.

.3 Pre-installation Meeting: Convene a pre-installation meeting before start of installation of acoustic door and frame assemblies. Require attendance of parties directly affecting work of this section, including contractor, architect, installer, and manufacturer's representative. Review installation and coordination with other work.

1.7 DELIVERY, STORAGE AND PROTECTION

.1 Section 01 01 50: General Instructions for Transport, handle, store, and protect products.

.2 Comply with HMMA 840.

.3 Weld minimum two temporary jamb spreaders per frame prior to shipment.

.4 Remove doors and frames from wrappings or coverings upon receipt on site and inspect for damage.

.5 Store in vertical position, spaced with blocking to permit air circulation between components.

.6 Store materials out of water and covered to protect from damage.

.7 Clean and touch up scratches or disfigurement caused by shipping or handling with zinc-rich primer.

1.8 WARRANTY

.1 Manufacturer's Limited Warranty: Five (5) years from date of supply, covering material and workmanship.

2 Products

2.1 ACCEPTABLE PRODUCTS

.1 AMBICO Limited
1120 Cummings Avenue
Ottawa, Ontario, Canada K1J 7R8
Toll Free Phone: 888-423-2224
Phone: 613-746-4663
Toll Free Fax 800-465-8561
Fax 613-746-4721

.2 Other products are acceptable provided they meet the requirements of this specification.

.3 Substitutions: Refer to Section 01 01 50.

2.2 MATERIALS

.1 Sheet Steel:
.1 Galvanized steel to ASTM A653/A653M, ZF180 (A60).

.2 Reinforcement Channel: To CSA G40.20/G40.21, coating designation to ASTM A653/A653M, ZF75.

2.3 ACCESSORIES

.1 Hinges: Heavy weight butts as recommended by the manufacture.

.2 Primer: Rust inhibitive zinc chromate.

.3 Threshold: Smooth and flush, to provide a seal for door in closed position.

.4 Perimeter and bottom acoustic seals: To provide a seal for door in closed position to meet STC 46.

2.4 FABRICATION

.1 Manufacture doors and frame assemblies to STC rating of 46, measured in accordance with ASTM E90.

.2 Steel Doors:
.1 Sheet steel faces, thickness, design, and core suitable to achieve specified STC performance.

.2 Acoustic core construction, longitudinal edges, mechanically inter-locked with visible edge seams.
.3 Reinforce doors where surface-mounted hardware is required.
.4 Drill and tap for mortised, templated hardware.
.5 Top and Bottom Channels: Inverted, recessed, welded steel channels.

.3 Steel Frames:
.1 Sheet steel, metal thickness and appropriate to maintain door STC, mitred corners, fully welded seams.
.2 Factory assemble and weld frames.

.4 Affix permanent metal nameplates to door and frame, indicating manufacturer's name, door tag, and STC rating where it shall be clearly visible.

2.5 FINISHES

.1 Factory Door Finish: Factory applied zinc chromate primer to be applied to all exposed surfaces.

3 Execution

3.1 INSTALLATION

.1 Install components to manufacturer’s written instructions.
.2 Install steel doors and frames to CSDMA, HMMA 840 standards and in accordance with local authority having jurisdiction.

.3 Utilize welders certified by Canadian Welding Bureau (CWB) for field welding.

.4 Coordinate with masonry and gypsum board wall construction for anchor placement.

.5 Set frames plumb, square, level and at correct elevation.

.6 Allow for deflection to ensure that structural loads are not transmitted to frame.

.7 Adjust operable parts for correct clearances and function.

.8 Install and adjust perimeter and bottom acoustic seals.

.9 Finish paint in accordance with Section 09 91 23.

3.2 ERECTION TOLERANCES

.1 Installation tolerances of installed frame for squareness, alignment, twist and plumbness are to be no more then ± 1.5mm in compliance with HMMA 841.

3.3 FIELD QUALITY CONTROL

.1 Provide qualified manufacturer's representative to instruct installers on the proper installation and adjustment of door assemblies.

.2 Provide manufacturer's representative to inspect door installation, and test minimum ten (10) cycles of operation. Correct any deficient doors.

3.4 SCHEDULE

.1 Acoustic Steel Door and Frame Assembly Schedule:

Dr #	Rm#	Nominal Size	Thick.	Mat'l.	Glz	F/R	STC	Comments
105	104	914mm x 2133mm	44mm	GS	-	NFR	46	Door thickness to suit STC
106	104	914mm x 2133mm	44mm	GS	-	NFR	46	Door thickness to suit STC
108	106	914mm x 2133mm	44mm	GS	-	NFR	46	Door thickness to suit STC
109	108	914mm x 2133mm	44mm	GS	-	NFR	46	Door thickness to suit STC
109A	108	914mm x 2133mm	44mm	GS	-	NFR	46	Door thickness to suit STC
134	145	914mm x 2133mm	44mm	GS	-	FR	46	Door thickness to suit STC
135	144	914mm x 2133mm	44mm	GS	-	NFR	46	Door thickness to suit STC
138	162	914mm x 2133mm	44mm	GS	-	NFR	46	Door thickness to suit STC
171	128	914mm x 2133mm	44mm	GS	-	NFR	46	Door thickness to suit STC

- Material types: GS = Galvanized Steel
- Fire Label types: FR= Fire rated to 90 minutes, NFR= Non-fire rated

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 05 50 00 - Metal Fabrications, for steel frames.

.2 Section 08 71 10 - Door Hardware, Masterkeyed cylinders and padlocks.

.3 Section 09 91 23 - Painting.

.4 Division 26 - Electrical power supply.

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)
.1 ASTM A 653/A653M-11, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.2 ASTM A 794/ A794M-09 - Standard Specification for Commercial Steel (CS), Sheet, Carbon (0.16 % Maximum to 0.25 % Maximum), Cold-Rolled.
.3 ASTM A659/659M-08 - Standard Specification for Commercial Steel (CS), Sheet and Strip, Carbon (0.16 Maximum to 0.25 Maximum Percent), Hot-Rolled.
.4 ASTM A123 / A123M - 09 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

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

.3 Underwriters Laboratories Canada (ULC)
.1 CAN/ULC-S705.1-01 Amendment 1 - Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Material - Specification

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1.3 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 01 50.
.1 Clearly indicate materials, operating mechanisms, required clearances and electrical connections.

.2 Provide maintenance data for overhead door hardware for incorporation into maintenance manual specified in Section 01 01 50.

1.4 DESIGN REQUIREMENTS

.1 Design door panels to withstand wind load of 1 kPa (kN/m²) with a maximum horizontal deflection of 1/120 of opening width.

2 Products

2.1 MATERIALS

.1 Galvanized steel sheet: commercial grade steel to ASTM A653M, Class 1, hot-dip galvanized with Z180 zinc coating.

.2 Sheet steel for tracks and ancillary equipment: commercial grade base material to ASTM A794, exposed, with galvanized zinc coated finish.

.3 Finish: acrylic-urethane paint coating to manufacturer's standard.

.4 Insulation: polyurethane to to CAN/ULC-S705.1, 41kg/m³ density

2.2 DOORS

.1 Fabricate insulated flush doors for roll formed steel sections as indicated and as specified below.

.1 All exterior overhead doors 128 to 131 incl:

.1 Fabricate steel roll formed doors from Z180 hot dip galvanized 1.42 mm face sheet and 1.42 mm back sheets bonded to fire retardant foamed polyurethane core to 50 mm thickness, reinforcing struts, primed and prefinished with polyester coating, reinforced and sealed, with thermal break, weatherstripped, including all-around weathertight seal.

.2 Each end panel with 1.42 mm thick galvanized sheet steel end caps to accept top roller carriers, end hinges, bottom corner brackets and locking devices.

.3 Warranty:

.1 10 year against perforation due to rust.

.4 Acceptable product: Thermostop Mark II for security applications.

.2 Rigid polyurethane core insulation foamed in place at high pressure between two face sheets. No exterior fasteners permitted.

.3 Apply shop coat of primer, after fabrication of doors, and factory applied acrylic urethane finish coat in colour selected by the Departmental Representative.

.4 Extend doors 100 mm minimum past both sides of door opening.

2.3 HARDWARE

.1 Track:

.1 Standard lift hardware 76 mm wide track.

.2 Hardware for all tracks of 76 mm size 3 mm core thickness galvanized steel double radius track for torsion spring lifting and to include ancillary hardware items. Minimum life cycle 50,000.

.2 Rollers: full floating hardened steel, ball bearing, size to suit track.

.3 Roller carriers: adjustable, minimum 2.4 mm galvanized steel for 76 mm size tracks.

.4 Hinges: heavy duty, bolted-on, 2.4 mm thick galvanized steel.

.5 Accessories:

.1 2.8 mm core thickness adjustable steel angle track supports.

.2 5 mm thick formed sheet 1500 mm high track guards.

.3 Pusher springs.

.4 Double contact extruded neoprene weatherstrip for door sill section, full width (with integral safety switch for electric operated door).
.5 Continuous compressible EPDM weatherstrip for jambs and head, to manufacturer's standard.

.6 Locking devices:
.1 For doors 128, 129 and 130 provide two horizontal bolts latching into track and drill hole in each track to accept padlocks as specified in Section 08 71 10; no exterior handle or cylinder.
.2 For door 131 control, install mortise cylinder in key switch as specified in Section 08 71 10.

.7 Finish ferrous hardware items with zinc coating to ASTM A123 / A123M.

2.4 OPERATOR

.1 Equip all doors for operation by electrical side mount type (Jack Shaft) operator, c/w manual operation galvanized steel chain
.1 Provide 200 mm φ x 1300 mm long, heavy duty PVC pipe enclosure secured to wall with 3 mm X 25 mm strapping plate (curved) c/w 2 - 12.7 mm φ x 65 mm lg. anchor bolts and 3 s/steel screws, and 12.7 mm φ x 250 mm stainless steel carriage bolt c/w hex nut and 38 mm φ s/s washers bolt at bottom to secure chain from being removed (lap chain around carriage bolt).

2.5 ELECTRICAL OPERATOR AND CONTROLS

.1 Electrical motors, controller units, control stations, relays and other electrical components: to CSA and ULC approval with EEMAC enclosures type 1 for interior areas and type 4 for exterior installed equipment.

.2 Power supply: 120/208V, 1 phase, 60 Hz.

.3 Controller units with integral motor reversing starter, overload protector, in each phase and time delay relay adjustable from 0 to 60 seconds.

.4 Control system, all components from one manufacturer (OH Door 131 only):
.1 Exterior control: key operated switch mounted in exterior weatherproof control box. Momentary-contact to open and close door.
.2 Interior control: momentary-contact, three button control station with push button controls labeled "open", "close" and "stop", controlled by key operated switch mounted inside Secure Bay on wall, beside three button station, adjacent to door leading into Patrol Corridor. Reference electrical drawings.
.3 Manual safety release: emergency chain hoist: for manual operation in event of jackshaft operator failure. Floor operated disconnect, to disconnect electric operator and engage chain hoist. Electrically interlocked to prevent operation of electric operator when chain hoist is engaged.
.4 Provide a combination roll rubber safety switch with limit switches for the full length of the bottom edge of the door, enabling the door to reverse to the open position when coming in contact with an object on the closing cycle. To prevent opening of door (by insertion of prying tool under closed door) the safety switches shall not open door when in fully closed position.

.5 Control system doors 128, 129 & 130, all components from one manufacturer:
.1 Exterior control: none.
.2 Interior control: momentary-contact, three button control station with push button controls labeled "open", "close" and "stop".
.3 Manual safety release: emergency chain hoist: for manual operation in event of jackshaft operator failure. Floor operated disconnect, to disconnect electric operator and engage chain hoist. Electrically interlocked to prevent operation of electric operator when chain hoist is engaged.
.4 Provide a combination roll rubber safety switch with limit switches for the full length of the bottom edge of the door, enabling the door to reverse to the open position when coming in contact with an object on the closing cycle. To prevent opening of door (by insertion of prying tool under closed door) the safety switches shall not open door when in fully closed position.

.6 Key Switches: keyed alike with all locks in room 139:
.1 Operation:
.1 From the interior or exterior, when the door is shut it may be opened by exterior key switch or interior key switch controlled three button station, and when the door is open it may be closed by exterior key switch or interior key switch controlled three button station. This operation must be capable of being overridden by the operation of the key switch operated three button station inside Room 139, and the safety reversing bar at the bottom of the door.
.2 If the exterior key switch or the interior key switch controlled three button station inside the Secure Bay is not activated to close the door, the adjustable time delay relay shall cause the door to close after the elapsing of the predetermined time.

.7 Mounting brackets: galvanized steel, size and thickness to suit conditions.

.8 Provide supplementary suspension steel members to support door tracks from structural roof members.

3 Execution

3.1 INSTALLATION

.1 Install door in accordance with manufacturer's recommendations and as specified.

.2 Cut and fit curved portion of track to provide smooth transition to straight portions at tangent points. Slope nominally horizontal tracks 1:50 upward from curved track at doors equipped with jackshaft operator. Brace horizontal tracks with galvanized steel angle cross-bracing at centre and ends to support doors over 3.6 m in height. Secure bracing to structural members only.

.3 Install electrical motor, and supply the following for installation under Division 26: controller units, control switches, relays, limit switches and other electrical equipment required for door operation. Provide schematics and location drawings.

.4 Fit, align and adjust complete door assembly level and plumb and to provide smooth operation and eliminate vibration.

.5 Install and adjust safety reversing mechanism so that when the door is fully closed it cannot be opened by the insertion of a prying tool underneath.

.6 Install weatherstripping to provide continuous seal.

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 and Peel and Stick membrane at rough openings.

.3 Section 07 27 10 - Air/Vapour Barriers.

.4 Section 07 62 00 - Metal flashing and Trim for head flashing.

.5 Section 07 92 10 - Joint Sealing.

.6 Section 08 11 25 - Aluminum Doors, Frames and Glazed Screens.

.7 Section 08 80 50 - Glazing for glass and glazing materials.

1.2 REFERENCED STANDARDS

.1 Canadian Standards Association (CSA International)
- .1 CAN/CSA-A440-M00(R2005) Windows.
- .2 CAN/CSA 12.20-M89 Structural Design of Glass for Buildings.

.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)

.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 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 Aluminum: extruded with 6063-T5 alloy and temper (ASTM B221 alloy T5 temper).
.3 Seals: extruded pvc to manufacturer's standard to meet Classification rating specified.
.4 Glass and glazing materials in accordance with Section 08 80 50, Clause 2.1.3 and its paragraphs.
.5 Bedding compound: to CGSB 19-GP-14M, one compound butyl polyisobutylene polymer base, solvent curing.
.6 Screens: to CAN/CGSB 79.1M.
.1 Type: 1.
.2 Class: C.
.3 Style: 1.
.4 Insect screening mesh: count 18 x 16, aluminum.
.5 Fasteners: tamper proof.
.6 Screen frames: colour to match window frames.
.7 Mount screen frames for interior replacement.
.8 Sill flashing: 1 mm thickness aluminum flashing under window frame.
.9 Isolation coating: alkali resistant bituminous paint.
.7 Sealants: in accordance with Section 07 92 10, colour selected by Departmental Representative.

2.2 WINDOW TYPE AND CLASSIFICATION

.1 Window Types:
.1 Aluminum curtain wall main frame with projected ventilator units, top hinged, bottom projected out:
.1 Main frame: extruded aluminum curtain wall frame, 63 mm wide x 150 mm overall depth, with thermal break, sealed double glazing, seals, pressure plates and snap-on cap. Glazed from exterior.
.2 Projected ventilator: extruded aluminum sash and frame with thermal break, snap-in glazing stops, sealed double glazing and integrated into fixed curtain wall main frame as one unit. Glazed from interior.
.3 Provide projected vent with restricted opening to maximum 100 opening for windows with less than 2100 mm headroom clearance from ground/sidewalk level.
.2 Screens: on ventilating portion of windows.
.3 Dormer windows to paragraph 2.2.1.1.1.

.2 Classification rating: to CAN/CSA-A440.
.1 Air leakage: A3 (Operable vents).
.2 Water leakage: B7
.3 Wind load resistance: C5
.4 Condensation Resistance Factor to AAMA 1502.7: 56.

.3 Conductive Thermal Resistance to AAMA 1503.1: maximum 0.45 BTU/hr/sf/F.

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 CSA G164.

.2 Manufacturer's nameplates on windows are not acceptable.

2.4 ALUMINUM FRAME FINISHES

.1 Factory finish: all exposed surfaces treated with caustic etch and clear anodic oxide treatment to AA-M12C22A31, AAMA 611, Architectural Class I.

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 windows in accordance with CAN/CSA-A440 with double sealed float glass with Low-e coating on #2 surface and Argon gas filler, using standard neoprene glazing splines and seals in accordance with manufacturer's instructions.

.2 Obscure/frosted glass for washroom window.

2.7 HARDWARE

.1 One pair stainless steel four bar side mount hinges. Provide hardware to restrict sash opening to maximum 100 mm as noted in para. 2.2.1.1.3.

.2 Cam handle mounted to window frame and unlatch sash without screen removal.

2.8 AIR BARRIER AND VAPOUR RETARDER

.1 Equip window frames with factory or site installed air barrier material for sealing to building air barrier as follows:

.1 Material: compatible with, building air/vapour barrier materials to provide required air tightness throughout exterior envelope assembly. Air/vapour barrier specified in Section 07 27 10.
.2 Material width: adequate to provide required air tightness to building air barrier.
.3 Submit samples and product data to Departmental Representative for review.
.4 Caulking perimeter joint between window frame and peel and stick air barrier membrane is acceptable and meets the above requirement.

3 Execution

3.1 WINDOW INSTALLATION

.1 Install windows in accordance with CAN/CSA-A440 and reviewed shop drawings . Install aluminum sill flashing and extend to overlap wall finish cap flashing.

.2 Install insect screen on inside of each projected ventilator unit.

.3 Arrange components to prevent abrupt variation in colour.

3.2 CAULKING

.1 Seal joints between window frames and wall air/vapour barrier membrane with sealant to provide weather tight seal at outside.

.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 Supply and installation of hardware for:
- .1 Section 06 23 00 - Finish Carpentry and Laminated Plastic for cabinet hardware.
- .2 Section 08 11 16 - Aluminum Doors, Frames and Glazed Screens, (as specified in this section).
- .3 Section 08 11 20 - Sliding Cell Doors, Frames and Hardware.
- .4 Section 08 11 25 - Glazed Counter Barrier and Acoustic Window.
- .5 Section 08 33 13 - Coiling Counter Doors.
- .6 Section 08 36 12 - Sectional Metal Overhead Doors:(except supply of cylinders and padlocks.)
- .7 Section 08 50 50 - Windows.
- .8 Section 10 51 13 - Lockers:(except supply of padlocks for clothes lockers).

.2 Installation only of hardware for:
- .1 Section 08 11 14 - Steel Doors and Frames.
- .2 Section 08 14 10 - Wood Doors.
- .3 Section 08 34 74 - Acoustic Steel Door and Frame Assemblies.

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 American National Standards institute/Builders Hardware Manufacturers Association (ANSI/BHMA)
- .1 ANSI/BHMA A156.1-2006, Standard for Butts and Hinges.
- .2 ANSI/BHMA A156.4-2000, Standard for Door Controls (Closers).
- .3 ANSI/BHMA A156.6-2010, Architectural Door Trim.
- .4 ANSI/BHMA A156.7-2009, Template Hinge Dimensions.
- .5 ANSI/BHMA A156.8-2005, Door Controls - overhead Stops and Closers
- .6 ANSI/BHMA A156.13-2005 Standard for Mortised Locks and Latches Series 1000.
- .7 ANSI/BHMA A156.16- 2002 Auxiliary Hardware.
- .8 ANSI/BHMA A156.18-2006 Materials and Finishes.
- .9 ANSI/BHMA A165.19-2007 Power Assist and Low-Energy Power-Operated Doors.
- .10 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.

.2 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 in accordance with requirements specified in Section 01 01 50.

1.7 DELIVERY AND STORAGE

.1 Store finishing hardware in locked, clean and dry area.

.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 120 months from the date of Substantial Completion.

1.9 WASTE DISPOSAL AND MANAGEMENT

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

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

.3 Dispose of corrugated cardboard, polystyrene, plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

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.

.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.

.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 Pivot hinges: to ANSI/BHMA A156.17, offset pivots with ball bearing race, designed to suit door weight and size, finished to 626.

.5 Electric hinges: 5 knuckle concealed bearing, 10 wire, stainless steel, 114 x 102 mm, with JB-2 Junction Box and Mortar Shield, for doors with electric locks.

.3 Latch and lock sets:

.1 Mortise locks and latches: to ANSI/BHMA A156.13 , series 1000 mortise lock, grade 1, designed for function and keyed as stated in Hardware Schedule.

.2 Lever handles: plain design with Return. **Door Knobs for Doors in Cell Block Area and where noted.**

.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.

.7 Solenoid mortised lockset: Sargent RXDX 8271 c/w deadbolt.

.1 24 volt internal bridge rectifier permitting 12/24 VAC/VDC power ± 10%.

.2 Solenoid: 24 VDC intermittent duty, 0.25 amp current draw at 24 VDC, fail secure.

.3 Lever monitor switches: of case and cap side lever hob monitoring for independent monitoring of each handle.

.4 Deadbolt monitor switch: to monitor position of deadbolt position.

.5 Electronic card access: weatherproof, mounted with concealed fasteners or security screws, flush mounted in wall. Card access operates electric solenoid locks at door # 112, 115, 126, 162 & 206.

.4 Sliding Door track hardware:

.1 Extruded aluminum surface mounted double track, two 4 wheel trolley assemblies per door of 57 kg (125 lb) capacity (KNC) C-500. 108 mm wide extruded aluminum bottom channel guide KNC C-202) floor mounted with spring loaded nylon guide (KNC C-200B) recessed in door bottom.

.2 Aluminum fascia mounted to track (KNC C-130). Recessed pulls 105 mm long (KNC C-75). Rubber stops floor or track mounted. Reference web page: *http://www.kncrowder.com/pdf/KNC-Track.pdf*

.5 Cylinders: for installation in special doors as listed in hardware schedule, 626 finish. Supply keys in duplicate for each cylinder.

.6 Normal strikes: box type, lip projection not beyond jamb, ANSI dimensions, finish to match lockset.

.7 Closers: provide adjustable backcheck 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 DA: Delayed action.

.4 PA: Parallel arm.

.5 Products with universal mounting and adjustments to take into account changing door configurations.

.8 Overhead door stop/holder: to ANSI/BHMA A156.8 surface mounted type with shock absorber and hold open device to degree noted.

.9 Electronic Door Controls:

.1 Electrical strikes: to BHMA, Grade 1 for mortised locks with latch and deadbolt, with deadbolt monitor as indicated, mortised into jamb, 632 finish, 24VAC service. Electric strike releases latchbolt. Locks with deadbolts incorporating a monitor switch. Fail secure or fail safe as indicated.

.2 Power supply: for all electric strikes and door controls, 24 VAC, amps to suit load, with regulated and filtered output, hardwired to purpose made electrical panel with key locked cover. Mount panel in storage closet room 105, except as noted otherwise.

.3 Push buttons: momentary contact buttons for doors 101, 102, 103, 104, 105 & 107.

.4 Refer to Electrical drawing for wiring diagram and other push buttons provided under Division 26 and 27. Low voltage wiring requirements specified in Division 27. Coordinate installation of control wiring with Division 27.

.10 Surface bolts, top and bottom of door: ANSI/BHMA A156.16 steel, 626 finish, 300 mm long with mortise bolt keepers. Provide dutch door bolts, 150 long.

.11 Weatherstripping:

.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. Pemko 3452CN.

.2 Jamb seals: adjustable trim of aluminum extrusion minimum 20 x 6 mm with EPDM sponge insert, Pemko # 305R.

.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.

.12 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. Pemko #420 and 430M.

.13 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. Pemko # 357 x S88

.14 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.

.15 Power Door Operator:

.1 To ANSI/BHMA A165.19, required for two single doors (101 & 102) located in Room 101. Each door will operate independently upon activation of switch. Door 101 entry controlled from Room 102 counter. Egress of both doors controlled by push buttons in Rooms 101 and 102.

.1 Low energy electrically controlled electro-mechanical operator, as defined in ANSI/BHMA A165.19, c/w push button switches as indicated and keyed switch to control off-on-hold open feature mounted on housing. Power requirements: 120 V, 5 Amp. Provide low voltage power source for power operated doors.

.2 Operator housing surface mounted above door/frame on wall or plates and full width of door, complete with aluminum housing and arm for butt hung door.

.3 Provide shop drawings showing dimensions, operator details and wiring diagrams.

.4 Anodized aluminum finish.

.2 Power operator door switches with 150 x 150 mm #4 satin finish stainless steel face plate and push button with engraved "barrier free" symbol and mounted in tamper resistant assembly installed by Factory Certified Personnel. Provide narrow style button where mounted in door frames

.1 Wall mounted switches: recess mounted switch and box, hard wired to operator housing.

.2 Provide one push button on each side of each power operated door, located on wall near strike side of door, except for door 101 entrance button. (Entrance button for door 101 is located at Reception counter). See para 2.2.9.3.

.3 Operation:

.1 Push button operates electric strike in door frame to release lockset latch/deadbolt and activate power operator to open door.

.2 Provide key switch in operator housing to deactivate door operators when doors are locked by deadbolt.

.16 Cylinder Pulls: for installation in doors as listed in Hardware Schedule, 626 Finish. Approximate size: 100 x 150 with grip. Similar to Trimco 1821. Pulls for Aluminum doors specified in Section 08 11 16.

.17 Padlocks: keyed heavy duty brass padlocks with hardened steel shackle, with six-pin key core cylinders to match locksets and keying system specified.

.18 Door viewers: to ANSI/BHMA A156.16, wide angle (min. 180°) viewer prism, 12 mm diameter, male/female threaded brass tube, adjustable for door thickness. Acceptable products: Loxem 190, Ives #698B3. Provide UL listed viewers for fire rated doors.

.19 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 250 x 865 mm or 250 x 825 mm to suit door width, installed both sides of door, No 4 finish.

2.3 KEYING

.1 All lockset and special lock cylinders of 6 pin design, pinned to 444444, minimum 32 mm long with restricted keying from one off the following products:

.1 Russwin H01.
.2 Sargent NG.
.3 Schlage D.

.2 Provide temporary locks in perimeter doors during construction until new locks are installed.

.3 Factory key all cylinder cores to 444444 and key all cylinders using a bonded locksmith, to keying schedule provided by Departmental Representative, and install cylinders in locks just prior to interim completion under the supervision of Departmental Representative.

2.4 DOOR SCHEDULE

.1 Quantities shown in schedule are for one opening only. Include all hardware for each door listed, except as noted. See drawings for door layout and arrangement.

.2 Door Types Legend:

.1 SCW: solid core wood door. (Section 08 14 10).
.2 HCM: Hollow core metal door with honeycomb core. (Section 08 11 14)
.3 SCM: Hollow core metal door with steel stiffened core. (Section 08 11 14)
.4 SRD: Sound reducing hollow metal door. (Section 08 34 74)
.5 Alum: Extruded aluminum glazed doors and frames. (Section 08 11 16)
.6 OH door: Sectional metal overhead door. (Section 08 36 12)
.7 PS: pressed steel frame. (Section 08 11 14)

Item	Door #	Rm to Rm	Door Type	Frame Type	Label	Hardware Description
Main Floor Level						
1	101	Exterior to Rm 101	Alum	Alum		1-1/2 pr butts 4 BB 114 x 102 Stainless Steel (NRP) 1 lockset F13 1 Electric strike - releases latchbolt only, fail secure, (activated by door operator push button controls). 1 power door operator with key switch in housing. 1 threshold - 260 mm wide Weatherstripping specified in section 08 11 16 2 push buttons with BF symbol (activates power door operator. Exterior control switch at reception counter)
2	102	Rm 101 to Rm 102	Alum	Alum		1 pr pivot hinges 1 lockset F13 1electric strike (releases latchbolt) 1 power door operator 2 push buttons with BF symbol (activates power door operator and electric strike) 1 wall stop
3	103	Rm102 to Rm 130	HCM	PS		1-1/2 pr butts 2BB 114 x 102 1 lockset F15 1 door closer PA 1 wallstop 1 Electric strike (releases latchbolt and deadbolt) fail safe, (activated by push button at Room 102 counter). 1 push button switch (at counter) 1 viewer
4	104	Rm102 to Rm103	SCW	PS		1-1/2 pr butts 2BB 114 x 102 1 lockset F07 1 closer PA 1 wall stop 1 kickplate 1 Electric strike releases latchbolt only, (activated by pushbutton at Rm 102 counter). 1 push button switch

Item	Door #	Rm to Rm	Door Type	Frame Type	Label	Hardware Description
5	105	Rm 102 to Rm 104	SRD	PS		1-1/2 pr butts 4BB 114 x 102 NRP 1 lockset F15 (Free egress from room 104) 1 door closer PA 1 wallstop 1 Electric strike (releases latchbolt and deadbolt) fail safe, (activated by push button at Rm 102 counter). (Soundstripping seals, drop strip and threshold specified in Section 08 34 74) 1 push button switch 1 viewer
6	106	Rm 104 to Rm 111	SRD	PS		1-1/2 pr butts 4BB 114 x 102 1 lockset F13 (key from Rm 104) 1 closer PA 1 wall stop (Soundstripping seals, drop strip and threshold specified in Section 08 34 74)
7	106a	Rm 104 to Rm 105	SCW	-		1 full length double Aluminum track with 4 double wheel roller carriers and recessed floor guides, stops valence, 2 recessed pulls
8	107	Rm102 to Rm 107	HCM	PS		1-1/2 pr butts 2BB 114 x 102 1 lockset F15 1 door closer PA 1 kickplate 1 wallstop 1 Electric strike releases latchbolt and deadbolt, fail safe, (activated by push button at reception counter). 1 push button switch 1 viewer
9	108	Rm107 to Rm106	SRD	PS		1-1/2 pr butts 4BB 114 x 102 1 lockset F15 1 door closer (Soundstripping seals, drop strip and threshold specified in Section 08 34 74) 1 wallstop

Item	Door #	Rm to Rm	Door Type	Frame Type	Label	Hardware Description
10	109	Rm 107 to Rm 108	SRD	PS		1-1/2 pr butts 4BB 114 x 102 1 lockset F15 1 door closer (Soundstripping seals, drop strip and threshold specified in Section 08 34 74) 1 wallstop
11	109A	Rm 108 to Rm 130	SRD	PS		1-1/2 pr butts 4BB 114 x 102 1 lockset F15 (key from Rm 108) 1 electric strike(releases deadbolt and latch bolt) 1 door closer (Soundstripping seals, drop strip and threshold specified in Section 08 34 74) 1 wallstop 1 viewer to room 108
12	110	Rm 107 to Rm 130	SCW	PS		1-1/2 pr butts 2BB 114 x 102 1 lockset F15 (key from Rm. 107) 1 electric strike(releases deadbolt and latchbolt) 1 door closer PA 1 kickplate 1 wallstop 1 viewer to room 107
13	111	Rm110 to Rm 130	HCM	PS	¾ HR	1-1/2 pr butts 2BB 114 x 102 1 lockset F01 1 door closer PA 1 set smoke seals 1 wall stop 1 kickplate
14	112	Exterior to Rm 111	SCM	PS		1 pr butts 2BB 114 x 102 NRP 1 electric hinge 114 x 102 NRP 1 solenoid lockset - Sargent RXDX 8271 (activated by card swipe door control) 1 door closer PA 1 threshold 260 mm wide 1 door bottom seal 1 set weatherstripping 1 latch guard 1 viewer

Item	Door #	Rm to Rm	Door Type	Frame Type	Label	Hardware Description
15	113	Rm105 to Rm 131	SCM	PS	¾ HR	1-1/2 pr butts 2BB 114 x 102 1 lockset F15 1 door closer PA 1 set smoke seals 1 kickplate 1 wallstop
16	115	Rm 111 to Rm132	HCM	PS	¾ HR	1 pr butts 2BB 114 x 102 1 electric butt hinge 114 x 102 1 solenoid lockset - Sargent RXDX 8271 (activated by card swipe door control) 1 closer PA 1 set smoke seals 1 wall stop
17	116	Rm132 to Rm133	SCM	PS	¾ HR	1-1/2 pr butts 2BB 114 x 102 1 lockset F15 1 door closer PA 1 wall stop
18	118	Rm 138 to Rm 135	SCM	PS	1½ HR	1 1/2 pr butts 2BB 114 x 102 1 lockset F15 1 door closer PA 1 wall stop
19	119	Rm138 to Rm 136	SCM	PS	¾ HR	3 pr butts 2BB 114 x 102 1 lockset F15 1 door closer PA 1 overhead stop with HO-100° 1 steel astragal (inactive door) 1 wall stop 1 pair surface bolts
20	120	Rm 138 to Rm 137	SCM	PS	¾ HR	3 pr butts 2BB 114 x 102 1 lockset F15 1 door closer PA 1 overhead stop with HO-100° 1 steel astragal (inactive door) 1 wall stop 1 pair surface bolts
21	121	Exterior to Rm 137A	SCM	PS		1-1/2 pr butts 2BB 114 x 102 NRP 1 lockset F13 with knobs 1 door closer PA 1 set weatherstripping 1 door bottom seal 1 threshold 260 mm wide 1 floor mounted door stop

Item	Door #	Rm to Rm	Door Type	Frame Type	Label	Hardware Description
22	122	Rm 138 to Rm 142	SCM	PS	1½ HR	3 pr butts 2BB 114 x 102 NRP 1 lockset F15 1 steel astragal (inactive door) 1 door closer 100 ° 1 overhead stop with 100 ° 2 sets smoke seals 1 threshold 2 door bottom seals 1 pair surface bolts
23	123	Rm 138 to Rm 140/141	SCM	PS	1½ HR	3 pr butts 2BB 114 x 102 NRP 1 lockset F15 (exit to corridor) 1 steel astragal (inactive door) 1 door closer 100 ° 1 overhead stop with 100 ° 2 sets smoke seals 1 threshold 2 door bottom seals 1 pair surface bolts
24	125	Rm142 to Rm 140/141	SCM	PS	1½ HR	1-1/2pr butts 2BB 114 x 102 NRP 1 lockset F15 with knobs 1 set smoke seals 1 narrow threshold 1 auto door bottom seal 1 viewer (142 to 141) 1 door closer PA 1 wall stop
25	126	Rm 138 to Exterior	SCM 1200 wide	PS		1 pr butts 2BB 114 x 102 NRP 1 electric butt hinge 114 x 102 1 solenoid lockset - Sargent RXDX 8271 (activated by card swipe door control) 1 door closer PA 1 set weatherstripping 1 door bottom seal 1 threshold 260 mm wide 1 floor mounted door stop 1 latch guard
26	127	Rm142 to Exterior	SCM	PS		1-1/2 pr butts 2BB 114 x 102 NRP 1 lockset F15 with knobs 1 door closer PA 1 set weatherstripping 1 door bottom seal 1 threshold 260 mm wide 1 floor mounted door stop 1 astragal

Item	Door #	Rm to Rm	Door Type	Frame Type	Label	Hardware Description
27	128	Rm 142 to Exterior	OH door	steel		1 key cylinder for OH door control of three button station 1 padlock for locking door track(all keys keyed alike with Secure Bay locks)
28	129	Rm 141 to Exterior	OH door	steel		1 padlock
29	130	Rm 140 to Exterior	OH door	steel		1 padlock
30	131	Rm 139 to Exterior	OH door	steel		1 key cylinder for exterior door control 1 key cylinder for interior OH door control of three button station 1 padlock for locking manual override (all keys, keyed alike with Secure Bay locks)
31	132	Rm 143 to Rm 146	SCM	PS	1½ HR	1-1/2 pr butts PB 114 x 102 NRP 1 lockset F14 with knobs 1 door closer 1 narrow threshold 1 set smoke seals 1 auto door bottom seal 1 wall stop 2 viewers
32	133	Rm146 to Rm 146A	SCM	PS	1½ HR	1-1/2pr butts 2BB 114 x 114 mm 1 lockset F07 with knobs 1 door closer PA 1 wall stop
33	134	Rm 143 to Rm 145	SRD	PS	1½ HR	1-1/2pr butts 2BB 114 x 114 mm 1 lockset F07 (Sound seals and drop strip specified in Section 08 34 74) 1 door closer PA 1 wall stop
34	135	Rm164 to Rm 144	SRD	PS		1-1/2pr butts 4BB 114 x 114 mm 1 lockset F18 with dummy knob and no inside trim (Sound seals and drop strip specified in Section 08 34 74)

Item	Door #	Rm to Rm	Door Type	Frame Type	Label	Hardware Description
35	136	Rm139 to Rm 164	SCM	PS	1½ HR	1-1/2pr butts 2BB 114 x 102 NRP 1 lockset F14 with knobs 1 set smoke seals 1 narrow threshold 1 auto door bottom seal 2 viewers 1 door closer PA 1 wall stop
36	137	Rm164 to Rm 163	SCM	PS		1-1/2pr butts 2BB 114 x 114 mm 1 lockset F07 with knobs 1 door closer with stop arm
37	138	Rm 164 to Rm 119	SRD	PS		1-1/2 pr butts 4BB 114 x 102 NRP 1 lockset F14 with knobs 1 door closer with stop arm (Sound seals and drop strip specified in Section 08 34 74)
38	139	Rm 164 to Rm 161	SCM	PS		1-1/2 pr butts 2BB 114 x 114 mm 1 lockset F07 with knobs 1 door closer with stop arm 1 viewport - Section 08 11 20
39	140	Rm 164 to Rm160	SCM	PS		1-1/2 pr butts 2BB 114 x 114 mm 1 lockset F07 with knobs 1 door closer with stop arm 1 viewport - Section 08 11 20
40	141	Rm146 to Rm 147	HCM	PS		1-1/2 pr butts 2BB 114 x 102 mm 1 lockset F01 knobs 1 door closer with stop arm
41	142	Rm164 to Rm 149	HCM	PS		1-1/2 pr butts 2BB 114 x 102 mm 1 lockset F18 - with dummy knob and no inside trim 1 door bottom drip cap 1 viewport - Section 08 11 20 1 door closer with stop arm
42	143 144	Rm 164 to Rm159 Rm 164 to Rm155	HCM	PS		1-1/2 pr butts 2BB 114 x 102 mm 1 deadbolt lock F18 key outside, no inside cylinder 1 cylinder pull
43	149 150	Rm 164 to Rm 153 Rm 164 to Rm154	HCM	PS		1-1/2 pr butts 2BB 114 x 102 mm 1 deadbolt lock F18 key outside, no inside cylinder 1 cylinder pull

Item	Door #	Rm to Rm	Door Type	Frame Type	Label	Hardware Description
44	145 146 147 148 151 152	Rm 164 to Rms 150, 151, 152, 156, 157 & 158	Cell door	steel		Cell door assembly & security hardware Specified in Section 08 11 20
45	153	Rm 164 to Exterior	SCM	PS		1-1/2 pr butts 2BB 114 x 102 NRP 1 lockset F14 with knobs 1 door closer PA Stop Arm 1 set weatherstripping 1 door bottom seal 1 threshold 260 mm wide 1 astragal
46	154	Rm 117 to Rm 112	SCW	PS		1-1/2pr butts 2BB 114 x 114 mm 1 lockset F01 1 wall stop
47	155	Rm 117 to Rm 113	SCW	PS		1-1/2pr butts 2BB 114 x 114 mm 1 lockset F04 1 wall stop
48	156	Rm 117 to Rm 114	SCW	PS		1-1/2pr butts 2BB 114 x 114 mm 1 lockset F01 1 wall stop
49	157	Rm 117 to Rm 115	SCW	PS		1-1/2pr butts 2BB 114 x 114 mm 1 lockset F01 1 wall stop
50	158	Rm 117 to Rm 116	SCW	PS		1-1/2pr 2BB butts 114 x 114 mm 1 lockset F04 1 wall stop
51	159	Rm 111 to Rm 118	SCW Dutch door	PS		2 pr PB Butts 114 x 114 mm 1 dutch door shelf 2 surface dutch door bolts x 150 long 1 lockset F04 1 overhead stop/HO arm 90° 1 door stop floor mtd.
52	160	Rm 118 to Stationary Storage	SCW	-		1 full length double Aluminum track with 8 double wheel roller carriers and recessed floor guides, stops valence, 4 recessed pulls
53	161	Rm 118 to Rm 117	Rollup door			1 Padlock

Item	Door #	Rm to Rm	Door Type	Frame Type	Label	Hardware Description
54	162	Exterior to Rm 120	SCM	PS		1 pr butts 2BB 114 x 102 NRP 1 electric hinge 114 x 102 NRP 1 solenoid lockset - Sargent RXDX 8271 (activated by card swipe door control) 1 door closer PA 1 threshold 260 mm wide 1 door bottom seal 1 set weatherstripping 1 viewer 1 latch guard
55	163	Rm 117 to Rm 120	HCM	PS		1-1/2 pr butts 2BB 114 x 102 1 lockset F01 1 door closer PA 1 wall stop 1 kickplate
56	165	Rm 117 to Rm 123	SCW	PS		1-1/2-pr butts 2BB 114 x 102 mm 1 latchset F01 1 door closer 1 wall stop
57	167	Rm 117 to Rm 124	SCW	PS		1-1/2-pr butts 2BB 114 x 102 mm 1 latchset F01 1 door closer 1 wall stop
58	170	Rm 117 to Rm 127	SCW	PS		1-1/2pr butts 2BB 114 x 114 mm 1 lockset F07 1 set smoke seals 1 door closer PA 1 wall stop
59	171	Rm 111 to Rm 128	SRD	PS		1-1/2pr butts 4BB 114 x 114 mm 1 lockset F15 (Soundstripping seals, drop strip and threshold specified in Section 08 34 74) 1 door closer 1 wall stop
60	172	Rm 111 to Rm 129	SCW	PS		1-1/2 pr butts 2BB 114 x 102 mm 1 latchset F01 1 door closer 1 wall stop

Item	Door #	Rm to Rm	Door Type	Frame Type	Label	Hardware Description
2nd Floor Level						
61	201	Rm 201A to Rm 201	HCM	PS	¾ HR	1-1/2 pr butts 2BB 114 x 102 1 lockset F01 1 door closer PA 1 set smoke seals 1 wall stop 1 kickplate
62	202	Rm 205 to Rm 202	HCM	PS	¾ HR	1-1/2pr butts 2BB 114 x 102 mm 1 lockset F07 1 door closer PA 1 wall stop 1 set smoke seals
63	203	Rm 201 to Rm 203	HCM	PS	¾ HR	1-1/2pr butts 2BB 114 x 102 mm 1 lockset F07 1 door closer PA 1 wall stop
64	204	Rm 205 to Rm 204	HCM	PS	¾ HR	1-1/2pr butts 2BB 114 x 102 mm 1 lockset F15 1 door closer PA 1 wall stop
65	205	Rm 205 to Rm 201	HCM	PS	¾ HR	1-1/2 pr butts 2BB 114 x 102 1 lockset F01 1 door closer PA 1 set smoke seals 1 wall stop 1 kickplate
66	206	Rm 205 to Rm 206	HCM	PS	¾ HR	1-1/2pr butts 2BB 114 x 114 mm 1 pr butts 2BB 114 x 102 NRP 1 electric hinge 114 x 102 NRP 1 solenoid lockset - Sargent RXDX 8271 (activated by card swipe door control) 1 door closer PA 1 electric strike 1 wall stop
67	207	Rm 201A to Rm 207	HCM	PS	¾ HR	1-1/2pr butts 2BB 114 x 114 NRP 1 lockset F15 1 set smoke seals 1 narrow threshold 1 auto door bottom seal 1 door closer PA Stop arm 1 wall stop

Item	Door #	Rm to Rm	Door Type	Frame Type	Label	Hardware Description
68	207A	Rm 201A to Rm 207A	HCM	PS	¾ HR	1-1/2 pr butts 2BB 114 x 102 NRP 1 lockset F15 1 set smoke seals 1 narrow threshold 1 auto door bottom seal 1 door closer PA Stop arm 1 wall stop
69	208	Rm 201A to Rm 208	HCM	PS	¾ HR	1-1/2pr butts 2BB 114 x 102 NRP 1 lockset F07 1 door closer PA 1 wall stop
70	209	Rm 208 to Rm 209	HCM Access Door	PS	1½ HR	1-1/2pr butts 2BB 114 x 102 1 lockset F07 1 door closer PA 1 wall stop
71	210	Rm 208 to Rm140/141	SCM	PS	1½ HR	3 pr butts 2BB 114 x 102 NRP 1 lockset F14 1 steel astragal (inactive door) 1 door closer 100 ° 1 overhead stop with 100 ° 2 sets smoke seals 1 threshold 2 door bottom seals 1 pair surface bolts
72	211	Rm 208 to Rm 211	HCM	PS	¾ HR	1-1/2pr butts 2BB 114 x 102 1 lockset F07 1 door closer PA 1 wall stop
73		Exterior chain Link fence Cage				1 padlock
74		Clothes lockers Gun Lockers				26 padlocks KD Specified in section 10 51 13.

3.3 DOOR LOCKSET FUNCTION LIST

.1 Locksets with function indicated as referenced to hardware schedule:

LOCKSETS FUNCTION SCHEDULE		
Schedule Reference	**Lock Description**	**Lock Function**
F01 & F75	Passage Set	Latchbolt by lever/knob either side.
F04	Entry lock	Latchbolt retracted by lever from either side unless outside lever is made inoperative by stop or other mechanical means other than key. When outside knob is locked, latchbolt may be retracted by key from outside or by rotating inside knob/lever. Auxilliary latch deadlocks latchbolt when door is closed.
F07	Storeroom	Latchbolt by inside lever and key outside. Outside knob always inoperative. Auxilliary deadlatch.
F05	Classroom	Latchbolt by knob from either side except outside knob is rendered inoperative by a stop or mechanical means other than key. When outside knob is locked, latchbolt may be retracted by key from outside or by rotating inside knob. Auxiliary deadlatch.
F13	Dormitory or exit lock	Latchbolt by inside and outside lever/knob. Deadbolt by thumbturn inside and key outside. Throwing deadbolt locks outside lever/knob. Turning inside lever/knob simultaneously retracts deadbolt and latchbolt and unlocks outside lever/knob.
F14	Store door Lock	Latchbolt by lever/knob either side, deadbolt by key outside.
F15	Hotel room Lock	Latchbolt operated by from outside or by rotating lever/knob inside. Outside knob/lever always inoperative. Deadbolt operated by inside thumbturn, shutting off all keys except emergency and display key. Auxiliary deadlatch indicator button. Inside lever/knob retracts both deadbolt and latchbolt simultaneously.
F18	Cylinder lock	Deadbolt by key from outside only.
F22	Bath/Privacy. Lock	Latchbolt retracted by lever/knob from either side. Deadbolt by inside turn piece inside and emergency release from outside.

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 manufacture's instructions.

.3 Remove protective material from hardware items where present.

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

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, Frames and Glazed screens.

.3 Section 08 14 10 - Wood Doors.

.4 Glazing of:
- .1 Windows - Section 08 50 50 .
- .2 Glazed Counter Barriers and Acoustic Window - Section 08 11 25.
- .3 Framed mirrors - Section 10 28 10.
- .4 Door Viewport Glazing - Section 08 11 20.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.
- .2 CAN/CGSB-12.8-97 Insulating Glass Units.
- .3 CAN/CGSB12.12-M90 Plastic Safety Glazing.
- .4 CAN/CGSB-12.11-M90, Wired Safety Glass.
- .5 CAN/CGSB-19.13-M87 Sealing Compound, One-Component, Silicone Base, Solvent Curing.

.2 Environmental Choice Program (ECP).
- .1 CCD-045-95, Sealants and Caulking.

.3 Glass Association of North America (GANA).
- .1 GANA Glazing Manual - 50th Anniversary Edition (2008).

.4 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 Departmental Representative.

.5 Divert unused wood materials from landfill to either recycling, reuse or composting facility.

2 Products

2.1 GLASS MATERIALS

.1 Float glass (annealed): to CAN/CGSB 12.3M, glazing quality of thickness indicated. Translucent, obscure surface where 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 float glass 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 Safety glass:
.1 To CAN2 12.1M, Type 2, tempered, Class B float of minimum 6 mm thickness, category I.

.5 Wired glass: to CAN/CGSB 12.11M, type 1, square wire mesh style, 6 mm thick.

.6 Plastic glazing: to CAN/CGSB12.12-M, clear polycarbonate sheet with abrasion resistant (silicone hardcoat) surface, 6 mm thick, light transmission of 82% minimum. Abrasion resistance test to ASTM D1044-Z26.1, CS10F taber abrasion wheel (100 cycles) with maximum 1-4% haze. Acceptable product Lexan No. MR10.

.7 Silvered glass mirrors: to CAN/CGSB 12.5M, silvered, Type 1B (blue label), clear, 6.0 mm thick, unframed ground and polished edges and supported with tamperproof concealed fasteners. Mirror sizes as indicated.

.8 Room 102 Counter Barrier and Room 144/145 Barrier Glazing:
.1 Security glazing: laminated glass of 6 mm tempered safety glass interior and exterior sheets laminated to 1.52 mm clear PVB interlayer, nominal 13.5 mm thickness.
.2 Speaking ports: to paragraph 2.3.1 and as indicated on Drawings.

.9 Cell door glazing:
.1 Specified in Section 08 11 20.

.10 Door viewport shutter glazing for doors in Cell block area as scheduled:
.1 Specified in Section 08 11 20.

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 Departmental Representative 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.

2.3 ACCESSORIES

.1 Speaking port: through glass mounted type, consisting of two circular 152 mm outside dia. perforated 14 ga stainless steel discs , through bolted.
.1 Perforations: 3 mm dia. holes spaced 10 mm apart each way. Holes in back plate offset 4.8 mm from front plate.
.2 Finish: exposed surfaces to ANSI No. 4, satin lustre.
.3 Fasteners: No 8 tamper resistant Torx flat head screws on secure side of room.
.4 Acceptable Product:
.1 Model 45-115-01-SD1 available from Securingcosmos.com.
.2 Metal Fab Services Ltd #820-SD.

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, 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 and allow clearance for polycarbonate glazing 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.

3.3 MIRROR INSTALLATION

.1 Install mirrors where indicated and in accordance with manufacturer's instructions using approved adhesive or concealed clips fastened to plywood backing.

3.4 SPEAKING PORT INSTALLATION

.1 Install speaking discs as indicated on drawings. Ensure hole size in glass is 120 mm.

3.5 GLAZING OF SHUTTER VIEWPORTS

.1 Remove protective coatings and clean contact surfaces with solvent and wipe dry.

.2 Set polycarbonate/glass glazing in silicone sealant against permanent stops 1.5 mm below sightline. Fill void with sealant and install stops. Fill void between stop and Lexan with sealant.

.3 Install spacers and ship cover plate frame loose ready for mounting in doors specified in Section 08 11 20.

3.6 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 07 46 13 - Roof and Wall Cladding Assembly for installation of gypsum board sheathing.

.4 Section 08 11 14 - Steel Doors and Frames.

.5 Section 08 34 74 - Acoustic Steel Doors and Frame Assemblies.

.6 Section 09 22 16 - Non Structural Metal Framing

.7 Section 09 51 13 - Acoustic Ceiling and Wall Panels for tiles adhered to gypsum board.

.8 Section 23 37 00 - Air Outlets and Inlets for trim for mechanical fixtures.

1.2 SYSTEM REQUIREMENTS

.1 Performance Requirements:

.1 Fabricate and install systems as indicated but not less than that required to comply with ASTM C754 under the following conditions:

.1 A pre-engineered drywall suspension system consisting of straight main tees (for Wall-to-Wall system) or straight main tees and straight furring cross tees, that join together to support screw attached interior gypsum panels, wood ceiling finishes where indicated, and independently supported light fixtures, and air diffusers, where applicable.

1.3 REFERENCED STANDARDS

.1 ASTM International (ASTM)

.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 - 10 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 - 10a 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 C1280 - 09 Standard Specification for Application of Gypsum Sheathing.
.10 ASTM C1396 / C1396M - 09a Standard Specification for Gypsum Board.

2 Products

2.1 GYPSUM BOARD

.1 Plain: to ASTM C 1396 , 12.7mm and 16 mm thick, regular and Type "X" where indicated 1220 mm wide x maximum practical length, ends square cut, edges tapered.

.2 Exterior gypsum sheathing board for 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.

.3 Tile backing board: to ASTM C1178 composed of silicone treated gypsum core and fibreglass matte facings 13 mm thick, 1220 mm wide x 2440mm, FSR 0 and SDC 0 to CAN-ULC S102, non-combustible when tested to ASTM E 136. Acceptable Product meeting these requirements; DENS-GLASS Tile backer board.

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, anchors: to ASTM C 754.

.7 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.

.8 Resilient drywall furring: 0.5 mm base steel thickness galvanized steel for resilient 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. Total weight of ceiling membrane plus overlaid surface finish material (e.g. ceramic tile) supported by the grid assembly should not exceed 20kg/m². If the load exceeds 20kg/m², reduce spacing of the hanger wires and/or main tees to suit additional loads.

.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 and double layer gypsum board to metal furring or framing using screw fasteners for first layer, laminating adhesive and perimeter screw fasteners for second layer. Maximum spacing of screws 300 mm on centre.

.1 Single-Layer Application:

.1 Apply gypsum board on ceilings prior to application of walls in accordance with ASTM C 840.

.2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.

.3 Double-Layer Application:

.1 Install gypsum board for base layer and exposed gypsum board for face layer.

.2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm.

.3 Apply base layers at right angles to supports unless otherwise indicated.

.4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.

.4 Apply type X gypsum board where indicated and for fire rated assemblies.

.5 Apply 12 mm diameter bead of acoustic sealant to walls/ceilings, noted as sound attenuated,(minimum STC 46) 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. In addition to above, seal at each layer of gypsum board on walls and ceiling with multiple layer applications. Seal butt joints and corners of panels. Seal exposed joint at perimeter of ceiling/wall junction with a paintable acrylic sealant.

.6 Apply gypsum sheathing board in accordance with section 07 46 13 and manufacturer's instructions.

.7 At security walls (wall type P5, RP5 & RP6) install wall furring over sheet steel wall reinforcement to ensure wall finish tolerances are met. Install furring level and plumb to specified tolerances.

.8 Apply single layer gypsum board at concrete block surfaces, where indicated, applied to studs as specified in para 3.2.2.

.9 Apply tile backing gypsum board, where tile is scheduled, perpendicular over studs in accordance with manufacturer's instruction. Do not fill joints and screw head depressions with drywall filler. Filling of joints specified in Section 09 30 13.

3.3 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.

3.4 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.

3.5 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 4: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

.4 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.5 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

.6 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.7 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

.8 Mix joint compound slightly thinner than for joint taping.

.9 Provide protection that ensures gypsum drywall work will remain without damage or deterioration at time of substantial completion.

3.6 SCHEDULES

.1 Construct fire rated assemblies where indicated in accordance with wall assemblies schedule.

.2 Construct sound rated assemblies where indicated in accordance with wall assemblies schedule.

.1 Minimum STC 46 partition assemblies:

.1 One layer 16 mm Type X gypsum board each side on metal studs full height of wall.

.2 Acoustic insulation in cavity to thickness indicated. (Section 07 21 16)

.3 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 05 41 00 - Structural Metal Stud Framing.

.3 Section 06 11 10 - Rough Carpentry for blocking and wall backing.

.4 Section 09 21 16 - Gypsum Board Assemblies.

.5 Section 09 51 13 -Acoustical Panel Ceilings and Walls for acoustical suspensions.

1.2 REFERENCES

.1 ASTM International (ASTM) .
.1 ASTM C 645-11a, Specification for Nonstructural Steel Framing Members.
.2 ASTM C 754-11, Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
.3 ASTM A 653/A653 M-11, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.4 ASTM C840 - 11 Standard Specification for Application and Finishing of Gypsum Board
.5 ASTM A1003 / A1003M - 12 Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

.2 Canadian Standards Association (CSA)
.1 CSA W59-03(R2008), Welded Steel Construction (Metal Arc Welding).

.3 Canadian Sheet Steel Building Institute (CSSBI)
.1 CSSBI Member Selection and Structural Design volume 7 Number 1, Maximum Height Tables for Interior Non-Load Bearing Partitions.

1.3 DESIGN CRITERIA

.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 Provide supplemental framing and blocking to support fixtures, equipment services, heavy trim and cabinets, grab bars, toilet accessories, furnishings and other similar construction attached to walls.

.2 Where steel stud walls exceed CSSBI maximum height tables, design steel stud walls with structural steel studs to suit wall heights and wall loads, maintaining stud widths in accordance with referenced standard.

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 Workplan.

.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 Departmental Representative.

.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 1.2 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 2.1.1.1, thickness to match studs, widths to accept stud depths x 32 mm flange height.
.2 For heavy duty interior studs: to paragraph 2.1.1.2, 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 with purpose made drill/screws for fastening into concrete block.
.2 Welding in accordance with Section 05 50 00.

3 Execution

3.1 ERECTION

.1 Install metal framing systems to ASTM C 754.
.1 Restrain system to support gravity and lateral loads. Comply with requirements in ASTM C840 that apply to framing installation.

.2 Steel stud sizes and metal core thickness, for walls in excess of 3.6 m, to meet CSSBI Architectural Design Guide, Interior Composite Limiting Wall Height table, for 5psf at 1/240.

.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 400 and 600 mm o.c., to suit wall height, 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 300 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. 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. 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 to10 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 1200 mm oc above finished floor for walls up to 2400 high and 1200 mm oc floor for walls higher than 2400 mm.

.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 03 05 10 - Cast-in-place Concrete concrete floor.

.3 Section 09 21 16 - Gypsum Board Assemblies (walls).

.4 Section 10 28 10 - Toilet and bath accessories.

.5 Section 22 40 00 - Plumbing Fixtures for Acrylic shower enclosure.

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA):
.1 A3001-08 Cementitious materials for use in concrete.

.2 Canadian General Standards Board (CGSB):
.1 CAN/CGSB-8.1- 88, Sieves, Testing, Woven Wire, Inch Series.
.2 CAN/CGSB-75.1- M88, Tile, Ceramic.

.3 American National Standards Institute (ANSI)
.1 ANSI A108/A118/A136.1:2009, American National Standards for the Installation of Ceramic Tile.

.4 Terrazzo Tile & Marble Association of Canada (TTMAC): 2009/2010 Specification Guide 09 30 00 Tile Installation Manual.

.5 ASTM International (ASTM) :
.1 ASTM C207 - 06 Standard Specification for Hydrated Lime for Masonry Purposes.

.6 British Standards Institute (BSI):
.1 BS EN 14411:2006, Ceramic tiles. Definitions, classification, characteristics and marking.

1.3 SAMPLES

.1 Submit duplicate sample of each colour, texture, size and pattern of porcelain tile, for selection by Departmental Representative, in accordance with Section 01 01 50.

.2 Submit duplicate 300 x 300 mm sample panels of each ceramic tile colour, texture, size, and pattern of tile, in accordance with Section 01 01 50.

.3 Adhere ceramic tile samples to 11 mm thick plywood and grout joints to represent project installation.

1.4 ENVIRONMENTAL CONDITIONS

.1 Maintain air temperature and structural base temperature at quarry and ceramic tile installation area above 12°C for 24 h before, during, and 24 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 TILES

.1 Ceramic wall tile (CT): to CAN/CGSB-75.1M, Type 5, Class MR4, 100 x 100 x 6 mm size, pillow edges, glazed finish, colour and pattern as selected by Departmental Representative.

.2 Porcelain floor tile (PT): to CAN/CGSB-75.1-M, Class MR 1 and conforming to the following:

.1 Size: 200 X 200 mm.
.2 Special shapes: coved base.
.3 Surface texture: flat non-slip.
.4 Performance criteria to control tests of BS EN 14411 Standard:
.1 Size tolerance (length and width): ± 0.40% of one tile (average of 10 samples).
.2 Thickness tolerance: ± 5% of production dimension.
.3 Straightness of sides: ± 0.5% of production dimension.
.4 Orthogonality (squareness test): ± 0.6% of production dimension.
.5 Convexity and concavity: ± 0.35 % of diagonal length.
.6 Warpage of a side: ± 0.35% of production dimension.
.7 Twist in % of diagonal length: ± 0.35%.
.8 Percentage of acceptable tiles per lot: greater than 95%.
.9 Water absorption: less than 0.1%.
.10 Bending strength min 27 N/mm².
.11 Mohs surface hardness of unglazed tiles: min. 6.
.12 Deep abrasion resistance of unglazed tiles: min. 150.
.13 Coefficient of thermal linear expansion from +20° to 100°C: 5.5 ÷ 70.
.14 Thermal shock resistance: 10 cycles from 105° to 15°C, no damage.
.15 Frost resistance: 150 cycles from 15° to -15°C, no damage.
.16 Acid and alkali resistance, unglazed tiles: resistant.

.17 Colour unalterability after exposure to UV: no change in colour.

2.2 MORTAR AND ADHESIVE MIXES

.1 Portland cement: grey white to A3001, Type 10.

.2 Sand: to CSA A23.1.

.3 Hydrated lime: to ASTM C207.

.4 Latex additive: formulated for use in portland cement mortar and thin set bond coat.

.5 Water: potable and free of minerals which are detrimental to mortar and grout mixes.

.6 Dry set mortar: to ANSI A108/A118/A136.1

.7 Thin set bond coat: to tile manufacturer's recommendation.

2.3 GROUT

.1 Polymer modified sanded Portland cement grout to ANSI A108/A118/A136.1 as approved by Departmental Representative.

.2 For porcelain tile: epoxy grout to ANSI A108/A118/A136.1

2.4 ACCESSORIES

.1 Sealant: in accordance with Section 07 92 10, and the following:
.1 Sealant between finish floor and wall tile: one component silicone base, mildew resistant, colour as selected.

.2 Grout sealer for ceramic tile: to CAN/CGSB 25.20M, Type 1.

.3 Tile backer board: specified in Section 09 21 16.

2.5 MORTAR AND GROUT MIXES

.1 Measure mortar ingredients by volume.

.2 Dry set mortar and grout: mix to manufacturer's instructions.

3 Execution

3.1 WORKMANSHIP

.1 Apply tile or backing coats to clean and sound surfaces.

.2 Fit tile around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Cut edges smooth and even.

.3 Maximum surface tolerance 1:800.

.4 Fill joints in tile backer board with thin set mortar material and allow to set. Finish all depressions flat with adjoining surfaces.

.5 Make joints between porcelain tiles uniform and approximately 6 mm wide, plumb, straight, true, even and with adjacent units flush. Layout floor tile joints at 45 degrees to walls in each room scheduled for porcelain tile and ensure that perimeter tiles are not less than ½ tile in area.

.6 Make joints between ceramic tile uniform and approximately 1.5 mm wide, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.

.7 Sound tiles after setting and replace hollow-sounding units to obtain full bond.

.8 Use bullnose edged tiles at termination of wall tile panels, except where panel abuts projecting surface or differing plane. Alternatively use Schluter corners and edges.

.9 Clean installed tile surfaces after installation and grouting cured.

.10 Make control joints where indicated. Make joint width same as tile joints. Fill control joints with sealant in accordance with Section 07 92 10 - Sealants.

3.2 CERAMIC WALL TILE

.1 Install wall tile to rooms scheduled, over tile base substrate in accordance with TTMAC details using acrylic modified thinset bond coat and polymer modified grout. Grout and tile colour as selected by Departmental Representative.

3.3 PORCELAIN FLOOR TILE

.1 Install tile on substrate in accordance with TTMAC details. Level concrete to specified tolerance and tile manufacturer's instructions with thin layer of mortar and allow to set.

.2 Install tile base to rooms indicated.

.3 Use epoxy grout.

3.4 PROTECTIVE COATING

.1 Apply grout sealer in ceramic tile joints in accordance with manufacturer's instructions.

3.5 CLEAN-UP

.1 At completion, remove tools, equipment and unused materials from site.

.2 Remove traces of cementitious materials from other surfaces.

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, for suspension systems.

.3 Section 23 37 00 - Air Outlets and Inlets for recessed mechanical fixtures.

.4 Section 26 50 00 - Lighting for trim for recessed light fixtures.

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)
.1 ASTM C635 / C635M - 07 Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
.2 ASTM C636/C636M-08 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
.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 ASTM E1264 - 08e1 Standard Classification for Acoustical Ceiling Products.

.2 CAN-ULC S102-07 - Standard Test Method for Burning Characteristics of Building Materials and Assemblies.

.3 CAN/CGSB 92.1-M89 - Sound Absorptive Prefabricated Acoustical Units.

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, as listed with the earthquake factors shown on the structural drawing.

1.4 SUBMITTELS

.1 Submit product data and samples in accordance with Section 01 01 50 General Instructions - submittals clause:
.1 Submit product data of ceiling and wall systems..
.2 Submit duplicate samples of acoustical units and eggcrate diffuser.
.3 Submit available MSDS data sheets of products being supplied.
.4 Submit to Departmental Representative for review.

1.5 MAINTENANCE MATERIALS

.1 Deliver following acoustical units for maintenance use for each item noted in accordance with Section 01 01 50. Store where directed and identify contents:

.1 Eggcrate diffuser: 1- 610 x 1220 unit.
.2 Suspended acoustical tiles 1 box of 610 x 1220 tiles.
.3 Ceiling Tiles: 6 - 300 x 300 tiles for room 162.
.4 Wall panels: remaining cuttings larger than 610 x 1220

.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.

.9 Eggcrate diffuser: 12.7 mm square open grid non-parabolic aluminum louvre, minimum 12.7 mm thick with 45°shielding angle, non-flammable, white enamel finish, in panel lengths of 1220 mm and width to suit opening size as indicated.

.10 Surface mounted ceiling tile: to CAN/CGSB-92.1M:
.1 Wet formed mineral composition with standard vinyl-plastic painted finish.
.2 Heavily textured non directional surface. (Resembles sculpted plaster)
.3 Flame spread rating: Class A to ASTM 1254, fire retardent.
.4 Light reflectance: 0.80.
.5 Edges: beveled/T&G.
.6 Colour: white.
.7 Size: Imperial 302 x 302 x 12.7 mm thick.
.8 Shape: flat.
.9 Tile cement: purpose made, as recommended by manufacturer.

.11 Acoustic wall panels for surface applied system, to ASTM E1264 Type: XII, Form: 2, Pattern: E ; conforming to the following properties:
.1 Fibreglass panels 25 mm thick fibreglass board faced with a fine texture surface facing of factory-applied latex paint on acoustically transparent membrane, washable, scratch and soil resistant. Colour white. Acceptable Product Armstrong Optima textured scrim wall panels.
.2 Flame spread rating to ASTM E84, CAN-ULC S102 of Class A, flame spread 25, smoke developed 50 or less.
.3 Non-sag at temperatures up to 40°C and 95% relative humidity.
.4 Noise reduction coefficient (NRC) designation of 0.80.
.5 STC rating: minimum 35-39.
.6 Light reflectance: 0.90.
.7 Edges: square.
.8 Size: panels of ; 1220 W x 1220 L or 2440 L; x 25 mm thickness.
.9 Acceptable product: Armstrong Optima Acoustical Wall Panel, Item #3154.
.10 EdgeTrim: extruded vinyl “C” trim moulding, 25 wide x 25 mm deep 25 x 2440 long as recommended by system manufacturer as recommended by system manufacturer.
.11 Butt Joining trim extruded vinyl “H” trim moulding, 45 mm wide x 25 mm deep 25 x 2440 long as recommended by system manufacturer.
.12 Application: A mounting (directly to masonry wall).
.13 Adhesive as recommended by panel manufacturer.

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 co-ordinated 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.

.14 Install egg-crate diffusers in panel sizes to suit opening width of cove trim and to facillitate fluorescent tube replacement. Egg-crate panels maximum 1220 long. Align 1220 long panels with fluorescent fixture.

.15 Install 300 x 300 mm ceiling tiles to Room 162 ceiling, using tile cement in accordance with manufacturer’s instructions. Trim exposed cut edges of ceiling tiles with white PVC J trim.

3.2 ACOUSTICAL WALL PANEL INSTALLATION

.1 Lay out panels cut to size and to correspond with layout of Room 162, in accordance with manufacturer’s instructions. Install panels and trim in a progressive manner.
.1 Maintain panel height at 1220 mm.
.2 Use H trim at butt joins and C trim at top bottom, corners and around openings. Joints H and C intersections to be tight of either square butt or miter join.

.3 Install panels, starting on back wall first, with one H trim at midpoint of wall and butt ends of panel to adjoining walls at corners. Cut panels to approximately 1370 wide and use remaining 1070 wide panels on adjoining walls.

.4 Install panels on two adjoining walls with H trim installed symmetrical at 1070 from corners. Use C trim at corners and at top and bottom of panel. Place remaining 2390 mm long panels, cut from 2440 panel, on long side walls.

.5 Install panel C trim at electrical and communication outlets to protect exposed edges. Install trim plumb and square with no sharp corners or edges.

.6 Install panels on front wall with C trim at corner, termination, top and bottom of panel and at perimeter of observation window.

.2 Provide square cutouts with C trim at all outlets/fixtures interfering with panel arrangement.

.3 Install panel C and H trim using drive pins into masonry at maximum 600 mm oc. Use adhesive as recommended by manufacturer to retain panel at field of acoustic wall panel. Install glue beads at 200 mm oc or use notch trowel.

.4 Make finished panels square to wall.

3.3 CLEANING

.1 Touch up abrasions, dirt and other defects in system finish. Replace scratched and gouged panels.

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 05 10 - Cast-in-Place Concrete for concrete finishing.

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)
.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 - 09 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, base and stair treads 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, 2m or1.83 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.

.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 Resilient stair treads:

.1 Treads: rubber, 41 mm canted nosing, full tread depth, full tread width, 6.4 mm thick, 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.

.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. Up to a maximum of four different colours will be selected.

.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.

.9 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 drain clamp 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 reducer strips at unprotected or exposed edges where flooring terminates.

.9 Install resilient stair treads on each tread and at mezzanine floor at top of flight, full width of stair tread, using polyurethane adhesive, in accordance with manufacturer's instructions.

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.

.4 Miter internal corners. Use premoulded sections or special wrap around type base for external corners.

.5 Use coved type base as scheduled.

3.5 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.

3.6 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 03 05 10 - Cast-in-place Concrete for concrete floor finish.

1.2 EXAMINATION

.1 Examine work upon which work of this section depends. Do not apply the work of this section until any unsatisfactory conditions have been rectified. Commencement will be deemed acceptance of substrate.

.2 Check finish schedule for areas requiring seamless flooring.

1.3 SUBMITTALS

.1 Provide submittals for review by Departmental Representative in accordance with Section 01 01 50 General Instructions for submittal requirements.

.2 Submit 100 x 100 mm samples of flooring for colour selection from manufacturer's standard colours. One colour will be used for all seamless flooring.

.3 Provide flooring manufacturer's maintenance instructions for seamless flooring for incorporation into maintenance manual specified in Section 01 01 50 General Instructions.

1.4 HANDLING AND STORAGE

.1 Store materials in original undamaged condition with manufacturer's labels and seal intact. Prevent damage to materials during handling and storage.

1.5 PROTECTION

.1 Protect work of others from damage resulting from work of this Section.

.2 Provide adequate ventilation.

.3 Do not install seamless flooring until other trades, except painter have finished their work.

.4 Maintain temperature above 13°C for installation and curing period.

1.6 DESCRIPTION OF SYSTEM

.1 Epoxy Flooring: (except Room 149)
- .1 Surface preparation and epoxy bond coat.
- .2 Coloured aggregate and epoxy matrix troweled-on over bond coat.
- .3 Clear epoxy topcoats with semi-gloss finish, roller applied.

.2 Room 149:
- .1 Surface preparation and waterproof membrane for floor and 200 mm base.
- .2 Epoxy grout topping sloped to drain.
- .3 Urethane membrane on walls and polyurethane top coat on walls and ceiling.
- .4 Non-Slip epoxy floor finish and base.

2 Products

2.1 MATERIALS

.1 Troweled on seamless epoxy/coloured aggregate flooring and base system of nominal 2.5 to 3 mm thickness comprised of:

.1 Primer: A two-component, penetrating, moisture tolerant, epoxy primer.

.2 Undercoat: A two-component, free flowing epoxy formulation consisting of resin and curing agent.

.3 Aggregate: Brightly colored, quartz broadcast aggregate.

.4 Sealer: A two-component, high performance, UV resistant,clear epoxy sealer.

.5 Physical characteristics of seamless flooring system:

Compressive Strength (ASTM C-579)	9,000 psi after 7 days
Tensile Strength (ASTM C-307)	1,600psi
Flexural Strength (ASTM C-580)	4,000 psi
Flexural Modulus of Elasticity (ASTM C-580)	1.0 X 10^{6} psi
Hardness (ASTM D-2240, Shore D)	85 to 90
Bond Strength (ASTM D-4541)	>400 psi (100% concrete failure)
Impact Resistance (ASTM D-2794)	>160 in./lbs.
Abrasion Resistance (ASTM D-4060, CS-17)	0.06 gm max. weight loss
Coefficient of Friction(Dry) (ASTM F-1679)	Standard Texture>1.0 Medium Texture - 0.96
Slip Resistance Index (Wet) (ASTM F-1679) Medium Texture - 0.93	Standard Texture>1.0
Flammability (ASTM D-635)	Self-Extinguishing Extent of burning 0.25 in. max
Thermal Coefficient of Linear Expansion (ASTM C-531)	1.8 x 10-5 in./in.°C
Water Absorption (ASTM C-413)	0.1 %
Heat Resistance Limitation	140°F/60°C (for continuous exposure) 200°F/93°C (for intermittent spills)
Cure Rate @ 5°C	12 hours for foot traffic 24 hours for normal operations

.6 Acceptable Product: Stonhard Stoneshield SLT. Other products meeting the above requirements in 2.1.1 are acceptable provide the physical characteristics are met.

.2 Physical characteristics of a Waterproof membrane floor and base in room 149: Two-component, liquid applied, 100% solids, urethane membrane for use on horizontal concrete surfaces and masonry wall base, compatible with all finishes and substrates in contact with membrane and meeting the following physical characteristics:

Tensile Strength (ASTM D412)	1,200 psi
Elongation (ASTM D-412)	200%
Hardness (ASTM D-2240,Shore A)	70
Bond Strength (ASTM D7234)	>300 psi (100% concrete failure)
Cure Rate	8 to 10 hours (@) 70°F/21°C, (for tack free surface, 12 to 48 recoat window
Pot Life	30 to 35 minutes @ 70°F/21°C
VOC Content	(ASTM D-2369, Method E) 0.05 lb/gal / (6g/l)
Passes ANSI A118.10	

.3 Physical characteristics of Sloped floor topping in room 149: three-component, fast-setting, troweled on, epoxy based grout designed for horizontal applications and compatibility with floor system and meeting the following physical characteristics:

Compressive Strength (ASTM D579)	7,600 psi after 7 days
Tensile Strength (ASTM C 307)	1,800 psi
Flexural Strength (ASTM C-580)	3,300 psi
Flexural Modulus of Elasticity (ASTM D-700)	8.5 x 10_5 psi
Hardness (ASTM D-2240,Shore D)	86-88
Bond Strength (ASTM D7234)	>400 psi (100% concrete failure)
Pot Life	30 minutes @ 75°F/24°C
Passes ANSI A118.10	2 to 4 hours @ 70°F/21°C

.4 Physical characteristics of Wall and ceiling Finish in room 149: multi-layer, liquid applied, flexible urethane wall system designed for use on vertical applications to provide a seamless, smooth, and sanitary, comprised of a two-component urethane membrane base coat and a two-component waterborne polyurethane topcoat, meeting the following physical characteristics:

Cure Rate	8 to 10 hours (@) 77°F/25°C, (for tack free surface, 24 hours @) 77°F/25°C for normal operations.
Pot Life , suggested application thickness	20 to 25 minutes @ 77°F/25°C 25 mil/635 microns
Tensile Strength (ASTM D 638)	1,100 psi
Elongation (ASTM D-638)	200%
Hardness (ASTM D-2240,Shore A)	70
Bond Strength (ASTM D7234)	>400 psi (100% concrete failure)

.5 Physical characteristics of Seamless epoxy floor finish for room 149: nominal 5 mm thick epoxy flooring system consisting of; a three-component, troweled mortar base consisting of epoxy resin, curing agent and finely graded silica aggregate; a three-component, free flowing epoxy formulation consisting of resin, curing agent and fine aggregate; brightly coloured quartz broadcast aggregate and a two-component, high performance, UV resistant, clear epoxy sealer; meeting the following physical characteristics:

Compressive Strength (ASTM D579)	10,000 psi after 7 days
Tensile Strength (ASTM C 307)	4,300 psi
Flexural Strength (ASTM C-580)	3,300 psi
Flexural Modulus of Elasticity (ASTM D-580)	20 x 10_6 psi
Hardness (ASTM D-2240,Shore D)	85-90
Bond Strength (ASTM D7234)	>400 psi (100% concrete failure)
Impact Resistance (ASTM D-2794)	>160 in/lbs
Abrasion Resistance (ASTM D-4060, CS-17 wheel)	0.06 gm max weight loss
Coefficient of Friction (Dry) ASTM F-1679	Standard Texture > 1.0 Medium Texture 0.96
Slip Resistance Index (Wet) (ASTM F-1679)	Standard Texture > 1.0 Medium Texture 0.93
Flammability (ASTM E-648)	Class 1
Thermal Coefficient of Linear Expansion (ASTM C-531)	1.8 x 105 mm/mm°C
Water Absorption (ASTM C-431)	0.1%
Heat Resistance Limitation	140°F/60°C (for continuous exposure) 200°F/93°C (for intermittent spills)
Cure Rate (@) 77°F/25°C)	12 hours for foot traffic 24 hours for normal operations.

.6 Termination strips: extruded aluminum as recommended by manufacturer and approved by Departmental Representative.

3 Execution

3.1 WORKMANSHIP AND INSTALLATION

.1 All workers installing epoxy flooring and base must be fully trained and manufacturer approved installers.

.2 Prepare surface of substrate in accordance with flooring material manufacturer's instructions.

.3 Patch cracks and other openings in substrate using an epoxy filler.

.4 Grind down uneven joints, rough area, projections and remove foreign matter from surfaces to receive flooring and base.

.5 Mask adjacent surfaces and apply seamless flooring, seamless fillet cove and monolithic flash cove base in accordance with manufacturer's directions.

.6 Install termination strips at junctions of seamless flooring and other floorings, at exposed edges of seamless flooring, at top of monolithic base and at other locations required due to application techniques of the system.

.7 Apply flooring to a minimum 2.5 mm thickness, tightly compacted and free from surface holes and depressions. Application consists of prime coat, granular ceramic aggregate in epoxy binder, and epoxy top coats to provide a slip resistant easy maintenance flooring.

.8 Allow primer, undercoat, aggregate and sealer coats to dry to touch between coats. Do not apply more than two coats per day.

.9 Protect grout coat and top coat from damage during curing period in accordance with manufacturer's instructions.

.10 At completion of work clean up and remove all surplus materials and debris.

.11 Workmanship and installation to manufacturer's instructions.

3.2 ROOM 149

.1 Prepare substrate to manufacturer’s instructions and install waterproofing membrane to floor surfaces and up CMU wall 190 mm. Install trowel applied epoxy grout sloped to drain in accordance with manufacturer’s instructions. Apply multi layered epoxy floor finish to room 149 floor and wall base in accordance with manufacturer’s instructions.

.2 Install primer and two component urethane membrane to CMU walls in room 149 in accordance with manufacturer’s instructions. Lap wall membrane over shower floor membrane. Apply two component waterborne polyurethane coating to CMU walls and concrete ceiling in accordance with manufacturer’s instructions.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 01 01 50 - General Instructions for; Submittals; Waste Management And Disposal; Temporary Utilities and Closeout Submittals.

.2 Section 03 05 10 - Cast-in-place Concrete concrete floor.

.3 Section 09 65 18 - Resilient base.

1.2 REFERENCE STANDARDS

.1 Underwriters Laboratories Canada ULc:
.1 CAN/ULC-S102.2-07, Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies.

.2 Canadian General Standards Board (CGSB):
.1 CAN/CGSB-4.129-93(R1997), Carpets for Commercial Use
.2 CGSB 4-GP-156-1975, Direct Glue-Down Carpet, Guide to Selection and Installation.
.3 CAN/CGSB-25.20-95, Surface Sealer Floors.

.3 ASTM International:
.1 ASTM D1335 - 11 Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings.
.2 ASTM D5417 - 11 Standard Practice for Operation of the Vettermann Drum Tester.

.4 Carpet and Rug Institute (CRI)
.1 CRI-104-2002, Standard Installation of Commercial Carpet.

.5 American Association of Textile Chemists and Colorists (AATCC)
.1 AATCC 16-2004, Color Fastness to Light.
.2 AATCC 118-2007, Oil Repellency: Hydrocarbon Resistance Test.
.3 AATCC 129-2011, Colour Fastness to Ozone in the Atmosphere Under High Humidities.
.4 AATCC 134-2011, Electrostatic Propensity of Carpet.
.5 AATCC 171-2010, Carpets: Cleaning of; Hot Water Extraction Method.
.6 AATCC Test Method 165-2008 Colorfastness to Crocking:Textile Floor Coverings—Crockmeter Method
.7 AATCC 175-2008, Stain Resistance: Pile Floor Coverings.
.8 AATCC 189-2002, Fluorine Content of Carpet Fibers.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 01 50 General Instructions.

.2 Submit duplicate 125 x 75 mm pieces of each carpet specified, for colour selection by Departmental Representative in accordance with Section 01015 General Instructions.

.3 Submit verification to demonstrate compliance with CAN/ULC S102.2.

.4 Submit proof that carpet has been tested and passed the Indoor Air Quality (IAQ) Carpet Testing Program requirements of the Carpet and Rug Institute (CRI) and the Canadian Carpet Institute (CCI).

.5 Submit report verifying that tuft bind meets requirements of CAN/CGSB-4.129 when tested to CAN/CGSB-4.2 No.77.1 or ASTM D1335 .

.6 Submit report outlining proposed dust control measures.

.7 Submit carpet schedule using same room designations indicated on drawings.

.8 Submit carpet manufacturer's installation instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance materials in accordance with Section 01 01 50 - General Instructions.

.2 Deliver 4 m² of each colour, pattern and type flooring material required for project for maintenance use. Identify each package. Store where directed.

.3 Maintenance materials to be same production run as installed materials.

.4 Provide manufacturer’s maintenance data for cleaning and maintaining carpeting.

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.

1.6 WARRANTY

.1 Provide a manufacturer’s limited lifetime stain resistance warranty, a limited 10 year warranty for fiber loss from abrasive wear, a limited antistatic warranty, a five-year warranty for color fastness after exposure to atmospheric contaminants and a 10-year warranty for color fastness after exposure to light. Submit proof that carpet has been tested and passed the Indoor Air Quality (IAQ) Carpet Testing Program requirements of the Carpet and Rug Institute (CRI) and the Canadian Carpet Institute (CCI) to maximum allowable 0.5 mg/m² hr total VOC emission, to ASTM D5116.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Store carpeting and accessories in location as directed by Departmental representative.

.2 Store carpet and adhesive at minimum temperature of 18° C and relative humidity of maximum 65% for minimum of 48 hours before installation.

.3 Prevent damage to materials during handling and storage. Keep materials under cover and free from dampness.

.4 Store materials in area of installation for minimum period of 48 hours prior to installation.

2 Products

2.1 MATERIALS

.1 Carpets required by NBCC 2010 to have flame spread rating or smoke developed classification to be tested in accordance with ULC S102.2 for floor surface covering and be certified by ULC. Test data from other laboratories may be approved upon submission to Human Resources Development, Fire Protection Engineer.

.2 Tufted carpet: to CGSB 4-GP-129, except as noted.

.1 Top effect: tufted loop pile with minimum four colour blend.

.2 Fibre type: bulked continuous filament yarn dyed type 6.6 nylon, from certified branded fibre, with soil hiding properties, permanent integral inherent anti-static properties 10 year guarantee for zipper and edge unravelling and abrasive wear. Acceptable nylon fibre Product: Antron Legacy or Lumina nylon with DuraTech Soil Protection.

.3 Yarn construction:

.1 Dyeing method: yarn dyed.

.2 Dyed from single dye lot.

.4 Tuft bind to ASTM D1335: 49 N.

.5 Machine gauge and tuft count: 31.5/10cm gauge and 32.68/10cm stitch count.

.6 Yarn weight: 881 g/m².

.7 Width: 366 cm.

.8 Static control: to AATCC Test Method 134 (Neolite), maximum 3.0 kV at 21°C and 20% RH. AATCC 171 Hot Water Extraction test, up to 5 washings prior to AATCC 134 test to determine the durability of the topical treatment

.9 Primary backing: woven polypropylene.

.10 Laminate: Hot melt thermoplastic (latex not permitted).

.11 Secondary backing: woven polypropylene.

.12 Light fastness: to AATCC Test Method 16E, International Grey Scale Rating of 3-4 or better after 160 AFUs.

.13 Stain Ratings(Crockfastness): to AATCC Test Method 165, International Grey Scale Rating of 4 wet or dry.

.14 Stain Resistance Test- to AATCC 175: minimum AATCC Red 40 Stain Scale rating of 6.

.15 Soil resistance after cleaning: Fluorine Specification- AATCC 189, average of 3 fluorine analyses of a single composite sample to be a minimum of 500 ppm fluorine by weight. Fluorine Durability Specification; average of 3 fluorine analyses of a single composite sample to be a minimum of 400 ppm fluorine by weight after 2 AATCC 171 (HWE) cleanings.

.16 Flammability: to meet CAN4-S102.2, NFPA Class 1 when tested to ASTM E-648 glue down, meets smoke density, less than 450.

.17 Atmospheric fading: to AATCC Test Method 129. Ozone and AATCC Test Method 23 Burnt Gas, minimum shade rating after two cycles in each test no less than International Grey Scale Rating of 3.

.18 Appearance Retention: Vetterman Drum ASTM D5417 for 22,000 cycles. A minimum rating of 3.0 using CRI TM-101 Reference Scale. Testing without underpad or brushing.

.19 Indoor air quality: maximum 0.5 mg/m^2hr total VOC emission, to ASTM D5116.

.20 Recycling, (new carpet): must be eligible for recycling by the supplying mill or fiber producer within an existing program. Submit program parameters.

.3 Edging: aluminum extrusion with mill finish of type recommended by carpet manufacturer.

.4 Adhesive: low VOC adhesive and seam adhesive system as recommended by carpet manufacturer.

.5 Concrete floor sealer: to CAN/CGSB 25.20M, Type 1.

.6 Subfloor filler: white premix latex requiring only water to produce cementitious paste.

3 Execution

3.1 WORKMANSHIP

.1 Install glue-down carpet in accordance with CGSB 4-GP-156, CRI-104 and adhesive manufacturer's written instructions.

3.2 PREPARATION

.1 Prepare floor surfaces in accordance with CGSB 4-GP-156.

.2 Slope and feather latex filler adjacent to areas with raised floor finishes to provide a flush floor finish with carpet.

3.3 CARPET EDGING

.1 Use extruded aluminum or solid PVC edging at exposed carpet edges.

3.4 CARPET INSTALLATION

.1 Install carpet in accordance with manufacturer's instructions. Maintain constant pile direction. Seal seams with approved adhesive.

.2 Install carpet tightly and fit neatly around architectural, mechanical, electrical and built-in fitments, to perimeter of rooms and into recesses, and around projections through floor.

.3 Seal edges of cut-outs with latex.

3.5 PROTECTION OF FINISHED WORK

.1 Vacuum carpets clean. Protect traffic areas of carpeted floors with approved drop sheets. Tape joints to prevent shifting.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 09 91 23 - Painting.

.2 Section 07 92 12 - Security sealant.

1.2 STANDARD REFERENCES

.1 ASTM International:
.1 ASTM D522 - 93a(2008) Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
.2 ASTM D1308 - 02(2007) Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
.3 ASTM D3359 - 09e2 Standard Test Methods for Measuring Adhesion by Tape Test.
.4 ASTM D3363 - 05(2011)e1 Standard Test Method for Film Hardness by Pencil Test.
.5 ASTM D4060 - 10 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
.6 ASTM E84 - 12 Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 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 Retain purchase orders, invoices and other documents to prove conformance with specification requirements when requested by Departmental Representative.

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

1.4 SAMPLES

.1 Submit samples of each colour and texture of coating applied to applicable surfaces, in accordance with Section 01 01 50.

.2 Include a letter of compliance from the coating manufacturer certifying that the epoxy coating conforms to requirements specified in clause 2.1.1.

1.5 MAINTENANCE DATA

.1 Provide maintenance data for coating for in incorporation into maintenance manual specified Section 01 01 50.

.2 Record epoxy coating information; list coating material, colour, treatment or finish methods used and provide data for incorporation into maintenance manual.

1.6 ENVIRONMENTAL REQUIREMENTS

.1 Do not apply unless uniform min 10°C air temperature at installation area for twenty-four (24) hours prior to and after application.

.2 Provide adequate ventilation or isolation measures to protect workers from coating fumes.

2 Products

2.1 MATERIALS

.1 Two component , low odour, low VOC high solids, water based acrylic epoxy high build coating system conforming to the following requirements:
.1 Fire hazard classification to ASTM E84, ULC for maximum; flame spread 25 and smoke developed 50 (test sample applied over cement asb. Board).
.2 Flexibility test Mandrel Bend to ASTM D522 with no cracking or splitting (3mm).
.3 VOC content: 195 gm/l.
.4 Abrasion resistance to ASTM D4060 60 mg maximum load with CS-17 wheel.
.5 Gloss, to Gardener 60° Glossometer, of minimum 85.
.6 Adhesion to primed steel to ASTM D3359 Method A: 4A @ 10 day cure at room temperature (Average of three tests).
.7 Sward hardness to ASTM D3363: 18 - 24.
.8 USDA approved.
.9 Minimum solids content 56% by mass, after mixing.
.10 Chemical and stain resistance to spot tests in accordance with ASTM D-1308 with no effect after 24 hours from the following chemicals:

5N Acetic Acid	Synthetic Urine
1N Hydrochloric Acid	Perspiration
5% Sodium Hydroxide	Coca Cola
5% Potassium Hydroxide	Blood
Bleach	Tea
Ethyl Alcohol	Coffee
Mustard	Lipstick
Stamp pad ink	Domestic Cleaner
Kado Ink	Domestic Detergent

> Note: All stains remaining on samples must be removable with domestic cleaners. A slight dulling (maximum 10% gloss change) and discoloration (maximum yellowness in NBS units not exceeding plus 5).

.11 Acceptable Product: Pittsburgh® Paints; Pitt-Glaze WB Water Borne Acrylic Epoxy 16-551 Series. Applied at a dry film thickness of not less than 2.0 mils.

.2 Blockfiller: epoxy based filler, compatible with epoxy coating as recommended by epoxy coating manufacturer.
.1 Acceptable Product: Pittsburgh® Paints; 6-7 SPEEDHIDE® Interior/ Exterior Masonry Latex Block Filler (14.00 g/L VOC): Applied at a dry film thickness of not less than 5.1 to 14.7 mils.

.3 Metal primer: inhibitive metal primer compatible with epoxy coating as recommended by epoxy coating manufacturer.
.1 Acceptable Product: Pittsburgh® Paints; 90-712 Series Pitt-Tech Int/Ext Industrial DTM Primer/Finish Enamel (123 g/L VOC corrosion protection product): Applied at a dry film thickness of not less than 2.0 mils.

2.2 MIXES

.1 Mix components parts according to manufacturer's instructions.

3 Execution

3.1 PREPARATION OF SURFACES

.1 Prepare surfaces in accordance with epoxy coating material manufacturer's instructions.

.2 For concrete block and concrete surfaces apply epoxy block filler to fill all porous holes in block surfaces. For metal surfaces apply one coat of alkyd enamel inhibitive primer compatible with epoxy coating. Primers, fillers and undercoats as recommended by epoxy coating manufacturer.

.3 Mask surrounding surfaces to provide neat, clean juncture lines.

.4 Protect adjacent surfaces and equipment from damage by over spray and splashes.

.5 Trade work penetrating the substrate to be completed before installing the epoxy coating.

3.2 COATING APPLICATION

.1 Fill holes in concrete and concrete block to smooth and even surface with epoxy block filler.

.2 Touch-up steel surfaces with compatible primer or prepare to manufacturer's instructions.

.3 Apply two coats water based acrylic-epoxy coating to produce smooth surface, uniform in sheen, colour and texture, free from marks, dirt, particles, runs, crawls, curling, holes, air pockets and other defects.

.4 Apply coating to minimum dry film thickness per coat of 2.25 - 2.7 mils. Allow first coat to dry overnight except as indicated otherwise by manufacturer's instructions.

3.3 SCHEDULE

.1 Apply epoxy coating to masonry walls and concrete ceilings as indicated in Room Finish Schedule and to steel surfaces of doors, frame assembly and primed or unfinished metal components to rooms inside cell block area.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 01 01 50 - General Instructions for Submittal Procedures, Waste Management And Disposal.

.2 Section 05 50 00 - Metal Fabrications.

.3 Section 06 23 00 - Finish Carpentry and Laminated Plastic.

.4 Section 09 81 50 - High Build Epoxy Coating.

.5 Section 10 14 10 - Building Sign.

.6 Section 10 56 13 - Metal Storage Units

1.2 DESCRIPTION OF WORK

.1 Refer to finish schedules and notes on drawings for painting and finishing surfaces.

1.3 REFERENCES

.1 ASTM International (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 and exterior 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.
.2 Bulkheads/Ceilings: No defects visible from at 45° to surface when viewed using final lighting source.
.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.5 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 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 other trades within the building.

1.10 WASTE MANAGEMENT

.1 Separate and recycle waste materials in accordance with Section 01 01 50 - General Instructions for 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 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 To match cabinet work wood finishes for touch up.

.2 Gypsum Board wall surfaces for Offices:
- .1 INT 9.2A Latex G3 or G4 finish (over latex sealer).

.3 Gypsum Board wall surfaces for Storage areas, Washrooms and Service rooms:
- .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 Surfaces:
- .1 INT 9.2A Latex G5 finish (over latex sealer).
- .2 INT 6.3S - Clear fire retardant finish (ULC rated). For plywood surfaces specified for fire retardant finish.

.6 Concrete Masonry Units:
- .1 Latex Block filler
- .2 INT 4.2D High performance architectural latex G5 finish.

.7 Concrete vertical surfaces: including horizontal soffits/ceilings:
- .1 INT 3. 1A - Latex flat finish (over sealer).

.8 Galvanized metal: misc. steel, pipes, overhead decking, and ducts at exposed ceilings.
- .1 INT 5.3A - Latex flat finish.

.9 Metal doors, frames, and miscellaneous metal items etc.
.1 INT 5.3B Waterborne light industrial G4 coating.
.2 INT 5.3M High performance architectural latex G4 finish.

.10 Cedar Ceiling:
.1 INT 6.3S - Clear fire retardant finish (ULC rated).
Paint system when applied to the cedar ceiling, to meet or exceed a flame spread rating of 25 maximum.

.11 Wood stain grade doors:
.1 INT 6.4J Polyurethane varnish G4 finish..

2.6 EXTERIOR PAINTING SYSTEMS

.1 Exterior Wood Columns and wood Trim:
.1 EXT 6.1E - Clear (2 component) polyurethane finish (over stain).

.2 Exterior steel doors and frames and miscellaneous metals, bollards etc:
.1 EXT 5.3G - Waterborne light industrial G4 coating.

.3 Exterior plastic rain water piping:
.1 EXT 6.8A - MPI # 69 Primer, Bonding, Solvent Based
.2 MPI # 15 Latex, Exterior, Low Sheen (MPI Gloss Level 4)

.4 Structural Steel and Metal Fabrications:
.1 EXT 5.1N - Waterborne light industrial G5 coating (over epoxy primer).

3 Execution

3.1 GENERAL

.1 Perform preparation and operations for 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 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 Concrete and masonry: 12%

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 Protect building trade occupants and general public in and about the building.

.6 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.

.7 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 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 06 10 11 Rough Carpentry - strapping and grounds

1.2 REFERENCES

.1 Aluminum Association Designation System for Aluminum Finishes - 2000.

.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 CAN/ULC-S706-02, Wood Fibre Thermal Insulation for Buildings.

.4 Porcelain Enamel Institute Standards (PEI).

1.3 SAMPLES

.1 Submit samples in accordance with Section 01 01 50 - General Instructions for Submittals.

.3 Submit 300 x 300 mm sample of tack board, white board and 300 mm long sample of trim.

1.4 PRODUCT DATA

.1 Submit product data in accordance with Section 01 01 50 - General Instructions for Submittals.

.2 Indicate type, size, backing, hardware, anchor or mounting details, trim and accessories.

2 Products

2.1 BASIC MATERIALS

.1 Laminating adhesive: to manufacturer's standard.

.2 Anchor clips, brackets and fasteners: concealed type recommended by manufacturer.

.3 Steel sheet: 0.6 mm thickness commercial grade steel to ASTM A653M, pre-cleaned and treated to ensure maximum adhesion of an acid resistant type A for Whiteboard, porcelain enamel.

.4 Adhesive: to manufacturer's standard.

2.2 CORE MATERIAL

.1 White boards: fibreboard to CAN/ULC-S706, Type II, 12.7 mm thickness with 0.002 mm thickness tempered aluminum foil backing.

.2 Tack boards: particle board 7 mm thickness.

2.3 BOARD FINISHES

.1 White Boards:
  .1 Porcelain enamel: to Porcelain Enamel Institute Standards Data Bulletin PEI 501, regards durability, smoothness of texture, colour continuity. Gloss factor of 6-8 as measured by 45 degree glossometer:
    .1 Surface finish for dry, water dampened, erasable markers and suitable for use as a projection screen: white colour.

.2 Tack board:
  .1 Colour cork: manufactured with pure cork particles, linseed oil and colour pigments, self sealing and with burlap backing, thickness 6 mm.

2.4 WHITE BOARD AND TACK BOARD FABRICATION

.1 Fabricate board panel size: 2440 long x 1220 high, 1630 whiteboard with a 610 wide tack board on right side.

.2 Factory laminate boards to backing material, consisting of board surface treatment, core material and extruded aluminum trim/frame.

.3 Make finished panels flat and rigid.

2.5 TRIM, FRAMING AND ACCESSORIES

.1 Extruded aluminum: Aluminum Association alloy AA6063-T5. Minimum 1.5 mm wall thickness.

.2 Marker pen tray: of extruded aluminum, continuous, integral with frame.

.3 Marker pens: provide one set of marker pens with each white marker board, one each of red, green, black and blue.

.4 Markerboard cleaner: one brush for each marker board and one 150 ml liquid cleaner designed for cleaning marker residue from Marker Boards.

2.6 ALUMINUM TRIM FINISHES

.1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.
  .1 Clear anodic finish: designation AA-M12CA31.

2.7 FACTORY INSTALLED TRIM

.1 Install trim on panels in factory. Make mitres and intersecting joints to hair-line fit, free of rough edges with concealed brackets to reinforce and hold joints tight and flush. No other joints permitted unless approved. No exposed fasteners permitted.

.2 Overlap trim 6 mm onto panels. Provide closed ends for open-end extrusions.

.3 Factory fit assemblies in one piece.

3 Execution

3.1 INSTALLATION

.1 Install whiteboard/tackboard in accordance with manufacturer's instructions, to provide rigid, secure surface. Size as noted in this section. Locate one unit in Room 104.

.2 Install trim and framing around panel board. Make mitres and intersecting joints to hair-line fit, free of rough edges. Use concealed brackets to reinforce and hold joints tight and flush. No exposed fasteners permitted. Overlap trim 6 mm onto panels.

.3 Mechanical attachment:
.1 To steel stud walls use self drilling screws. Secure into framing members or backing in stud walls.

3.2 CLEANING

.1 Clean surfaces after installation using manufacturer's recommended cleaning procedures.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 03 05 10 - Cast-in-place Concrete.

.2 Division 26 - Electrical.

1.2 HANDLING AND STORAGE

.1 Store sign assembly in secure lockable dry enclosure, and remove from packaging. Dispose of packaging in accordance with Section 01 01 50 General Instructions for Waste Management and Disposal clause.

.2 Handle carefully to avoid damage.

.3 Be responsible for sign until final certificate of completion.

2 Products

2.1 SIGN

.1 Building Identification Sign: Type 2B freestanding sign on posts 1950 mm high, 1970 long x 600 high sign, internally illuminated, double sided sign available from Enseignes Imperial Signs, 3101 ch. Hawthorne Rd. Ottawa Ontario K1G 3V8. Tel: 1 800 661-2493.
.1 Refer to electrical drawings for illumination.
.2 Sign to include posts, sign board with overlay image and lamps, post caps, base covers, base plates, anchor bolts and internal conduit in post.
.3 Order sign in advance, to allow sufficient time for long delivery and installation.

.2 Concrete base: see drawing detail.

3 Execution

3.1 INSTALLATION

.1 Install concrete sign base as indicated and in accordance with sign manufacturer's reviewed shop drawings and instructions.

.1 Install sign level and plumb and anchor to concrete base in accordance with manufacturer's instructions. Use galvanized or stainless steel fasteners.

.2 Connect to power supply and leave in working order; replace lamps, as required, at time of final completion.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 10 28 10 - Washroom Accessories.

.2 Section 22 40 00- Plumbing Fixtures and Trim for acrylic shower unit.

1.2 REFERENCES

.1 ASTM International (ASTM)
.1 ASTM A 167-99(2009), Standard 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.

.2 Canadian General Standards Board (CGSB)
.1 CGSB 1.81M-90 - Primer, Alkyd, Air Drying and Baking for Vehicles and Equipment.
.2 CAN/CGSB-1.104M-91- Enamel, Alkyd, Air Drying and Baking, Exterior and Interior, Semigloss.

1.3 SUBMITTALS

.1 Submit in accordance with Section 01 01 50 - General Instructions for Submittals
.1 Submit samples in complete sets of panel finish colour charts.
.2 Submit shop drawings and clearly indicate fabrication details, plans, elevations, hardware, and installation details.

2 Products

2.1 MATERIALS

.1 Sheet steel: commercial quality stretcher leveled sheet steel to ASTM A653/A653M with Z275 zinc coating.

.2 Minimum base steel thickness:
.1 Panels and doors: 0.8 mm.
.2 Pilasters: 1.0 mm
.3 Reinforcement: 3.0 mm
.4 Headrails: 25 mm x 41 mm x 1.0 mm thick, extruded anodized aluminum.

.3 Stainless steel sheet metal: to ASTM A167, Type 304, with No. 4 satin finish.

.4 Pilaster shoe: 0.8 mm thick, 75 mm high, die formed stainless steel.

.5 Attachment: stainless steel tamperproof type screws and bolts.

2.2 HARDWARE

.1 Hinges:

.1 Exposed heavy duty, self lubricating.
.2 Material/finish: chrome plated non-ferrous casting.
.3 Swing:
  .1 Toilet compartments, outward adjustable door open angle.
  .2 Shower dressing compartments, inward.
.4 Return movement: non-rising.
.5 Adjustable to hold door open at any angle up to 90°.
.6 Emergency access feature.

.2 Latch set: graspable latch operating and locking mechanism built-in, combination door-stop, keeper and bumper, chrome plated non-ferrous, casting or extrusion with emergency access feature.

.3 Wall and connecting brackets: chrome plated non-ferrous extrusion or casting.

.4 Toilet compartment coat hook and handicap shelf: coat hook to partition manufacturer's standard.

.5 Shower dressing compartment: combination coat hook and rubber door bumper, chrome plated non-ferrous casting.

.6 Door pull: D-type door pulls 140 mm long (both sides) type suited for outswinging or inswinging doors, chrome plated non-ferrous.

.7 Headrail: extruded aluminum channel with anodized finish of anti-grip design.

2.3 FABRICATION

.1 Doors and panels: 25 mm thick, two sheet steel faces pressure bonded to honeycomb core:
  .1 Door sizes:
    .1 Toilet compartments: 914 mm wide x 1473 mm high.
    .2 Shower dressing compartments: 872 mm wide x 1473 mm high.
  .2 Panel sizes: widths as indicated x 1473 mm high.

.2 Pilasters: 32 mm thick, constructed same as door, 102 mm wide x 2083 mm high.

.3 Provide formed and closed edges for doors, panels and pilasters. Miter and weld corners and grind smooth.

.4 Provide internal reinforcement at areas of attached hardware and fittings. Temporarily mark location of reinforcement for partition mounted coat hook and stainless steel shelf.

2.4 SHOP FINISHING

.1 Clean, degrease and neutralize steel components with phosphate or chromate treatment.

.2 Spray apply primer to CGSB 1-GP-81M, 1 coat.

.3 Spray apply finish enamel to CAN/CGSB-1.104M, Type 2, semi-gloss, 2 coats and bake to smooth, hard finish 0.025 mm thick.

.4 Finish: doors and pilaster/panels same colour as selected by Departmental Representative from manufacturer's standard colours, total one colour for all partitions.

3 Execution

3.1 PARTITION ERECTION

.1 Install partitions secure, plumb and square.

.2 Leave 12 mm space between wall and panel or end pilaster.

.3 Anchor fixing brackets to masonry/concrete surfaces using screws and shields: to hollow walls use bolts and toggle type anchors, to steel supports use bolts in threaded holes.

.4 Attach panel and pilaster to mounting brackets with through type sleeve bolt and nut.

.5 Provide for adjustment of floor variations with screw jack through steel saddles made integral with pilaster. Conceal floor fixings with stainless steel shoes.

.6 Secure pilasters to floor with pilaster supports anchored with minimum 50 mm penetration into structural floor.

.7 Equip each door with hinges, latch set, and each toilet stall with coat hook; in shower dressing compartment mount coat hook on door; mounting height 1400 mm maximum in accordance with NBCC. Adjust and align hardware for easy, proper function. Set door open position at 30° to front.

.8 Equip each outswinging handicap compartment door with one (1) door pull to each face. Locate one door pull below door latch on exterior face, position vertically. Locate one door pull adjacent to hinge side of door on interior face, 915 mm above finish floor x 90 mm from door edge, position horizontally.

.9 Set tops of doors level with tops of panels when doors are in closed position.

.10 Make good baked enamel surfaces damaged during shipment or installation.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 09 22 16 - Non-Structural Metal Framing.

1.2 SUBMITTALS

.1 Submit samples in accordance with Section 01 01 50 General Instructions for Shop Drawings, Product Data, Samples and Mock-Ups.

.2 Indicate, by large scale details, all materials, finishes, dimensions, anchorage and assembly.

2 Products

2.1 MATERIALS

.1 Corner guard: 1.6 mm thickness stainless steel angle/channel, type 304 with #4 finish and 89 x 89 mm legs and 1200 mm high, mounted with construction adhesive. End wall guards to wrap wall. Acceptable product C/S Group #CO-8 for corners and SCO-8 for end walls

.2 Wall bumper guard: Vinyl/Acrylic of extruded material high impact with pebble grain texture, chemical and stain resistance to ASTM D-1308, to match C/S Group Acrovyn Rub Strip model RSE Series 150 x 1.5 mm thickness, flat profile, tapered edges and surface mounted with double faced tape or construction adhesive, colour selected by Departmental Representative. Fire performance characteristics: ULc label indicating product has been tested in accordance with ASTM-E84-01 (CAN/ULC S102.2) for Class 1 characteristics For flame spread: 25 or less and smoke developed: 450 or less

2.2 ACCESSORIES

.1 Fastening: construction adhesive as recommended by manufacturer.

3 Execution

3.1 INSTALLATION

.1 Install units on solid backing and erect with materials and components straight, tight and in alignment.

.2 Measure and cut rub strip to full length of each wall. Intermediate joints are not permitted.

.3 Install as recommended by manufacturers.

.4 Wall bumper strip:

.1 Mechanically fasten rigid vinyl rub strip wall guards with double sided adhesive tape or construction adhesive, to Room 104, with top surface betweem 787 amd 838 mm above finish floor line as indicated, straight and level to variation plus or minus 3 mm over 3000 mm straight edge, non-cumulative.

.5 Adhere corner guards with construction adhesive to 1200 mm above wall base to locations noted on floor plan.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 05 55 00 - Metal Fabrications for Fabricated metal rough-in components.

.2 Section 08 80 50 - Glazing for unframed silvered glass mirrors.

.3 Section 22 40 00 - plumbing fixtures for Prefab Acrylic Shower units

1.2 REFERENCE STANDARDS

.1 CSA International (CSA)
.1 CSA W59-03(R2008), Welded Steel Construction (Metal Arc Welding).

.2 ASTM International (ASTM)
.1 ASTM A123 / A123M - 09 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
.2 ASTM A167-99(2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
.3 ASTM A 269-10, Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
.4 ASTM A276-10 Standard Specification for Stainless Steel Bars and Shapes.
.5 ASTM A 653/A653M-11, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.6 ASTM A666 - 10 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

1.3 SUBMITTALS

.1 Submit samples and 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, for 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 Manufacturer's or brand names on face of units not acceptable.

2.3 FIXTURES

.1 Surface mounted toilet tissue dispenser: single and double roll type as scheduled, chrome plated steel frame with hood, capacity of 500 double ply roll; roll under spring tension for controlled delivery.

.2 Combination paper towel dispenser/disposal unit:

.1 Large Unit: semi recess mounted, fabricated from 1.2 mm stainless steel cabinets, dispensing either roll, or single fold paper towels and disposal bin of 35 litre capacity with plastic liner, doors with full length S.S. piano hinge, tumbler lock, size approximately 1460 high, 350 wide and depth of 180 mm with max 102 recessed.

.2 Small unit: surface mounted, fabricated from 1.2 mm stainless steel cabinets, dispensing either roll, or single fold paper towels and disposal bin of 15 litre capacity with plastic liner, doors with full length S.S. piano hinge, tumbler lock, size approximately 980 high, 305 wide and 180 depth.

.3 Towel dispenser: 0.7 mm thick stainless steel cabinet, universal surface mounted, dispensing 150 dia x 250 roll or single fold towels, approximately 270 long x 190 high and 150 deep, with lock.

.4 Kitchen waste receptacle:

.1 Purpose made unit for mounting inside of kitchen counter cabinet below sink with hinged top lid and polyethylene receptacle mounted on sliding full extension carriage.

.5 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. Length 900 mm on side walls and 300 mm on back walls at water closets.

.6 Wall mounted soap dispenser: surface mounted stainless steel rectangular tank, size 180 wide x 150 high, with 1.2 L capacity, corrosion resistant push-in valve dispenses viscous lotion soaps, synthetic detergents, vegetable oil liquid soaps and antiseptic soaps, stainless steel piston and spout assembly, locked hinged fillertop, 84 mm spout to wall dimension.

.7 Vanity mounted soap dispenser: corrosion resistant push-in valve dispenses viscous lotion soaps, synthetic detergents, vegetable oil liquid soaps and antiseptic soaps, self contained translucent polyethylene 1 L tank, stainless steel piston and 100 long spout, tamper proof filler lock, body, shank and cover of moulded plastic, chrome plated cover locks to body. Cover, spout and valve assembly unlocked and removed for top refilling.

.8 Towel bar/grab bar: 25 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. Peened bar at area of hand grips. Grab bar material and anchorage to withstand downward pull of 2.2 kN.

.9 Deodorant block holders: 130 mm dia. x 52 mm deep perforated round design, stainless steel, satin finish.

.10 Robe hook: satin stainless steel with 75 mm projection, concealed mounting.

.11 Folding shower seats: surface mounted, folding against wall type, from type 304 satin stainless steel seat and leg frame, 25 mm O.D. carried on stainless steel wall supports. Seat members from 12 mm x 70 mm teak wood or phenolic plastic slats, stainless steel bolt mounted to companion frame. Seat not less than 410 mm deep x 457 mm wide, located 480 mm off floor.

.12 Shower curtain: 0.178 mm thick anti-bacterial fire resistive self-extinguishing vinyl laminated fabric shower curtain. Provide curtain holdback hook and chain at each curtain.

.13 Shower curtain rods: part of prefab shower specified in Division 22.

.14 Mop rail: (for Janitor Rooms) extruded aluminum with three (3) rubber gripper inserts.

.15 Mirrors: No. 1 quality 6 mm float or plate glass, electrolytically silverplated, with 15 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 heliac welded and ground and polished smooth. Provide with companion vandal-proof concealed fastening, locking fasteners and wall hangers.

.16 Feminine napkin disposal bin: stainless steel surface unit, continuous hinged door, self closing, embossed with "napkin disposal", removable stainless steel receptacles fitted with spring clip for deodorizer block.

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 masonry walls and building framing.

3 Execution

3.1 INSTALLATION

.1 Install and secure fixtures rigidly in place as follows:
.1 Hollow masonry units: use toggle bolts drilled into cell/wall cavity or anchors as indicated.
.2 Solid masonry: use bolt with lead expansion sleeve set into drilled hole.
.3 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.
.4 Install grab bars on built-in anchors provided by bar manufacturer.
.5 Use tamper proof screws/bolts for fasteners.
.6 Fill units with necessary supplies shortly before final acceptance of building.

3.2 LOCATION AND QUANTITY

.1 Locate accessories where indicated and as follows. Exact locations to be determined by Departmental Representative.

.2 Room 103
.1 Double Toilet tissue dispenser, surface mounted.
.2 Combination paper towel/waste dispenser unit, semi-recess mounted, large unit.
.3 Wall mounted soap dispenser, surface.
.4 2 grab bars, 300 and 900 mm long.
.5 1 framed mirror 610 x 900.

.3 Room 147:
- .1 Single toilet tissue dispenser, surface mounted.
- .2 Combination paper towel/waste dispenser unit, surface mounted, small unit.
- .3 Wall mounted soap dispenser.
- .4 1 framed mirror 610 x 900.

.4 Room 121/122 (F)
- .1 1 Double Toilet tissue dispenser, surface mounted, in each toilet compartment.
- .2 1 Fem napkin disposal, in each toilet compartment
- .3 1 Combination paper towel/waste dispenser unit, semi-recessed large unit.
- .4 1 Vanity mounted soap dispenser.
- .5 2 Grab bars in BF toilet compartment, 300 and 900 mm long.
- .6 1 Full length mirror (Section 08 80 50).
- .7 1 Fold down seat.
- .8 1 Shower curtain rod (part of shower enclosure Division 22).
- .9 1 Shower curtain with hooks and hold back chain.
- .10 2 Robe hooks in shower dressing area.
- .11 1 Towel/grab bar in shower dressing area.

.5 Room 125/126 (M)
- .1 1 Double Toilet tissue dispenser, surface mounted, in toilet compartment.
- .2 1 Combination paper towel/waste dispenser unit, semi-recessed large unit.
- .3 2 Vanity mounted soap dispenser.
- .4 2 Grab bars in BF toilet compartment, 300 and 900 mm long.
- .5 1 Full length mirror (Section 08 80 50).
- .6 1 Fold down seat.
- .7 1 Shower curtain rod (part of shower enclosure Division 22).
- .8 1 Shower curtain with hooks and hold back chain
- .9 2 Robe hooks in shower dressing area.
- .10 1 Towel/grab bar in shower dressing area.

.6 Room 104:
- .1 Universal towel dispenser.
- .2 Kitchen waste receptacle.

.7 Room 148:
- .1 Universal towel dispenser.
- .2 Kitchen waste receptacle.

.8 Rooms 127 & 146A:
- .1 One mop rail each.

.9 Room 132:
- .1 Universal towel dispenser.
- .2 1 wall mounted soap dispenser.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 22 40 00 Plumbing Fixtures and Trim, for valves for hose bibb:

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01015.

.2 Clearly indicate size with hose and valve assembly shown.

2 Products

2.1 HOSE CABINETS

.1 Hose cabinet; flush type as indicated, body and frame constructed of 1.6 mm thick steel with full opening door of 2.0 mm thick steel. Construct and hinge door to prevent sway or sag when opened up to 180 °. Size to suit valves, hose length, bracket and masonry opening. Provide bracket to store 15 m long x 19 mm hose.

.2 Provide 5 pin cam lock and recessed pull handle, chrome plated.

.3 Provide cabinet door with metal pull recess mounted.

2.2 HOSE AND NOZZLE

.1 Hose: clear reinforced PVC, FDA approved, NSF certified under NSF51, 19 mm φ x 15 meters long with threaded couplings on each end.

.2 Spray nozzle: 19 mm φ non-corroding cast brass or bronze with spring lever action valve and adjustable spray nozzle from wide to narrow stream.

2.3 FINISHES

.1 Prepare surfaces and apply powder coated polyester finish to cabinet door and frame, colour as selected by the Departmental Representative.

3 Execution

3.1 INSTALLATION

.1 Install in accordance with approved shop drawings.

.2 Install hose cabinet, door and hardware in accordance with reviewed shop drawing.

.3 Install door to open 180° to prevent door from obstructing passage at Room 164.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 06 10 11 - Rough Carpentry Grounds and nailing strips.

.2 Section 08 71 10 - Door hardware - for padlocks and prepinned cylinders (Clothes lockers).

1.2 SUBMITTALS

.1 Submit colour samples and product data in accordance with Section 01 01 50 - General Instructions for Submittals.
.1 Indicate, configuration, all materials, finishes, dimensions, anchorage and assembly.

1.3 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, for Common Product Requirements clause.

.2 Storage and Protection:
.1 Cover steel surfaces with 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.

1.4 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 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, FABRICATION

.1 Clothes lockers:
.1 Approved Product: DSM “Freestyle Personal Storage Locker” described as follows:
.1 Modular, single tier, full height, banks of lockers as indicated.
.2 Size 457 mm wide x 457 mm deep x 2134mm high.

.3 Welded cabinet construction with reinforced corners and double wall door box construction.
.4 Lock/handle pocket: recessed handle with inset number plate and padlock hasp.
.5 Adjustable metal shelf with integral garment hanger, 200 mm clear with 150 mm drawer located under shelf.
.6 Integrated peg board holes on door.
.7 Integral 241 mm deep solid butcher block maple bench, 91 kg capacity ball bearing drawer slides, with 457 high bench external access drawer below bench. Drawer interlocked with door to automatically lock/unlock with door.
.8 150 mm high internal lockable drawer.
.9 Finish: powder coated finish in colour selected By Departmental Representative.
.10 Locking system: padlocks for lockers, specified in Section 08 71 10

.2 Pistol lockers: (2 units required)
.1 Four (4) compartment, hinged door pistol locker, key locked unit, factory assembled, fabricated from cold rolled steel, all welded without bolts with all burrs removed and prepainted with baked enamel.
.2 Sides and Back: of 1 mm thickness one piece construction.
.3 Bottom, Top and Shelves: fabricated from 1 mm thickness sheet steel.
.4 Door: fabricated of 1.6 thickness sheet steel.
.5 Overall size 335 mm wide x 102 mm deep x 710 mm incorporating four equal sized compartments with interior padded rest for gun muzzle, interior dimensions of each locker, 350 x 73 x 142 mm.
.6 Key lockable doors with piano hinge. Two keys per compartment, removable for replacement. ALSS key locking system to manufacturers standard designed to protect against unauthorized duplication.
.7 Finished Surface: Steel is prepared, cleaned and protected from corrosion using a phosphate treatment. A baked enamel finish with a (lust 40-45%) is applied.
.8 Locker Includes: 4 compartments with lock (2 keys per lock). Color: Standard Grey.
.9 To facilitate the recess mounted locker in the wall, provide the back with 10 mm diameter holes.
.10 Provide Numbering plates 58 mm W x 1.5 mm D x 20 mm H, assembled with aluminum rivets.
.11 Approved Product manufacturer: Canadian Locker Company Ltd, in Western Canada contact 1-800-494-9073.
.12 URL - http://www.canadianlocker.com/products/pistollocker-wm.html.

3 Execution

3.1 INSTALLATION

.1 Assemble and install clothes lockers in accordance with manufacturer's written instructions.

.2 Securely fasten lockers to grounds and nailing strips.

.3 Install finished end panels to exposed ends of clothes locker banks.

.4 Install locker identification numbers, cylinder locks and padlocks.

.5 Install pistol locker units flush mounted in wall, plumb, square and aligned using anchor devices to suit wall type, in accordance with manufacturers instructions. Mount pistol locker 1066 mm from floor to bottom of unit.

END OF SECTION

1 General

1.1 REFERENCES

.1 ASTM A 924/A924M - 10a, Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

.2 CSA W59-03(R2009), Welded Steel Construction (Metal Arc Welding).

1.2 DESIGN CRITERIA

.1 Design and construct mailboxes in modular units to provide 27 individual mailboxes of 140 mm high x 300 mm wide with four additional boxes 280 high x 300 mm wide. All mail boxes 356 mm deep. Mail boxes flush mounted in wall with open back for loading from Room 118. Mail boxes constructed of:

.1 Extruded 6063 aluminum door of 3 mm thickness with interlocking aluminum hinge.

.2 Mailbox cabinet of 0.6 mm satin coat galvanized steel with spot welded assembly.

.3 Doors and frames brushed aluminum and clear lacquered.

.4 Steel cabinet satin coat galvanized steel, unpainted.

.5 Locks: 5 pin tumbler cam lock for each compartment door, all keyed different, nickel finish. Provide two keys per lock.

.6 Number plates: 1.6 mm plastic tab, 18 mm x 37 mm with engraved black numbers on silver gray with adhesive backing. Plastic tab to fit emboss on door, numbered in sequence with #101 - 131, starting at top left mailbox and numbering downward column by column.

.8 Trim: of aluminum extrusion 50 x 6.4 mm continuous around face perimeter of each group assembly, brushed and coated with clear lacquer to match doors and frames. Provide all corners and mountings to suit flush mounted application.

.9 Label holder of extruded aluminum 12.7 mm wide with adhesive backing to fasten to rear of shelf with card label to identify each mail slot.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 01 50.

.2 Indicate mailbox layout, number of units, number of rows and columns, size of unit and mailboxes, system of mounting and anchoring devices.

2 Products

2.1 MATERIALS

.1 Galvanized steel sheet: commercial grade to ASTM A 924/A924M.

.2 Steel sections and plates: to CAN/CSA-G40.21, Type 400W.

.3 Welding materials: to CSA W59.

.4 Aluminum sections and plates: Aluminum Association alloy AA6063-T5.

.5 Aluminum bolts, nuts and washers: Aluminum Association alloy AA6061-T6.

2.2 MAIL BOXES

.1 Fabricate mailboxes in modular units for assembly on site, to layout indicated.

3 Execution

3.1 INSTALLATION

.1 Install to manufacturer's instructions and to reviewed shop drawings.

.2 Brace, secure and anchor mailbox units in place. Install trim around perimeter on front face.

.3 Make good surfaces damaged during shipment or installation.

.4 Install number plates and label holders as directed by Departmental Representative.

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 10 56 27 - Mobile Storage Shelving-Manual.

1.2 REFERENCES

.1 ASTM International (ASTM)
.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.

.2 Canadian Standards Association (CSA)
.1 CAN/CSA-G40.21-M04(R2009), Structural Quality Steels.
.2 CSA W59-03(R2009), 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 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 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.

1.5 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 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.

2.2 PRODUCTS

.1 Automotive tire rack: All steel prefabricated storage unit, all steel construction, purpose made for storing tires. Refer to drawing A-602 Detail 7.

.2 Interior Bicycle storage rack:
- .1 Acceptable Product: Bike Up, bicycle parking system.
- .2 Mounted to masonry wall with expansion anchors.
- .3 Prefinished to manufacturer's standard paint finish.
- .4 To accommodate all tire sizes.

.3 Exterior Bicycle Parking Rack:

.1 38 mm inside φ schedule. 40 pipe, rolled in the shape of an inverted "U" to a 610 mm outside radius of standing 914 mm high.

.2 Coating: plastisol rubberized applying 12-20 mils thick jacket.
- .1 Standard Color-Black
- .2 Texture-regular grain
- .3 Tensile Strength-1800 psi min.
- .4 Resistance to abrasion
- .5 Salt Spray Resistance to >2000 hours
- .6 Hardness (Shore D) ASTM D 2240 – Results 52.

.3 Provide 5 rack units.

.4 Installation: In-ground or Surface-Mount.

.5 Accceptable Product : Bicycle rack part #(12700), as manufactured by Cycle-Safe, Inc.

3 Execution

3.1 INSTALLATION

.1 Assemble and install storage racks on masonry walls using expansion anchors or hook bolts set into filled masonry cores in accordance with manufacturer's written instructions.

.2 Install bicycle rack to masonry wall using expansion anchors, in accordance with manufacturer’s instructions.

.3 Install exterior pipe bicycle stand to concrete slab, inground or surface mount.

.4 Touch up damaged painted surfaces using matching paint.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 01 01 50 - Submittal Procedures, Waste Management And Disposal.

.2 Floor finish - Section 09 65 18 Sheet Vinyl Flooring.

1.2 DESCRIPTION OF WORK

.1 Supply and installation of mobile shelving, with fixed shelving, floor track and operating hardware.

1.3 REFERENCES

.1 ASTM International (ASTM)
.1 ASTM A490M-11 Specification for High-Strength Steel Bolts, 150 ksi (1035 MPa) Tensile Strength.
.2 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-1.81-M90 Air Drying and Baking Alkyd Primer for Vehicles and Equipment.
.2 CGSB 1-GP-88M-83 Enamel, Alkyd, Air Drying and Baking, Gloss.
.3 CGSB 31-GP-107Ma-90 Non-inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.

.3 CSA International (CSA)
.1 CAN/CSA-G40.21-04(2009) Welded Structural Quality Steel/Structural Quality Steels.
.2 CSA W59-03(R2008) Welded Steel Construction (Metal Arc Welding).

1.4 DESIGN CRITERIA

.1 Purpose: storage of legal files.

.2 Seismic Performance : Provide mobile storage units capable of withstanding the effects of earthquake motions determined by NBCC 2005.

.3 Track/Rail system:
.1 Design track to carry minimum 1491kg per linear m of carriage.
.2 Design track/rail system flush with floor for barrier free access with no visible gaps between track and adjacent flooring.

.4 Carriage:
.1 Mobile carriage : A carriage consist of two members, housing two (2) wheels each, welded to two (2) cross members. Structure made of 3.6 mm members and cross members 70 wide x 65 mm high riveted together (to prevent stress from welding).
.2 Four (4) steel wheels 75 mm diameter x 20 wide, assembled on 16 mm diameter solid steel axle, supported by two ball bearing and secured to housing member. Maintenance free. Cabinet style walls and back are fastened to the carriage using 2 bolts (to increase the rapidity of installation without reducing the strength of the system).
.3 Provide manual safety lock to prevent carriages from being moved while personnel access open aisle

.5 Shelving:
.1 A fixed section of a Cabinet-style shelving installed on a base and assembled with an anti-tip guide and fixation angle on top. 2 mm steel base 44 mm high adjustable with four (4) levelers. Fixation angle made of 2 mm steel 38 mm high x 140 wide designed to attach to the wall.

.2 Mobile section : A Mobile section is made of a Cabinet-style shelving installed on a mobile carriage and assembled with an anti-tip guide on top.

1.5 QUALIFICATIONS

.1 Qualifications: installation by factory trained, authorized installer, with minimum of 5 years experience installing mobile systems on regular basis.

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

1.6 SHOP DRAWINGS

.1 Submit drawings stamped and signed by professional engineer registered or licensed in any Province of Canada for track type, track installation detail, track and deck assembly, stationary tie down detail, rubber bumpers, drive upright detail, handle detail, crank, carriage detail including splice, and accessories.
.1 Indicate dimensions, layout, number of bays, number of shelves, number of dividers, system of bracing against tipping and anchoring devices.

.2 Indicate mobile storage shelving layout and dimensions to room plan, number of bays, number and configuration of shelves, system of bracing, rolling mechanism, track and raised floor details if required and anchoring devices.

1.7 WARRANTY

.1 Warranty product free of defects in material and workmanship for 5 years on all component parts.

2 Products

2.1 MATERIALS

.1 Galvanized steel sheet: commercial grade to ASTM A 924/A924M, Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process, with baked enamel finish.

.2 Steel sections and plates: to CAN/CSA-G40.21, Type 400W.

.3 Steel bolts, nuts and washers: to ASTM A490M.

.4 Welding materials: to CSA W59.

2.2 FABRICATION

.1 Track and raised floor: provide aluminum extrusion 'T' style tracks with 25 mm x 12.7 mm cold rolled bar stock insert.
.1 Mould shoulders of aluminum track to accept neoprene insert on either side of bar stock to accommodate flanged wheels without gaps or protrusions.
.2 Supply track with lap joints to provide continuous structure along entire length of track.
.3 Subfloor: to Section 06 10 11 - Rough Carpentry, G1S, T&G 19 mm thickness.

.2 Carriages: C-channel steel frame, 2.68 mm.
.1 Provide integral unit by welding main transverse framing section of same material to main support members.

.3 Wheels: precision machined with two sealed lifetime lubricated self aligning flanged bearings.
.1 Two wheels per rail for each movable carriage.
.2 Connect all wheels on one side of carriage by a 25 mm solid steel drive shaft.

.4 Drive mechanism: each movable carriage to have direct chain-drive system with built-in tensioning device to transfer force from tree-spoke handle to drive wheels.
.1 Push-pull aisle lock mechanism on mobile units.

.5 Stationary platforms: provide fixed units as indicated to be mounted on platforms of same construction and height as carriages only anchored to track for complete homogenous system.

.6 End panels: provide 16 mm thick melamine, laminated high density particleboard, light grey.
.1 Finish edges with black plastic moulding .
.2 Provide nameholders 127 x 76 mm, two per double faced panel and one per single faced panel.

.7 Shelving: provide standard shelves formed of cold rolled steel with flanges on four sides.
.1 Turned in and up front and rear flanges.
.2 Include 2 mm shelf supports for 762 mm wide bays, and 3 mm shelf supports for 1067 mm wide bays.
.3 Overall system height: 2250 mm. (Minimum 460 clear of finish ceiling)
.4 Colour: as selected by Departmental representative..
.5 Shelf height: 2050 mm high shelf unit with 7 shelf openings each minimum of 280 ± mm high plus top shelf.
.6 Double sided shelves: 762 mm deep with 102 mm high centre stop to prevent boxes from being pushed through from one side to other.
.7 Shelves and centre stops slotted every 51 mm for addition of dividers.
.8 Adjustable shelves on 38 mm centres.
.9 Provide bumper stops to provide 100 mm separation between shelf units.
.10 Provide sheet metal or wire file separators at 50 mm oc on each shelf.

.8 System configuration: as indicated.

2.3 FINISH

.1 Finish metal shelving in colour selected by Departmental Representative from manufacturer's standard range.

.2 Finish: Electrostatic epoxy powder coated.

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 sheets.

3.2 INSTALLATION

.1 Install metal storage shelving in accordance with reviewed layout, installation and start-up instructions.

.2 Install rail to tolerances of maximum 2.5 mm from true level within module, maximum 1.6 mm between adjacent rails and maximum 1 mm in 3048 mm rail length.

.3 Level track anchor and grout between track and floor.

.4 Install raised floor plywood deck free of gaps or barriers at track locations.
.1 Install ramp to raised floor with slope in accordance with CSA-B651.

.5 Install components in place, plumb, straight and level.

.6 Brace, secure and anchor components in place.

.7 Install shelving at uniform, equal height spacing, unless instructed otherwise.

.8 Make good finished surfaces damaged during shipment or installation.

.9 Brace, secure and anchor mobile and fixed shelving units and mobile carriage in place.

.10 Make good factory finished surfaces damaged during shipment or installation.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:
.1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
.2 Schedule site visits, to review Work, as directed in PART 1 - QUALIFICATIONS.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 31 23 33 - Excavation, Trenching and Backfilling.
.2 Section 03 05 10 - Cast-in-Place Concrete.
.3 Section 26 05 28 - Grounding - Secondary for lightning grounding cables.

1.2 DESIGN CRITERIA

.1 Design 7.32 m high flagpole, bases and anchorage devices to resist minimum wind velocity of 145 km/h unflagged, 100 km/h wind velocity flagged.

.2 If requested by Departmental Representative, furnish copies of structural calculations for approval.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 01 50.

.2 Clearly indicate dimensions, finishes, base jointing, anchoring and support systems, cleats, halyard boxes, trucks, finials and base collar for flagpole.

.3 Indicate flagpole orientation regarding tilt function to verify that flagpole can be tilted down without encountering obstruction.

1.4 DELIVERY AND STORAGE

.1 Spiral wrap flagpole with heavy kraft paper, wood strip and steel band, or polyethylene wrap and pack in tubing for shipment.

.2 Deliver flagpole in 1 piece.

2 Products

2.1 MATERIALS

.1 Aluminum: Aluminum Association alloy AA6351-T6 seamless extruded aluminum tubing.

.2 Galvanized steel: to CSA GI64-M, minimum zinc coating of 0.610 kg/m2.

.3 Isolation coating: alkali resistant bituminous paint or epoxy solution.

2.2 FABRICATION

.1 Supply flagpole as complete unit including base, anchorage tilt anchor hinge assembly and fittings.

.2 Flagpole:
  .1 Telescoped, stepped or cone tapered.
  .2 Join pipe sections of consecutively decreasing diameters or form in one piece.

.3 Form tight shop joints between inserted sections with shrunk or closely telescoped fit attained by reducing diameter of outer section where required by hydraulic bell-die swaging.
.4 Provide internal rest collar self-aligning sleeve of same material as flagpole welded to inside of pipe for snug fitting, watertight field joints.
.5 Weld exposed edge of section joint to form a neat continuous bevelled weld. Grind smooth.
.6 Make joints air and water tight.

.3 Do welding to appropriate CSA Standard, using welders certified by Canadian Welding Bureau. Finish exposed welds flush and smooth.

2.3 FITTINGS

.1 Internal halyard system: stainless steel cable connected to internal revolving truck, with neoprene covered stainless steel flag retaining loop; internal gearless direct drive winch with removable handle and pressure band brake, concealed by flush set hinged lockable weathertight access door.

.2 Finals: round cap of 1.6 mm base metal thickness pressed aluminum covering truck assembly.

2.4 BASE

.1 Steel cage foundation assembly suitable for use in cast-in-place concrete bases, with lightning grounding cable connection fittings.

.2 Provide hinged flush assembly to permit manual tilting of flagpole (tilt base). Include threaded stainless steel locking lug to secure flagpole in upright position and friction fitting full base cover pressed from aluminum sheet to conceal tilt mechanism.

2.5 FINISHES

.1 Galvanized finish: hot dipped galvanizing with a minimum coating to Table 1 of CSA G164-M1981.

.2 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes - 1980:
.1 Clear anodic finish: designation AAM32C22A31, to match Departmental Representative's sample.
.2 Appearance and properties of anodized finishes designated by the Aluminum Association as Architectural Class 1.

.3 Stainless steel: AISI No. 4 finish.

.4 Isolation coating: shop apply to metal surfaces of flagpole and base that will be in contact with concrete.

2.6 MOUNTING

.1 Fabricate ground-set foundation assembly for manual tilt installation of flagpole as indicated.

.2 Fabricate mountings of same metal as flagpoles where exposed and of galvanized steel below ground level and where encased in concrete.

.3 Provide lightning spike with base reinforcement.

3 Execution

3.1 INSTALLATION

.1 Install flagpole, base assemblies and fittings in accordance with reviewed shop drawings and manufacturer's instructions. Hand over base plate assembly to concrete installer for installation.

.2 Set flagpole to tilt clear of obstructions.

.3 Check and adjust installed fittings for smooth operation of halyards.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 07 46 13 - Roof and Wall Cladding Assembly. Provide flashings to metal roof installer to facilitate sealing of roof panels to flashings

1.2 WORK INCLUDED

.1 Work of this section includes the design, layout of anchors, supply and installation of safety tie-back anchors.

1.3 REFERENCE STANDARDS

.1 Comply with the Industrial Health and Safety Regulations, Pursuant to WCB of B. C. Reg. 296/97, effective April 15/98-as amended by BC Regulation 185/99. This regulation shall take precedence over CSA Z91-M90.

.2 Workers' Compensation Board of British Columbia Occupational Health & Safety Reg., 296/97 as amended by 185/99,General Hazard Requirements, Part 11.

.3 Comply with Canada Occupational Safety and Health Regulations, Section 12.10, Fall Protection Systems.

.4 Comply with CSA W59-03(2008): welded steel construction.

.5 Comply with CSA W47.1-09: certification of companies for fusion welding of steel structures.

.6 Comply with CAN/CSA Z91-02(2008) safety code for window cleaning.

.7 ASTM A 36/A 36M-08, Specification for Carbon Structural Steel.

.8 ASTM A123 / A123M - 09 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

1.4 QUALIFICATIONS

.1 Only manufacturers that have specialized in the design, layout and installation of permanent fall protection equipment for at least two years.

.2 Manufacturer to provide completed product and liability insurance in the amount of $5,000,000.00 covering all aspects of their installation, design against failure of the safety anchors.

1.5 DESIGN

.1 Engineer and design a fall protection system that meets proper rooftop maintenance practices and protects a worker from falling a vertical distance of four feet (Industrial Health and Safety Regulations (IHSR) pursuant to Workers Compensation Board (WCB) of British Columbia Regulation 296/97-as amended by Regulation 185/99). Provide the necessary hardware and design the system to permit the “hands-free” uninterrupted passage of the worker across the intermediate anchor points.

.2 Workers' Compensation Board of British Columbia Occupational Health & Safety Reg., 296/97 as amended by 185/99,General Hazard Requirements, Parts 11

.3 Contractor's Engineer to design and Verify this specific System; any modification to structure, devices and equipment required to complete the system will be paid as extra to Contract Price in accordance with the General Conditions.

1.6 SUBMITTALS

.1 Submit test data from a qualified testing lab. Anchors to be tested in 360 degrees to absolute failure (fracture).

.2 Include a letter of compliance from a structural engineer registered in the province of British Columbia, certifying that the anchors meets the performance requirements of the British Columbia Industrial Health and Safety Regulations (IHSR) pursuant to Workers Compensation Board (WCB) of British Columbia's "Fall Protection Regulations" B.C. Regulation 296/97-as amended by Regulation 185/99: include signed and sealed drawings.

.3 Provide design loads to be imposed by HLL anchors on building structural members to the Departmental Representative, at all the anchor points. Verification of structural adequacy to withstand these loads is the responsibility of the structural engineer. Any additional structural reinforcing required to upgrade building structural members will be paid as extra to Contract Price in accordance with General Conditions.

.4 Submit Letters of Assurance from the structural engineer as required by authorities having jurisdiction.

.5 Submit required safety inspection log book for yearly inspections.

.6 Submit a copy of a reduced plexi-glass mounted as-built shop drawings showing anchor locations and details, to be supplied to the Departmental Representative to post near roof entrances.

1.7 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 01 50 General Instructions, showing complete layout and configuration of system, locations and all other components and accessories.

.2 Clearly indicate design, fabrication details, plans, elevations, hardware and installation details. Shop drawings to indicate any use restrictions.

.3 Shop drawings to bear seal of qualified professional engineer registered in the Province of British Columbia.

.4 Shop drawings shall meet the requirements of the Province of British Columbia IHSR, pursuant to WCB of B.C.

2 Products

2.1 MANUFACTURER

.1 Specification is based on systems manufactured by Atlas Anchor Systems (B. C.) Other products meeting the specification requirements of this section are acceptable.

2.2 EQUIPMENT

.1 Provide information on equipment to allow workers to use the system.

.2 Include pricing of the following personal safety equipment:
.1 full body harness with extended "D" ring
.2 four foot shock absorbing lanyard

.3 5/8” diameter rope grab
.4 carabiners

.3 Personal safety equipment is not included in Contract Price.

2.3 MATERIALS

.1 Steel plate: to ASTM Grade A.36 or better.

.2 Welding: to CSA W59 by welders qualified to CSA W47.1.

.3 Exposed anchor surfaces: Exposed structural components stainless steel type 304. Non-structural flashing components aluminum.

.4 When steel piers are used instead of concrete piers all steel for pier to be galvanized. Stainless Steel: to be Type 304 with a yield strength of 35 Ksi.

.5 Drilled Concrete Anchors: Hilti HVU Adhesive Capsules, manufactured by Hilti Ltd., or pre-approved equivalent.

.6 Galvanizing: conforming to ASTM A123 “Standard Specification for Zinc coating (Hot Dipped Galvanizing) of Iron and Steel Products”.

2.4 METAL ROOFING

.1 Provide compatible flashing components to metal roofing trade to weather seal roof anchors to roofing system.

3 Execution

3.1 EXAMINATION

.1 Examine job conditions before commencement of work.

.2 Commencement of work will indicate acceptance of conditions.

.3 Faults occurring in installed work due to acceptance of incorrect conditions will be rectified at no extra cost.

3.2 INSTALLATION OF SAFETY TIE-BACK ANCHORS

.1 Install anchors under the supervision of a qualified professional engineer registered in the Province of British Columbia.

.2 Supply handling instructions, anchorage information, roughing-in dimensions, templates and service requirements for installation or work of this Section, and assist or supervise, or both, the setting of anchorage devices and construction of other work incorporated with products specified in this section.

.3 Install work to meet manufacturer’s recommended specifications, true, tightly fitted, and level or flush to adjacent surfaces, as suitable for installation.

.4 Include anchorage and mounting devices required for the installation of each product.

.5 Protect components where contact is made between dissimilar metals to prevent electrolysis.

3.3 ADJUSTMENT AND FINAL INSPECTION

.1 Verify under work of this section that installed products function properly, and adjust them accordingly to ensure satisfactory operation.

.2 Complete inspection log book to certify the system for use.

.3 Provide a 280 x 430 mm Plexiglas-mounted roof plan drawing and install adjacent to the roof entrance as directed by the Departmental Representative.

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 Toprail:
- .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 Woven fabric , polyester resin impregnated, inherently flame retardant, flexible and shape retaining.

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 headrails.

.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 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 each exterior window as indicated, in accordance with manufacturer's instructions.

.2 Secure top rail with cadmium plated steel wood screws into wood subframe above window frame.

.3 Install blinds square, plumb, true to line with operable parts adjusted for correct function.

END OF SECTION

1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 05 50 00 - Metal Fabrications for Security Fasteners.

.2 Section 09 81 50 - High Build Epoxy Coating.

.3 Section 07 92 12 - Security Sealant.

1.2 WORK INCLUDED

.1 Supply and install two (2) institutional stools one in room 144 and 161.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 01 50.

1.4 OPERATION AND MAINTENANCE DATA

.1 Submit maintenance data for finishes and hardware.

2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 The stool and table manufactured to the requirements of these specifications, as approved by the Departmental Representative , are acceptable for use on this project.

.2 Standard of Acceptance:
- .1 Institutional Stool:
  - .1 Kach Model No. 517.
  - .2 SecurityCosmos.com: Model 10-125-85-001.

2.2 BASIC MATERIAL

.1 Steel stools: consists of a 300 mm φ x 2 mm thickness stainless steel seat with a 60 mm φ black iron pipe support column and 6 mm base plate 200 x 200 with 4 - 12 mm φ holes for fastening. The stool is shipped with a coat of shop primer, except for the stainless steel top.

.2 Fasteners: roundhead security screws (furnished).

2.3 FINISHES

.1 Stainless steel with No 4 finish. Non-stainless steel surfaces with primer.

3 Execution

3.1 PREPARATION

.1 Examine the rooms where the stools are to be installed and verify all dimensions.

.2 Inform Departmental Representative of any defects, which may affect the installation, prior to start of work.

3.2 INSTALLATION

.1 Secure stool pipe support to floor as recommended by manufacturer. Install stools where indicated.

.3 Install stools in accordance with manufacturer's instructions, reviewed shop drawings and as directed by the Departmental Representative .

3.3 SEALANT APPLICATION

.1 Apply clear silicone sealant to exposed plate edges on floor plate and underside of floor base plate edges and around floor anchor bolts. Strike smooth to a 45° level.

3.4 CLEANING

.1 Clean up and remove all debris from the site as a result of installation work.

END OF SECTION

1 GENERAL

1.1 WORK INCLUDED

.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 DESCRIPTION OF WORK

.1 The fire suppression contractor shall retain the services of a Professional Engineer registered in the Province of British Columbia to provide complete engineering design and field review services including signed and sealed CAD fire suppression drawings and hydraulic calculations.

.2 The fire suppression contractor's Professional Engineer shall provide field reviews of the work on site as the work progresses and submit signed copies of the reports to the Departmental Representative.

.3 Submit all documentation to the Authorities Having Jurisdiction, arrange for, pay for and obtain trade permits prior to commencing installation work on site.

.4 Arrange for, pay for and obtain static and residual water supply pressure information from the utility or municipality in writing and submit a copy of this information with the Shop Drawings. If this information is not available, arrange for, pay for and perform a hydrant flow test.

.5 Provide all fire suppression systems throughout the buildings including:

- .1 Wet sprinkler systems in all heated areas
- .2 Dry sprinklers in all exterior and unheated areas including attics and exterior canopies
- .3 Portable fire extinguishers

.6 Connect to the combined fire suppression / potable water supply main or dedicated fire suppression water main located as shown on the drawings.

.7 Refer to the Civil Engineer's drawings for work beyond 1 meter from the building.

.8 Provide all Testing, Adjusting and Balancing; Commissioning and Identification for all fire suppression systems as described in the associated specification Sections.

1.3 RELATED WORK

.1 The following fire suppression systems and related work are specified in the noted Sections:

- .1 Water Utilities - Section 33 10 00
- .2 Testing, Adjusting and Balancing for Fire Suppression - Section 21 05 93
- .3 Commissioning of Fire Suppression - 21 08 00
- .4 Identification for Fire Suppression Piping and Equipment - 21 05 53
- .5 Fire Suppression Sprinkler Systems - Section 21 13 00
- .6 Fire Extinguishers - Section 21 25 00
- .7 Electrical - Division 26

1.4 CODES, BYLAWS, STANDARDS AND APPROVALS

.1 Installation, workmanship and testing shall conform to the following standards:

- .1 National Building Code of Canada 2005.
- .2 National Fire Protection Association NFPA 10 - Standard for Portable Fire Extinguishers.
- .3 National Fire Protection Association NFPA 13 - Standard for the Installation of Sprinkler Systems.
- .4 Fire Commissioner of Canada standards.

.5 Factory Mutual (FM) approval guides.

.6 Insurer's Advisory Organization (IAO) Interpretive Guides.

.2 Installation shall be subject to design approval, inspection and test of the Authority Having Jurisdiction.

.3 All system components shall be of one manufacturer. Normally, materials and devices listed by nationally recognized fire test laboratories will be acceptable.

1.5 DOCUMENT SUBMITTALS

.1 Provide letters of assurance signed and sealed by the fire suppression contractor's registered Professional Engineer.

.2 Some Cities or Municipalities may allow sprinkler contractors to perform limited amounts of sprinkler work (such as the relocation or addition of a limited number of sprinklers) under a Trade Permit, without the requirement of submitting Schedules B-1, B-2 and C-B. Where this scenario is permitted by the City or Municipality, the sprinkler contractor may not, under the scope of this contract, break down the work and take out multiple Trade Permits in order to alleviate submitting Schedules B-1, B-2 and C-B.

.3 Submit 'Schedule B-1: Assurance of Professional Design and Commitment for Field Review' and 'Schedule B-2: Summary of Design and Field Review Requirements' in accordance with the National Building Code of Canada 2005, to the Departmental Representative and to the local Authority Having Jurisdiction at the time of the shop drawing submission.

.4 Submit static and residual water supply pressure information.

.5 Submit CAD drawings of all fire suppression sprinkler systems and other fire suppression or fire extinguishing systems.

.6 Submit hydraulic calculations for all water based fire suppression sprinkler systems.

.7 Submit 'Schedule C-B: Assurance of Professional Field Review and Compliance' in accordance with the National Building Code of Canada 2005 to the Departmental Representative and to the local Authority Having Jurisdiction a minimum of 10 working days prior to Occupancy.

.8 Submit a "Contractor's Material and Test Certificate" for each Underground and each Aboveground section of the work in accordance with the Authority Having Jurisdiction test procedure requirements, to the Departmental Representative and to the local Authority Having Jurisdiction a minimum of 10 working days prior to Occupancy.

.9 Submit a Backflow Prevention Test Certificate for all backflow prevention devices.

.10 Submit a signed letter from the fire stopping installation firm on their company letterhead certifying that all penetrations of fire suppression piping through vertical and horizontal rated separations have been fire stopped in accordance with CAN4-S115.

.11 Obtain form the Division 26 Electrical contractor, and submit a copy of the Fire Alarm Verification Certificate.

.12 Submit maintenance data for all systems and arrange for inclusion in the project Mechanical Maintenance and Operations Manuals as outlined below.

.13 Submit shop drawings as noted below.

.14 Submit samples as noted below.

1.6 SHOP DRAWINGS

.1 Submit shop drawings for the following items where they are provided for the project:

.1 Piping materials.

.2 Valves, fittings and couplings.

.3 Fire department siamese connections.

.4 Backflow preventers.
.5 Alarm and dry pipe valves.
.6 Air compressors.
.7 Supervisory switches.
.8 Flow switches.
.9 Pressure switches.
.10 Sprinklers and escutcheon plates.
.11 Fire extinguishers and cabinets.
.12 Fire stopping component data sheets and ULC or Warnock Hersey listings.

1.7 SAMPLES

.1 Submit 2 samples for all sprinkler types and other samples as required in other Sections of the specifications.

1.8 MAINTENANCE DATA

.1 Provide maintenance data for all fire suppression systems complete with a Table of Contents and coordinate with the plumbing and HVAC trades for incorporation into a designated section of the project Mechanical Operation and Maintenance Manual.
.2 Include a copy of National Fire Protection Association NFPA-25, Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems.
.3 Detailed instructions for the normal maintenance of all installed equipment including operational procedures, frequency of operational checks, service instructions and trouble shooting instructions. Information provided must be suitable for incorporation into the local Fire Department's operation manual if so requested by the Authority Having Jurisdiction.
.4 Local source of supply for each item of equipment indicating the manufacturer’s and local supplier’s company names, addresses, phone numbers, faxes and e-mails.
.5 Labeling and identification schedules.
.6 Valve schedule including location, service type and normal position for all systems.
.7 Warranties, certificates and miscellaneous reports.
.8 Manufacturer's operating and maintenance brochures, including wiring diagrams.
.9 Comprehensive description of the operation of the system including the function of each item of equipment within the system.
.10 Operating electrical switchgear schedule indicating location of equipment.
.11 Lubrication schedule indicating the recommended lubricants and grades (grease or oil) for all lubricated equipment components.
.12 Shop drawings for all components as listed in the Shop Drawings clauses above.
.13 Documentation as listed in the Documentation Submittals clauses above.

1.9 CONNECTION FEES

.1 There are no connection fees in this scope of work.
.2 This does not preclude potential connection fees in the civil scope of work.

1.10 SEISMIC PROTECTION

.1 Supply and install sway-bracing hangers on fire suppression piping systems in accordance with NFPA 13 requirements. Generally this shall apply to all crossmains 50 mm and larger, and shall apply to all feed mains including all standpipe risers. Horizontal piping shall be 2-way bracing and vertical piping shall include 4-way bracing at the tops of all risers. On floor loops, sway-braces are also required at the corners of all loops.

.2 Power-driven fasteners shall not be used to attach braces to the building structure, unless ULC listed for this service in the seismic zone in which the fire suppression systems are being installed.

1.11 PIPE, FITTINGS AND COUPLINGS

.1 The responsibility for including for all pipe, fittings, couplings, valves, nipples, drains, test connections and all accessory pipe work for a complete installation is to be included in this Section of the work within the base tender price.

.2 No extra cost will be considered based on failure of the contractor to allow for extra pipe, fittings and pipe work as required during construction to provide offsets to avoid structural components, and to coordinate with other piping services, ductwork, cable trays, conduits or other obstacles whether shown on the drawings or not.

1.12 SPRINKLERS

.1 The responsibility for allowing for all sprinklers for a complete installation is to be included in this Section of the work within the base tender price. The layout on the drawings shows the general intention of the work and sprinkler locations with respect to other ceiling elements such as ceiling tiles, lights and diffusers. However the contractor shall provide all additional sprinklers as may be required.

.2 No extra cost will be considered based on failure of the contractor to allow for extra sprinklers as required during construction to conform to all NFPA requirements and the Authority Having Jurisdiction, whether shown on the drawings or not.

1.13 CLEAN UP

.1 Leave systems operating with work areas clean to satisfaction of the Architect or the Departmental Representative.

2 PRODUCTS

2.1 GENERAL

.1 All materials shall be ULC Listed for the intended service and shall be supplied in original factory packaging.

2.2 HANGERS AND SUPPORTS

.1 All hangers and supports including seismic restraints shall be ULC Listed and shall conform to the appropriate NFPA standards.

.2 Toggle hangers or strap hangers are unacceptable.

2.3 FIRE STOPPING

.1 Provide fire stopping materials listed in accordance with CAN4-S115 at all pipes penetrating horizontal and vertical fire rated separations.

2.4 MISCELLANEOUS METAL RELATED TO FIRE PROTECTION SYSTEM

.1 All miscellaneous metal related to the fire suppression systems including all metal back up plates, stands, brackets and supports for all roof, floor or wall supported equipment and piping systems is part of this Section of the work.

.2 Provide two coats of heavy red oxide primer to all steel components after fabrication, and touch up on site after installation.

2.5 BACKFLOW PREVENTION STATIONS

.1 Provide a ULC Listed double check valve assembly (DCVA) complete with O.S.& Y. inlet and outlet shut-off valves.

.2 Backflow prevention stations shall be in complete accordance with the manual "Cross Connection Control Manual" published by the Pacific Northwest Section of the American Water Works Association.

.3 Isolation valves shall be provided with supervisory switches connected to supervisory signals at the fire alarm system.

3 EXECUTION

3.1 GRADING AND DRAINAGE OF PIPING

.1 Grade all fire suppression piping so that it can be drained through drain cocks.

.2 Pipe all sprinkler system drains to floor drains in mechanical service rooms.

3.2 BUILDING MOVEMENT

.1 Install all piping systems, including all take-offs installed within the building such that the piping and connected equipment will not be distorted by expansion, contraction or building settlement.

.2 Provide offsets and / or piping expansion components at all building expansion joints, all building seismic joints and all firewalls.

.3 Provide anchors where necessary to control pipe expansion and pipe movement.

3.3 PIPE SLEEVES AND ESCUTCHEONS

.1 The supply and installation of pipe sleeves and escutcheons for fire suppression system piping is included in this Section of the work.

.2 Do not cast piping into concrete walls, slabs or masonry walls.

.3 At exterior wall or slab penetrations, provide sleeves a minimum of 2 nominal pipe diameters larger than the pipe. (i.e. a 300 mm sleeve for a nominal 200 mm diameter pipe).

.4 Install pipe concentric within the sleeves.

.5 Remove plastic sleeves, where they are used, prior to installation of the pipe penetration. The resulting hole shall be then classified as the sleeve except in wet areas.

.6 Provide minimum Schedule 10 steel pipe sleeves where piping penetrates masonry walls.

.7 Extend sleeves 50 mm above floor slabs in wet areas. Wet areas include penthouse equipment rooms, janitor's rooms, utility rooms and washrooms.

.8 Seal all penetrations through aboveground exterior walls, and underground exterior walls and slabs including slabs on grade, where no hydrostatic pressure exists, with a flexible, non-hardening, weatherproof caulking compound. Seal around the exterior circumference of the sleeves as well as the annular space between the pipes and the sleeves.

.9 Seal all penetrations through underground exterior walls and slabs, including slabs on grade, where hydrostatic pressure exists, with mechanical seals such as Link Seal.

.10 Install chrome plated escutcheons on exposed piping passing through walls, floors and ceilings in finished areas.

.11 Risers for fire suppression systems with horizontal branch takeoffs passing through sleeves that are set rigidly in the structure adjacent to the risers shall be set to accommodate long term structural movement to avoid imposing stress on these systems.

3.4 FIRE STOPPING

.1 Provide fire stopping to CAN4-S115 at all pipes penetrating horizontal and vertical rated separations.

.2 Smooth the finished surface in a neat and workman like appearance.

3.5 CORE DRILLING

.1 The fire suppression contractor shall be on site and coordinate sleeves and block out requirements in accordance with the project construction schedule to minimize coring.

.2 Arrange and pay for all costs of all core drilling required for fire suppression systems in this Section of the work.

.3 Verify the location of existing service runs and structural reinforcement within existing concrete floors and walls prior to core drilling and cutting. Core drilling and cutting of structural building components shall only take place upon the receipt of specific written approval of the structural Engineer. Repairs that may be required to existing services damaged as a result of core drilling is included in this Section of the work.

.4 Penetrations up to 150 mm nominal pipe size in precast concrete may be cored on site per the fire suppression contractor. Larger penetrations shall be located and arranged for in precast work with the precast manufacturer prior to shipping to the construction site.

3.6 BACKFLOW PREVENTION STATIONS

.1 Install backflow prevention stations in complete accordance with the "Cross Connection Control Manual" published by the Pacific Northwest Section of the American Water Works Association. Mount backflow preventers a maximum of 1.5 meters above the adjacent floor level for servicing.

.2 Complete testing of all backflow prevention devices shall be carried out under this Section of the work prior to final acceptance of fire suppression systems. Submit a certificate duly signed and witnessed that testing was satisfactorily completed and a include a copy in the project Mechanical Operation and Maintenance Manual.

3.7 HANGERS AND SUPPORTS

.1 Provide all hangers and supports as outlined in NFPA including supports to adequately secure the piping to restrict movement upon activation of the fire suppression systems including the activation of fire pumps, and charging of the systems through the fire department siamese connections..

3.8 PRESSURE GAUGES

.1 Provide pressure gauges at the following locations and additional gauges as required by NFPA, the AHJ and the system configuration:

.1 Water entry valve station both upstream and downstream of the backflow preventer.

.2 Upstream and downstream of all pumps.

.3 At the top of all fire suppression standpipe and sprinkler risers.

3.9 SEISMIC RESTRAINTS

.1 Provide seismic restraints as outlined in NFPA and to the seismic zone listed in the applicable building code or bylaw.

.2 Anchorage and seismic restraints of the fire suppression systems as listed in the Letters of Assurance Schedules B-1, B-2 and C-B is included in this Section of the work.

3.10 TESTS AND INSPECTION

.1 Furnish all labour, materials, equipment and instruments necessary for all required tests. All work shall be subject to review by the Departmental Representative and local Authority Having Jurisdiction.

.2 Provide at least seventy-two (72) business hours notice for projects within 100 km of the City of Vancouver and a minimum of one hundred and twenty (120) business hours notice for projects greater than 100 km of the City of Vancouver, in advance of making the required tests.

.3 Tests on fire suppression systems shall include pressure tests and shall conform to the standards of the Authority Having Jurisdiction. Fire department siamese connection and fire pump test header lines shall also be hydrostatically tested.

END OF SECTION

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 SCOPE OF WORK

.1 Refer to Section 23 05 53 Identification for HVAC Piping and Equipment. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping, equipment and systems listed in Section 23 05 53 provide identification on all fire suppression piping, valves and equipment including the following:

.1 Fire suppression wet sprinkler systems.

.2 Fire suppression dry sprinkler systems.

.3 Identification of all fire suppression systems must comply with the requirements of the applicable NFPA Standard where the requirements of that standard exceed these specifications.

END OF SECTION

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 Also refer to Section 21 08 00 Commissioning of Fire Suppression.

1.2 SCOPE OF WORK

.1 Refer to Section 23 05 93 Testing, Adjusting & Balancing for HVAC. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping, equipment and systems listed in Section 23 05 93 provide testing, adjusting and balancing for all fire suppression piping, equipment and systems including the following:

.1 Fire suppression wet sprinkler systems.

.2 Fire suppression dry sprinkler systems.

.3 The fire suppression contractor shall provide testing, adjusting and balancing of the fire suppression and fire extinguishing systems.

.4 Provide completed copies of Contractor’s Material and Test Certificates for Aboveground Piping, and for Underground Piping as per NFPA-13.

END OF SECTION

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 SCOPE OF WORK

.1 Refer to Section 23 08 00 Commissioning of HVAC. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping, equipment and systems listed in Section 23 08 00 provide commissioning of all fire suppression piping, equipment and systems including the following:

.1 Fire suppression wet sprinkler systems.

.2 Fire suppression dry sprinkler systems.

.3 The fire suppression contractor shall provide commissioning of the fire suppression and fire extinguishing systems.

END OF SECTION

1 GENERAL

1.1 GENERAL

.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 DESCRIPTION OF WORK

.1 The following is a general description of the work involved:

.1 Wet sprinkler systems throughout the building.

.2 Dry sprinkler systems at designated areas subject to freezing.

1.3 QUALITY ASSURANCE

.1 Provide a wet sprinkler system throughout the building, in accordance with the listed codes, bylaws, standards and approvals including NFPA 13 and the National Building code of Canada 2005.

1.4 RELATED WORK

.1 Coordinate with Division 26 Electrical for connection of all supervised isolation valves to supervisory signals, flow switches to alarm signals, and supervisory switches to supervisory signals on the fire alarm system.

.2 Coordinate the work of this Section with the HVAC trades, plumbing trades, electrical trades and ceiling trades.

1.5 SPRINKLER SYSTEM SHOP DRAWINGS

.1 The fire suppression subcontractor's Registered Professional Engineer shall prepare their own complete, electronic, cad fire suppression sprinkler system drawings, to scale. Any drawings prepared by the Engineer were done to show only the general features of the systems, and general concepts of the arrangement and locations of the sprinklers.

.2 The fire suppression subcontractor and their Registered Professional Engineer shall include for all sprinklers as required to fully comply with NFPA-13 and the National Building code of Canada 2005 whether or not they are indicated on the Engineer's, Architect's or any other drawings.

.3 Indicate on the drawings all information required by the Authority Having Jurisdiction including features of the building construction, direction and size of beams, ceiling configurations, partition locations, as well as light fixtures (noting the depths of surface mounted light fixtures where these occur) and diffuser locations.

.4 Stipulate the positions and elevations of the sprinklers with respect to the floor elevations; the temperature rating all sprinklers; the spacing and types of hangers; drains and low point drains; test and flushing connections; types of sprinkler alarms; locations and types of sprinkler control valves; backflow preventers and all other essential features of the piping systems.

.5 Include with the submission detailed sprinkler plans and hydraulic calculations as described in Chapter 6 of NFPA 13.

.6 Only those shop drawings that have been reviewed, signed and sealed by the fire suppression subcontractor's Registered Professional Engineer shall be submitted to the Departmental Representative for review.

.7 Include Schedules B-1 and B-2, signed and sealed by the fire suppression subcontractor's Registered Professional Engineer with the shop drawing submission to the Departmental Representative.

.8 Submit additional signed and sealed sets of shop drawings as requested by the Departmental Representative for their use and for review by their insurer, and incorporate all requirements made during that review process.

.9 Submit to the Authority Having Jurisdiction for their review and/or approval, complete sets of shop drawings and hydraulic calculations for each area.

.10 Arrange for, pay for and obtain a fire suppression system / sprinkler permit prior to commencing the fire suppression system installation.

.11 In addition to the foregoing documentation, submit shop drawings for the following items:

.1 Backflow preventers.

.2 Pipe, valves, fittings and couplings.

.3 System and zone isolation valves.

.4 Water flow switches.

.5 Pressure switches.

.6 Supervisory switches.

.7 Test and drain assemblies.

.8 Sprinklers including all sprinkler types.

.9 Dry pipe valves and trim.

.10 Air compressors.

1.6 SAMPLES

.1 Submit to the Departmental Representative at the time of the shop drawing submission, 2 samples of each type of sprinkler of the same model number, response rating, temperature rating, orifice size and finish as the associated shop drawings.

2 PRODUCTS

2.1 SPRINKLER PIPING AND FITTINGS - ABOVE GROUND

.1 Piping:

.1 Steel pipe, black or hot dipped galvanized, standard weight or lightwall, material and IPS dimensions conforming to NFPA 13 and ASTM A53, ASTM A135 or ASTM A795.

.2 Seamless copper tube to ASTM B75, seamless copper water tube to ASTM B88, wrought seamless and alloy tube to ASTM B251 of wall thickness type 'K', ‘L’ or ‘M’. Brazing filler metal (Classification BCuP-3 or BCuP-4) to AWS A5.8.

.3 Ductile iron pipe or copper pipe for the portion of the combined potable water and fire suppression system upstream of a ULC listed backflow prevention device, as per Section 21 11 00.

.4 CPVC piping is **not** acceptable for this project.

.5 Provide copper pipe where specifically stated on the drawings, such as in exposed finished areas as requested per the Architect to minimize the visibility of fittings.

.2 Fittings:

.1 Compatible with the piping material and suitable for the maximum pressures in the system but not less than 1210 kPa working pressure.

.2 Welded fittings shall conform to ANSI B16.5, B16.9, B16.11 and B16.25 and ASTM A234.

.3 Threaded fittings conforming to ANSI B16.1, B16.3 and B16.4 are acceptable on minimum Schedule 40 steel pipe up to 150 mm diameter and minimum Schedule 30 steel pipe for 200 mm diameter and larger and shall have a ULC corrosion resistance ratio of 1.00 or greater.

.4 Grooved end fittings shall be ductile iron conforming to ASTM A536, and shall provide full flow design. Fittings, couplings and gaskets shall be of one manufacturer and shall provide a rigid joint.

.5 Branch connections may be provided by bolted, mechanical branch connections complete with synthetic rubber gaskets approved for line service. Acceptable Products: Victaulic Style 920, 921, 925 and 929.

.6 Victaulic "FIT System" may be used on Schedule 10 or Schedule 40 or high strength cold rolled lightwall pipe; conforming to ASTM A795 for piping 50 mm and smaller.

.7 Victaulic 922 outlet tees shall have cast upper and lower housings and may be used for up to 25 mm branch outlets and individual sprinklers.

.8 Grinnell "Easy Tees" fittings may be used only for individual sprinklers.

.9 Victaulic "Pressfit System" utilizing Schedule 5 pipe and cold drawn carbon steel fittings with integral synthetic O-ring is not acceptable for this project.

.10 For dry pipe systems, use a flush seal coupling gasket in rigid and flexible couplings where required by NFPA 13. Acceptable Products: Victaulic Style 005 Firelok and 75.

.11 Submit requests for consideration of other products or systems in accordance with the submittal procedures, prior to the closing of this subtrade tender.

2.2 SPRINKLER PIPING AND FITTINGS - BELOW GROUND

.1 Not applicable to this project.

.2 If piping is required to be routed below grade contact the Departmental Representative.

2.3 VALVES

.1 Gate - 1210 kPa - Underwriters' Laboratories Canada (ULC) listed:

.1 12 mm - 50 mm: Jenkins 305-U, Crane 459, Nibco T-104-0, Kennedy.

.2 65 mm and larger: Jenkins 825, Crane 467, Nibco F-607-0TS and F-607-RW, Kennedy.

.2 Butterfly/Ball - 1210 kPa - ULC or UL listed and FM approved:

.1 12 mm - 50 mm: Victaulic 728 Firelock ball valve with supervisory switch, Milwaukee BB-SCS Butterball slow close butterfly valve with indicator and integral supervisory switch, Nibco KT-505-8.

.2 50 mm - 300 mm: Victaulic Style 705 and 728 grooved end Fireball complete with factory installed double throw / double pole supervisory switch, Nibco.

.3 100 mm - 300 mm: Demco Series NE-H with tapped lug end design, Grinnell, Nibco L-002-N6 complete with gear operator and indicator.

.3 Pressure regulating sprinkler zone control valve - 2750 kPa - ULC listed:

.1 64 mm: NFE model A203NB cast brass, straight pattern valve, rough brass finish with red wheel handle, female threaded outlet, 2760 kPa rated. Capable of field adjustment of the pressure.

.4 Test and Drain Valves - 1210 kPa - ULC listed

.1 25 mm and 32 mm: NFE model A61 forged brass construction, tapped 6 mm gauge outlet, and integral sight glass. Victaulic TestMaster

.5 Check - 1210 kPa - ULC listed/FM approved:

.1 65 mm and larger: Victaulic Style 717, Jenkins 477, Crane 375, Mission, Nibco F-908-W, Kennedy.

.2 Provide a spool piece to ensure full check valve opening where adjacent an alarm or gate valve.

.6 Alarm and Dry Pipe Valves:

.1 ULC listed for automatic fire suppression sprinkler systems.

.2 Acceptable Products: FireFlex, Tyco SimplexGrinnell, Victaulic, Viking

.7 All valves shall be ULC listed for fire suppression systems.

.8 Where working pressure exceeds 1035 kPa provide 2060 kPa valves.

.9 All grooved end valves shall be of one manufacturer. Acceptable products: Victaulic, Gruvlok.

.10 All drain valves shall be provided with hose end adaptors complete with caps and chains, and auxiliary drains shall be provided with a drum drip.

2.4 SPRINKLER ZONE CONTROL VALVE CABINETS

.1 Sprinkler zone control valve cabinets to conceal / protect valve assemblies in exposed areas:

.1 N.F.E. model CV-200 recessed wall mounted cabinet sprinkler zone control valve cabinet.

.2 762 mm wide x 762 mm high x 305 mm deep cabinet.

.3 Fully recessed steel cabinet with 13 mm turn back frame for 305 mm wall depth.

.4 Full length semi-concealed piano hinges for 180 degree swing.

.5 Flush stainless steel door latch with no exposed fasteners.

.6 18 gauge baked enamel corrosion protected steel tub.

.7 14 guage baked enamel corrosion protected full metal steel door. Doors hinged as shown on the plans, or if not shown then orient to maximize cabinet access and to not obstruct exit doors or exit routes.

.8 Grey prime coated enamel finish ready for field painting – reconfirm color per architect prior to ordering.

.2 Acceptable Products: National Fire Equipment

2.5 SPRINKLERS

.1 Upright – plain brass, quick response, glass bulb in unfinished mechanical and service rooms without ceilings

.2 Upright – chrome plated, quick response, glass bulb in finished rooms and spaces without ceilings such as atriums, skylights and sprinklered exterior covered areas.

.3 Recessed Pendent – recessed, quick response, glass bulb, chrome plated finish on sprinklers and escutcheons in all finished areas with ceilings except noted below

.4 Concealed Pendant – concealed, quick response, chrome plated flat cover plate, at locations as noted on the drawings including main entrances, foyers, boardrooms, and other similar high profile locations.

.5 Recessed Horizontal Sidewall - recessed, quick response, glass bulb, chrome plated finish on sprinklers and escutcheons

.6 Extended Throw Sidewall - recessed, glass bulb, quick response, chrome plated finish on sprinklers and escutcheons

.7 Dry Horizontal Sidewall - recessed, glass bulb, quick response, chrome finish on sprinklers and escutcheons

.8 Intermediate temperature and high temperature sprinklers – provide at top of each elevator shaft, elevator machine rooms and electrical rooms and other required locations as per NFPA 13, complete with wire guards.

.9 Dry Sprinklers – provide dry pendant or dry sidewall sprinklers where serving an exterior area or an area subject to freezing from wet sprinkler system piping

.10 Institutional sprinklers – pendant institutional sprinklers with a breakaway release mechanism for all confined areas such as in psychiatric rooms, holding cells and prison inmate areas.

Acceptable Products: Viking HQR-2, Sprinkler No. 10554, Sprinkler Identification No. VK410, Escutcheon No. 10627.

.11 All sprinklers in exposed areas subject to viewing by the occupants of the building shall be in chrome plated finish with chrome plated escutcheons. All sprinklers in service spaces, mechanical and electrical rooms and other spaces subject to view by the maintenance staff of the building may be in natural plain brass finish.

.12 Escutcheon plates shall allow accessible (T-bar) ceilings to be removed without removing sprinklers. Construction consists of a cup and skirt, the cup being the portion retaining the sprinkler and the skirt being the removable portion around the exterior perimeter of the cup that covers the tile hole. The finished escutcheon installation shall not project more than 6 mm below the finish ceiling surface. Recessed two piece escutcheons and single piece escutcheons that are specifically manufactured with sprinklers to permit escutcheon and ceiling tile removable without sprinkler removal are also considered to be acceptable. The escutcheons shall match the sprinkler finish, be of the same manufacturer as the sprinkler and shall coordinate with architectural features of the building.

.13 Provide wire sprinkler guards in areas such as mechanical rooms, service rooms, elevator shafts, below lower level stair landings, gymnasiums, exterior locations, etc. where sprinklers are susceptible to mechanical damage or vandalism.

.14 All sprinklers shall be ULC listed for use in the occupancies in which they are to be installed.

.15 All sprinklers shall be quick response unless stated otherwise.

.16 All sprinklers shall be for commercial applications unless stated otherwise. Residential sprinklers are only permitted in residential areas of residential buildings.

2.6 FLOW SWITCHES

.1 ULC listed flow switches suitable for 24 volts D.C. each with one set of normally open and one set of normally closed contacts, time delay feature and paddle indicator specifically chosen and ULC listed for the size of pipe in which the flow switch is mounted.

.2 Flow switch test and drain assembly immediately downstream of each flow switch in addition to normal inspector's test connections required by NFPA 13 requirements.

.3 Flow switches shall be manufactured specifically for use in sprinkler systems rated a minimum 1210 kPa.

2.7 PRESSURE SWITCHES

.1 ULC listed pressure switches where shown on drawings. Pressure switches shall be suitable for 24 volt DC contact rating unless otherwise specified, rated a minimum 1210 kPa.

2.8 SUPERVISORY SWITCHES

.1 ULC listed supervisory switches, Potter complete with "J" hooks (on gate valves of OS&Y type) Potter PIVS-C (on NRS valves) or "Potter" BF (on butterfly valves) complete with 1 set of normally open contacts and 1 set of normally closed contacts, or 2 sets of SPDT contacts.

.2 Switches shall be suitable for 24 volt DC contact rating unless otherwise specified, rated a minimum 1210 kPa.

.3 Looped cable devices are not acceptable.

.4 Approved valves with integral and/or factory installed indicators and supervisory controls are acceptable products.

2.9 AIR COMPRESSORS

.1 Select air compressors for the capacity as determined by the hydraulic calculation design of the dry sprinkler systems.

2.10 SPARE SPRINKLERS

.1 Provide a red baked enamel steel cabinet containing a minimum of 2 spare sprinklers of each pattern, but in addition, not less than the following of all types:

Number of Sprinklers	Total Spares
up to 300	6 minimum
300 - 1000	12 minimum
over 1000	24 minimum

2.11 FIRE DEPARTMENT SIAMESE CONNECTIONS

.1 Flush mounted fire department Siamese inlet connections at the main building entrance:

.1 N.F.E. model 229 flush mounted fire department Siamese inlet connection, cast brass body, double 64 mm clapper valves, 2 – 64 mm inlet ports with brass plugs and chains, 100mm outlet, integral ball drip. Threads per local Fire Department.

.2 Wall escutcheon plate 380 mm x 229 mm marked with 25mm high raised letters “AUTO SPKR STANDPIPE”.

2.12 BALL DRIPS

.1 Solid brass 19mm male threaded auto ball drips.

.2 NFE model A58.

3 EXECUTION

3.1 FIRE SUPPRESSION SPRINKLER SYSTEMS

.1 Supply and install fire suppression sprinkler systems throughout the building, in accordance with the listed codes, bylaws, standards and approvals including NFPA-13 and the National Building Code of Canada 2005.

.2 Test sprinkler systems to listed requirements and furnish a certificate stating that such testing has been carried out and approved.

.3 Provide inspector's test valves and drain pipes at all remote points in the system to NFPA 13 requirements.

.4 Supply and install fire suppression sprinkler systems in accordance with the general piping configuration depicted on the drawings. The sprinkler contractor shall hydraulically calculate the sprinkler systems in accordance with the following provisions:

.1 Such calculations shall be the responsibility of, and shall be signed and sealed by, the fire protection subcontractor’s Registered Professional Engineer. Submit 'Schedule B-1: Assurance of Professional Design and Commitment for Field Review' and 'Schedule B-2: Summary of Design and Field Review Requirements' to the Departmental Representative and to the local Authority Having Jurisdiction in accordance with the National Building Code of Canada 2005.

.2 Such calculations shall be based on the general piping configuration depicted on the tender and/or contract drawings.

.3 The water supply hydraulic data shall be confirmed in writing by the contractor with the water utility or the municipal authority prior to the submission of shop drawings.

.5 Supply and installation of the sprinkler systems on the basis of the hydraulic calculations shall be the responsibility of the fire suppression subcontractor and their Registered Professional Enigneer.

.6 Locate sprinklers in general conformance with the locations shown on the sprinkler design drawings. For exact locations refer to the architectural reflected ceiling plans. In the absence of reflected ceiling plans sprinklers shall be installed at the centre point, quarter point and/or third point in the long dimension of ceiling tiles, and in the center point of the short dimension of ceiling tiles, and/or in line with other ceiling elements, light fixtures, diffusers, audio devices and other fittings, in a symmetrical and aesthetic pattern acceptable to the Architect. Coordinate the sprinkler layout with architectural, structural, electrical and mechanical HVAC ceiling elements.

.7 At substantial completion, and a minimum of 10 working days prior to the scheduled Occupancy date, submit 'Schedule C-B: Assurance of Professional Field Review and Compliance' to the Departmental Representative and to the local Authority Having Jurisdiction in accordance with the National Building Code of Canada 2005 .

.8 Submit to the Departmental Representative a completed Contractor's Material and Test Certificate for all fire suppression systems, and a provide copy in the project Mechanical Operation and Maintenance Manuals.

3.2 PIPE AND FITTINGS

.1 All welding shall be done in the shop using welding fittings. Field welding is not permitted.

.2 Flanged pattern fittings shall be used for piping 200 mm diameter and larger, and at valve stations and fire department connections.

.3 Provide expansion joints or flexible couplings at building expansion joints, building earthquake joints, building firewalls and all other locations as necessary.

.4 All grooved end components including valves, fittings and couplings shall be of one manufacturer and shall be installed in accordance with the manufacturer’s instructions.

.5 Victaulic FIT and Pressfit products shall be installed in accordance with the manufacturer’s instructions and piping shall be clearly marked at each joint to indicate pipe insertion depth.

.6 Tie rods shall only be used in conjunction with fittings possessing integral tie lugs.

.7 Tie rods complete with their associated nuts and bolts shall be coated with two coats of asphaltic paint after installation.

3.3 FLUSHING OF SPRINKLER SYSTEMS

.1 Flush all underground water mains and fire department siamese connection lines before connecting to the fire suppression standpipe systems.

.2 Flush pipe lines until effluent is clear and free of debris.

.3 Rate of flushing flows shall be as indicated in NFPA-13.

.4 Provide proper drainage for this flushing operation.

3.4 FLOW SWITCHES

.1 Provide tight pipe drain connections from test valves to open discharge at floor drains, service sinks, or other discharge points acceptable to the Departmental Representative.

.2 Conduct tests in conjunction with Division 26 Electrical on each device to ensure the indication of an "alarm" signal and the correct location and labeling thereof on the fire alarm system.

3.5 SUPERVISORY SWITCHES

.1 Install supervisory switches on all valves supplying the fire suppression sprinkler systems inside the building perimeter.

.2 Conduct tests in conjunction with Division 26 Electrical on each device to ensure the indication of a "supervisory" signal and the correct location and labeling thereof on the fire alarm system.

3.6 ELECTRICAL EQUIPMENT PROTECTION FROM WATER

.1 Sprinkler piping and sprinklers are to be installed in various areas containing electrical equipment as shown on the drawings.

.2 Responsibility for water damage to electrical equipment in these areas from the sprinkler system installation whether due to testing or leakage prior to the Departmental Representative's acceptance of the building shall be the responsibility of this Section.

.3 Provide and install in this Section of the work minimum 20 gauge sheet metal protective hoods individually located over all electrical equipment susceptible to water damage upon release of sprinklers in electrical areas. Such electrical equipment shall include all transformers, all equipment with ventilation grilles and all other switchgear with openings that will allow water entry into the electrical equipment. Protective hoods shall be sloped to allow shedding of water and shall project horizontally beyond the equipment perimeter and shall not be integrally mounted on the equipment unless prior approval has been obtained from the electrical authorities. Holes through protective hoods that cannot be avoided as in the case of transferring electrical conduit shall be sealed with an appropriate waterproof sealing compound.

3.7 FIRE DEPARTMENT SIAMESE CONNECTIONS

.1 Mount the center line at 1000 mm above the adjacent ground, sidewalk or grade surface unless noted otherwise on the drawings. Install the escutcheon plates true and level.

.2 Seal the perimeter of the escutcheon plates to the building face with clear, water resistant, silicone caulking in a neat manner.

END OF SECTION

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 REFERENCE STANDARDS

.1 Perform work in accordance with the recommendations and requirements of:

.1 National Fire Protection Association, NFPA 10 - Standard for Portable Fire Extinguishers.

.2 National Building Code of Canada 2005.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for fire extinguishers and extinguisher cabinets.

1.4 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into the Mechanical Operation and Maintenance Manuals.

2 PRODUCTS

2.1 FE-1 RECESSED CABINET WITH EXTINGUISHER (FINISHED AREAS):

.1 N.F.E. model CE-950-3-2 extinguisher cabinet

.2 229 mm wide x 610 mm high x 152 mm deep cabinet

.3 semi – recessed steel cabinet with turnback frame for 100 mm wall thickness

.4 full length semi-concealed piano hinges for 180 degree swing

.5 flush stainless steel door latch with no exposed fasteners

.6 22 gauge steel tub

.7 16 guage steel door and trim with optional 5 mm clear tempered glass (-G-T)

.8 grey prime coated finish ready for field painting

.9 NFE 4.5 kg ABC dry chemical multipurpose fire extinguisher

2.2 FE-2 SURFACE MOUNTED CABINET WITH EXTINGUISHER (SERVICE AREAS):

.1 N.F.E. Classic Cabinet model ECS-999 extinguisher cabinet

.2 267 mm wide x 610 mm high x 160 mm deep cabinet

.3 surface mount steel cabinet

.4 cylinder lock with key (provide same keying throughout the facility and turn keys over to the Departmental Representative's at time of demonstration)

.5 18 gauge steel tub

.6 plexi glass panel, break glass hammer and instruction decal

.7 white baked enamel finish

.8 NFE 4.5 kg ABC dry chemical multipurpose fire extinguisher

3 EXECUTION

3.1 INSTALLATION

.1 Install fire extinguishers in cabinets at locations as indicated on the drawings.

.2 Coordinate locations of fire extinguisher cabinets with the framing trades in order to facilitate recessed and semi-recessed installations.

.3 Mount fire extinguishers and cabinets such that the top of the extinguisher is at 1220 mm above the floor.

.4 Install fire extinguisher cabinet doors, glazing panels and fire extinguishers in the cabinets prior to the project substantial completion review by the Departmental Representative.

3.2 IDENTIFICATION

.1 Identify fire extinguishers in accordance with the recommendations of NFPA 10.

.2 Attach a tag or label to all fire extinguishers, indicating the month and year of installation, with space for recording subsequent service dates.

END OF SECTION

1 GENERAL

1.1 GENERAL

.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 The General Conditions, Supplements, and Amendments shall govern the plumbing sections (ie. 22 00 00 to 22 99 99 sections) of the work (read in conjunction with the Instructions to Tenderers or Bidders). This section covers items common to the 22 00 00 series sections and is intended only to supplement the requirements of Division 31.

.3 Plumbing drawings are diagrammatic and approximately to scale. They establish the scope of the plumbing work and the general location and orientation of the plumbing facilities. Plumbing facilities shall be installed generally in the locations and generally along the routings shown close to the building structure with minimum interference with other services. Piping shall be concealed within walls, ceilings or other spaces and shall be routed to maximize head room and the intended use of the space through which they pass, unless specifically noted otherwise.

1.2 RELATED WORK

.1 HVAC

.2 Trenching and Backfilling

.3 Civil Works

1.3 DESCRIPTION OF SYSTEMS

.1 The following plumbing systems inside and/or buried beneath and/or on the roof of the building to a point 900 mm beyond the exterior face of the building are specified in the noted section:

.1	Facility Water Distribution	Section 22 11 00
.2	Facility Sanitary Sewerage and Storm Drainage	Section 22 13 00
.3	Propane Gas System	Section 22 16 00

1.4 CODES, STANDARDS AND APPROVALS

.1 Installation, workmanship and testing shall conform to the following standards:

.1 National Building Code of Canada 2005

.2 Canadian Gas Association, CSA B149.1, Natural Gas and Propane Installation Code

.3 British Columbia Gas and Safety Branch Bulletins

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 23 05 00.

.2 Shop drawings are required for:

.1 Pipe, fittings and couplings.

.2 Cleanouts and access panels.

.3 Floor drains.

.4 Domestic water heaters.

.5 Hydrants/hose bibbs.

.6 Plumbing fixtures.

.7 Pumps and controls.

.8 Trap primers.

.9 Valves including circuit balancing valves and tempered water mixing valves.

.10 Water hammer arrestors.

1.6 MAINTENANCE DATA

.1 Provide maintenance data summarized below in English for incorporation into maintenance manual specified in Section 23 05 00.

.2 Detailed instructions for the normal maintenance of all installed equipment including operational procedures, frequency of operational checks, service instructions and trouble shooting instructions.

.3 Local source of supply for each item of equipment indicating location.

.4 Labeling and identification schedules.

.5 Valve schedule; including location, service type and normal valve position for all systems.

.6 Warranties, certificates and miscellaneous reports.

.7 Manufacturer's operating and maintenance brochures, including wiring diagrams.

.8 Comprehensive description of the operation of the system including the function of each item of equipment within the system.

.9 Lubrication schedule indicating the recommended lubricants and grades (grease or oil) for all lubricated equipment components.

1.7 RECORD DRAWINGS

.1 Provide project record drawings as specified in Section 23 05 00.

1.8 CONNECTION FEES

.1 There are no connection fees in this scope of work.

.2 This does not preclude potential connections fees in the civil scope of work.

1.9 TEMPORARY USAGE OF PLUMBING EQUIPMENT

.1 Plumbing equipment and systems shall not be used without the written permission of the Engineer or the Departmental Representative and in no circumstances shall be used prior to testing and inspection.

1.10 CHROMIUM PLATED PIPING

.1 Use strap wrenches only on chromium plated pipe or fittings. Surfaces damaged by wrench marks shall be replaced. Joints shall be threaded or slip joints.

1.11 ACOUSTICAL TREATMENT

.1 General

.1 This project includes acoustical requirements to ensure low noise levels in noise sensitive areas. The contractor shall pay close attention to detail during the rough-in stage in order to assure maximum acoustical benefit.

.2 The insulation for wall, ceilings and pipe chases as outlined herein is to be provided and installed under another division of work. This section is responsible for ensuring that all special requirement for plumbing systems have been met before the wall or ceilings have been closed in.

.2 General Scope of Work

.1 All plumbing systems located in any walls or within 2 metres in any direction of the enclosing walls of the following areas (or of similar areas not specifically named) shall be especially protected against noise transmission as defined herein:

.1 General Office

.2 Multi-purpose Room

.3 Reception

.4 Private offices.

.3 Summary of Requirements

.1 Drain, Waste and Vent Stacks:

.1 Cast iron pipe and mechanical or neoprene compression gasket hub fittings shall be used. Plastic, copper and aluminum DWV piping are unacceptable.

.2 Waste connections from appliances and fixtures may be copper to the waste stack.

.3 All copper dry vent pipes in walls, chases and ceiling plenums shall be lagged with 25 mm preformed glass fiber pipe insulation, canvas wrapped and sealed airtight and with one or more coats of heavy enamel paint.

.2 Domestic Water Operating Parameters:

.1 The maximum pressure at any faucet or outlet shall be 275 kPa with at least 10% of maximum rated flow through any pressure reducing valve in the system.

.2 The maximum flow velocity in pipes in the supply and circulating system shall be 1.5 metres per second.

.3 Pipe Sizes:

.1 The minimum pipe size to faucets or mixing valves of each fixture shall be 12 mm. The use of 9 mm pipes is strictly prohibited.

.4 Plumbing Fixtures and Trim:

.1 Quick Acting Valves: All flush valves and solenoid operated or other quick acting valves shall be equipped with water hammer arresters located as close to the valves as possible.

.5 Fastening to the structure:

.1 Piping shall not contact any framing stud or wall surface; or any other conduit, electrical or ventilation fixture that is connected to any wall or ceiling surface.

.2 Piping shall not be fastened to a partition which forms part of an adjacent room not served by the pipe in question. Do not secure piping to gypsum wallboard or its supporting frame.

.3 Pipe hangers shall be oversized to suit the insulation and shall have a protection shield between the insulation and the hanger.

.4 Pipe hangers shall contain 50 durometer, 3.2 mm thick neoprene pads inserted between the hanger saddle and pipe.

.6 Clearance Around Pipes:

.1 All pipe (bare or insulated) shall be clear of contact with studs or gypsum wallboard.

.2 Pipes in acoustically critical walls shall be wrapped with a minimum thickness of 6 mm of Armaflex or Rubatex sleeving and secured by use of oversized clamps. This is not necessary where the piping is insulated provided that pipe clamps are mounted around the exterior of the insulation. Hard plastic pipe sleeves shall not be used.

.7 Wall and Slab Penetration by Pipes:

.1 Gypsum wallboard or plaster wall pipe penetrations shall be 3 mm to 6 mm oversized with the pipe centred in the hole and the gap caulked with silicone or other non-hardening sealant.

.2 Pipe expansion joints shall be for noise free operation.

.8 Ceiling, Wall and Other Plumbing Pipe Chases:

.1 The interior spaces shall be insulated with non-compressed RSI 2.11 batt insulation in the following proportions:

.1 Ceiling plenum - 80% of area above the room.

.2 Chases - 100% of all four vertical surfaces.

.3 Walls - 50% of space containing pipe, and 100% of adjacent stud space.

.9 Water Pumps and Pressure Reducing Valves (PRV):

.1 Inlet and outlet of the PRV shall be fitted with a 600 mm spool piece as provision for installation of acoustical filters if required. The spool section should be clear of obstacles for a 305 mm radius around the pipe.

.2 Small in-line pumps (less than 750 watts) completely supported by the piping need no additional vibration isolation beyond that specified above.

1.12 COLD WEATHER PROTECTION

.1 Roof Penetrations:

.1 All vent penetrations of roof structure shall be 100 mm minimum size.

.2 Insulate all vent piping through the unheated attic spaces and 3 meters back into the heated part of the building.

.2 Water service:

.1 The water service shall connect to the civil water service line below the frost depth, and remain at the depth of the civil service until it rises up into the mechanical room.

1.13 OTHER CONTRACTS ON THIS SITE

.1 These documents include work that will require connection of piping systems to piping provided under the civil scope of work.

.2 Cooperation with respect to on-site coordination of all piping connections is an integral part of the responsibility of this section of the work all within the basic tender price. No extra cost will be allowed based on a failure to allow for scheduling of piping connections to produce a complete workable system whether shown on the drawings or not.

2 PRODUCTS

2.1 ACCESS DOORS

.1 Refer to Section 23 05 00

2.2 CLEANOUTS

.1 Cleanouts shall be full size for pipe sizes up to 100 mm and not less than 100 mm on larger sizes. Cleanouts in inside finished areas shall all be of the same shape either round or square.

.2 Pipe manufacturers' cleanouts are acceptable for vertical installation at the base of soil and waste stacks or rainwater leaders only.

.3 Make cleanouts with Barrett type fitting that has a bolted coverplate and gasket, fitting that has a threaded plug, or a cleanout ferrule that is installed in a wye or extended wye.

.4 Outside area cleanouts shall be of heavy duty construction. - Acceptable Product: Zurn Z1400, Jay R. Smith 4220, Ancon, Mifab

.5 Unfinished concrete area cleanouts shall be of heavy duty construction and have a fully exposed scoriated cover. - Acceptable Product: Zurn Z1400, Jay R. Smith 4229, Ancon, Mifab

.6 Lino or lino tiled area cleanouts shall have the centre portion of cover recessed to receive a piece of tile that matches the adjoining tile. - Acceptable Product: Zurn ZN 1400-X or ZN 1400-TX, Jay R. Smith 4140, Ancon, Mifab

.7 Ceramic tile floor area cleanouts shall have a fully exposed scoriated cover. - Acceptable Product: Zurn ZN 1400 or ZN 1400-T, Jay R. Smith 4020, Ancon, Mifab

.8 Latex floor area cleanouts. - Acceptable Product: Zurn ZN 1400-DX, Jay R. Smith DX4343/2646Y, Mifab

.9 Carpet area cleanouts shall be fully concealed with a small raised marker. - Acceptable Product: Zurn ZN 1400-CM, Jay R. Smith 4020-Y, Ancon, Mifab

2.3 HANGERS AND SUPPORTS

.1 Refer to section 22 05 29 for Hangers and Supports for Plumbing Piping & Equipment.

2.4 PIPE SLEEVES AND ESCUTCHEONS

.1 Refer to Section 23 05 00.

2.5 MISCELLANEOUS METAL RELATED TO PLUMBING SYSTEMS

.1 Frames shall be of welded construction consisting of angle iron sections with 7.9 mm locating strips and anchoring lugs at a minimum of 900 mm centres.

.2 Backing Plates shall be adequate to support the use intended and shall be a minimum 4.76 mm in thickness.

2.6 PIPE BEDDING

.1 All buried piping inside the building below floors and slabs, shall be supported on a bed of well compacted sand (ie. 95% Modified Proctor Density). Bedding shall extend from 150 mm below pipe and shall support the pipe barrel; not the joints and/or couplings. Before backfilling, the complete line shall be inspected and approved by the authorities having jurisdiction.

3 EXECUTION

3.1 PIPING INSTALLATION

.1 General:

.1 Install piping straight, parallel and close to walls and ceilings, with a fall of not less than 1:50 for gravity piping and with a slope to drain cocks, fixtures or equipment for all pressure piping unless otherwise indicated on drawings. Use standard fittings for direction changes. Provide drain cocks as required.

.2 Install groups of piping parallel to each other; spaced to permit application of insulation, identification, and service access, on trapeze hangers.

.3 Where pipe size differs from connection size to equipment, install reducing fitting close to equipment. Reducing bushings are not permitted.

.4 Brass and copper pipe and tubing shall be free from surface damage. Replace damaged pipe or tubing.

.5 Ream ends of pipe and tubes before installation.

.6 Lay copper pipe so that it is not in contact with dissimilar metal and will not be crimped or collapsed. All joints on cast or ductile iron pressure service piping shall be made electrically conductive.

.7 Install flanges or unions to permit removal of equipment without disturbing piping systems.

.8 Clean ends of pipes or tubing and recesses of fittings to be jointed. Assemble joints without binding.

.9 Install piping to connections at fixtures, equipment, outlets and all other appurtenances requiring service. Trap and vent waste connections to fixtures. Grade all vents to drain back to waste piping.

.10 Plug or cap pipe and fittings to keep out debris during construction.

.11 Jointing of pipe shall be compatible with type of pipe used.

.12 Non-corrosive lubricant or teflon tape shall be applied to the male thread of threaded joints.

.13 Flush and clean out piping systems after testing.

.2 Equipment Drainage:

.1 Install drain valves at low points.

.2 Extend equipment drain piping to discharge into floor or hub drain.

.3 Expansion and Contraction:

.1 Support piping to prevent any stress or strain.

.2 Install pressure piping with loops and offsets which will permit expansion and contraction to occur without damaging the pressure piping system.

.4 Buried Piping:

.1 Lay pipe on compacted bedding of clean, coarse sand or 3/8 minus, free from clay, snow or ice, organic matter or stones.

.2 Do not lay pipe in water or when conditions are unsuitable.

3.2 ACCESS DOORS

.1 Install access doors at all concealed cleanouts, traps, unions, expansion joints, valves, control valves, air vents, water hammer arrestors, special equipment, trap primers, vacuum breakers and any other equipment for which subsequent periodic access will be required during the life of said equipment.

.2 Locate access doors so that all concealed items are readily accessible for adjustment, operation, maintenance and replacement.

.3 Do not locate access doors in feature walls or ceilings without the prior approval of the Departmental Representative. Locate in service areas and storage rooms wherever possible.

3.3 CLEANOUTS

.1 Install cleanouts at the following locations:

.1 Building drain leaving building on the upstream side of exterior wall.

.2 Changes of direction of more than 45 degrees in drainage piping.

.3 Nominally horizontal branch or building drain at intervals of not more than 7.5 metres for pipe sizes 65 mm and less, 15 metres for 75 mm and 100 mm pipe sizes, and 26 metres for pipe sizes larger than 100 mm.

.4 Fixture drain of a sink or chen piping at intervals not exceeding 7.5 metres for pipe all sizes.

.5 Base of soil or waste stacks and rainwater leaders.

.6 National Building Code of Canada 2005

.2 Cleanouts which are located low on walls shall be located 75 mm minimum above the top of the baseboard or minimum 200 mm above finished floor level where there is no baseboard.

.3 Cleanouts shall be coordinated with all millwork and with all other obstructions, shall be placed in readily accessible locations and shall have sufficient clearance for rodding and cleaning.

.4 Extend cleanouts to the finished floor or wall.

.5 Cleanouts in wet floor areas shall extend above the floor in walls or be provided with gasketted waterproofed tops.

.6 Cleanouts on outside drains shall be brought to grade and anchored in a concrete collar.

3.4 HANGERS AND SUPPORTS

.1 Refer to section 22 05 29 for Hangers And Supports for Plumbing Piping & Equipment.

3.5 PIPE SLEEVES AND ESCUTCHEONS

.1 Refer to Section 23 05 00

3.6 MISCELLANEOUS METALS RELATING TO PLUMBING SYSTEMS

.1 All miscellaneous metal related to the plumbing systems including, all metal back up plates and supports for all ceiling or wall supported equipment or plumbing fixtures is part of this section of the work.

.2 Lay out the location of all pipe trenches and coordinate the construction thereof with the responsible contractor.

.3 Prime coat after fabrication with two coats of red primer.

3.7 PIPING EXPANSION

.1 All piping systems, including all take-offs shall be so installed within the building that the piping and connected equipment will not be distorted by expansion, contraction or settling.

.2 If circumstances on the job require additional changes in direction from those shown on the drawings, the configuration shall be adjusted to suit at no extra cost.

.3 Anchors shall be installed where necessary to control expansion. Expansion joints or loops shall be installed on hot water piping where required.

3.8 FIELD REVIEW OF WORK

.1 Refer to Section 23 05 00.

END OF SECTION

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 SCOPE OF WORK

.1 Refer to Section 23 05 20 Thermometers and Pressure Gauges for HVAC. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping, equipment and systems listed in Section 23 05 20 provide thermometers and pressure gauges on all plumbing piping systems and equipment including the following:

- .1 Domestic cold water.
- .2 Domestic hot water and recirculation.
- .3 Domestic tempered water.
- .4 Propane gas.
- .5 Tanks, pumps, and all other equipment.

.3 Provide thermometers in brass or stainless steel wells at all domestic water heaters, and other equipment intended to change the temperature of the fluid.

.4 Provide pressure gauges complete with isolation ball valves on both sides of all pressure reducing valves, backflow prevention stations, pumps and other equipment intended to change the pressure of the fluid. Provide snubbers for all pressure gauges located adjacent pumps.

END OF SECTION

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 Also refer to Section 22 05 49 Seismic Restraint Systems for Plumbing Piping and Equipment.

1.2 SCOPE OF WORK

.1 Refer to Section 23 05 29 Hangers and Supports for HVAC Piping and Equipment. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping, equipment and systems listed in Section 23 05 29 provide hangers and supports on all plumbing piping and equipment including:

- .1 Domestic cold water.
- .2 Domestic hot water and recirculation.
- .3 Domestic tempered water.
- .4 Sanitary waste and venting.
- .5 Storm drainage.
- .6 Propane gas.
- .7 Tanks, pumps, and all other equipment.

END OF SECTION

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 SCOPE OF WORK

.1 Refer to Section 23 05 49 Seismic Restraint Systems for HVAC Piping and Equipment. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping, equipment and systems listed in Section 23 05 49 provide seismic restraints on all plumbing piping and equipment including the following:

- .1 Domestic cold water.
- .2 Domestic hot water and recirculation.
- .3 Domestic tempered water.
- .4 Sanitary waste and venting.
- .5 Storm drainage.
- .6 Propane gas.
- .7 Tanks, pumps, and all other equipment including domestic water heaters.

1.3 DOCUMENT SUBMITTALS

.1 Provide letters of assurance signed and sealed by the contractor’s specialist registered Professional Engineer.

.2 Submit 'Schedule B-1: Assurance of Professional Design and Commitment for Field Review' and 'Schedule B-2: Summary of Design and Field Review Requirements' in accordance with the National Building Code of Canada 2005, to the Departmental Representative and to the local Authority Having Jurisdiction at the time of the shop drawing submission.

.3 Submit ‘Schedule C-B: Assurance of Professional Field Review and Compliance' in accordance with the National Building Code of Canada 2005 to the Departmental Representative and to the local Authority Having Jurisdiction a minimum of 10 working days prior to Occupancy.

END OF SECTION

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 SCOPE OF WORK

.1 Refer to Section 23 05 54 Identification for HVAC Piping and Equipment. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping, equipment and systems listed in 23 05 54 provide identification on all plumbing piping, valves and equipment including the following:

- .1 Domestic cold water.
- .2 Domestic hot water and recirculation.
- .3 Domestic tempered water.
- .4 Sanitary waste and venting.
- .5 Storm drainage.
- .6 Propane gas.
- .7 Tanks, pumps and all other equipment.

END OF SECTION

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 Also refer to Section 22 08 00 Commissioning of Plumbing.

1.2 SCOPE OF WORK

.1 Refer to Section 23 05 93 Testing, Adjusting & Balancing for HVAC. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping, equipment and systems listed in Section 23 05 93 provide testing, adjusting and balancing for all plumbing piping, equipment and systems including the following:

- .1 Domestic cold water.
- .2 Domestic hot water and recirculation.
- .3 Domestic tempered water.
- .4 Sanitary waste and venting.
- .5 Storm drainage.
- .6 Propane gas.
- .7 Tanks, pumps, and all other equipment.

.3 Balancing of the domestic hot water and tempered water recirculation systems by a recognized balancing agency and submission of a balancing report is mandatory.

.4 Pressure test all plumbing piping systems in accordance with the specific requirements of the specification sections that describe those systems and submit pressure test reports.

END OF SECTION

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 SCOPE OF WORK

.1 Refer to Section 23 07 19 HVAC Piping Insulation. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping and systems listed in Section 23 07 19 provide piping insulation on all plumbing piping systems including the following:

- .1 Domestic cold water.
- .2 Domestic hot water and recirculation.
- .3 Domestic tempered water.
- .4 Offset waste piping, p-traps and supplies under all wheelchair accessible lavatories and sinks.
- .5 Provide foil faced flexible insulation on components requiring adjustment or servicing including meter sets, pressure reducing valves, valve bodies, strainers etc.
- .6 Sanitary vent stacks for the last 3 meters prior to penetrating the unheated attic and throughout the unheated attic.

END OF SECTION

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 SCOPE OF WORK

.1 Refer to Section 23 08 00 Commissioning of HVAC. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping, equipment and systems listed in Section 23 08 00 provide commissioning of all plumbing piping, equipment and systems including the following:

- .1 Domestic cold water including PRV set point.
- .2 Domestic hot water and recirculation including temperature set points.
- .3 Domestic tempered water including set points.
- .4 Sanitary waste and venting.
- .5 Plumbing fixtures including adjustments of all flush valves, and setting temperature limit stops on shower valves.
- .6 Propane gas.
- .7 Tanks, pumps and all other equipment.

END OF SECTION

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 SCOPE OF WORK

.1 Domestic water systems include domestic cold water, domestic hot water, domestic hot water re-circulation and tempered water systems.

.2 Interior domestic water piping shall be provided as depicted on the drawings to all plumbing fixtures, appliances and equipment that require domestic water service.

.3 Domestic water piping shall be connected to receive domestic water supply from the exterior cold water building service as depicted on the drawings from the civil engineer’s scope of work.

1.3 CROSS CONNECTION CONTROL

.1 Double check valve assemblies and reduced pressure principle backflow prevention devices shall have approval from the Foundation for Cross Connection Control, University of Southern California.

.2 Vacuum breakers shall conform to the requirements of C.S.A. B64.5.

.3 Following installation, a test report completed by a certified tester shall be submitted to the Departmental Representatvie, indicating satisfactory operation of each device.

.4 Tests are to be conducted in the period 30 to 60 days prior to date of Substantial Completion.

.5 Provide one repair kit for every cross connection control device installed.

2 PRODUCTS

2.1 PIPE AND FITTINGS

.1 Buried water pipe and fittings inside the building:

.1 100 mm and smaller.

.1 Type 'K' seamless soft copper tubing to ASTM B88 or copper pipe to ASTM B42 with cast brass or wrought copper fittings and silver soldered joints all encased in a polyethylene piping system.

.2 Above ground water pipe inside the building:

.1 Ductile iron pipe to AWWA C151 for cut grooved fittings. Ductile iron pressure coupling to ANSI/AWWA C-606 for cut grooved ductile iron pressure pipe with synthetic rubber gasket, plated carbon steel bolts, alkyd phenolic primer and protective enamel finish.

.1 Acceptable Product: Victaulic Style 31 Couplings and Style 307 Transition Couplings, Grinnell Gruvlok.

.2 Type 'K' hard drawn seamless copper tubing to ASTM B88 or copper pipe to ASTM B42. All type 'K' copper water tubing shall be certified by the Canadian Standards Association or Warnock Hersey Professional Services Ltd. to ASTM B88.

.3 Above ground copper water pipe fittings inside the building:

.1 Use of the 'T-Drill' system of joining copper piping is unacceptable.

.2 Cast brass or wrought copper solder joint pressure fittings with 95/5 Sn/Sb or Silvabrite 100 solder joints; or

.3 Cast bronze or wrought copper roll grooved pressure fittings with grooved mechanical pipe connector couplings with angle bolt pad and Victaulic style of 'flush seal' gaskets.

.4 Acceptable Products:

.1 Victaulic 'The Copper Connection System for Copper Tubing (CTS)' with 606 couplings, 600 series fittings and 641 flange adaptors.

.2 Grinnell 'Gruvlok Copper Method' with 7400 Rigidlite couplings, 7012 flanges, 7500 series fittings and 7500C ball valves.

2.2 VALVES

.1 Gate: (for shut-off and isolation)

.1 50 mm and smaller, bronze body, solid wedge disc, bronze or stainless steel trim, non-rising stem, 860 kPa rating.

.2 Acceptable Products:

.1 Solder joint type: Crane, Jenkins, Kitz 41, Red & White / Toyo 281A.

.2 Threaded joint type: Crane, Jenkins, Kitz 40, Red & White / Toyo 280A.

.3 65 mm and larger, flanged ends, cast iron body, solid wedge disc, bronze or stainless steel trim, rising stem, outside screw and yoke. Acceptable Products: Crane, Jenkins, Kitz 72, Red & White / Toyo 421A.

.2 Ball: (in lieu of gate valves or as specified)

.1 50 mm and smaller, brass two piece body, blow-out proof stem, PTFE seats, brass chrome plate ball, lever handle operator, 1035 kPa rating.

.2 Acceptable Products:

.1 Solder joint type: Red & White / Toyo 5049A, Apollo 70-100, Crane, Jenkins, Kitz 59.

.2 Threaded joint type: Red & White / Toyo 5044A, Apollo-70-200 Series, Crane, Jenkins, Kitz 58.

.3 Butterfly: (in lieu of gate valves or as specified)

.1 65 mm and larger, 1,380 kPa rating, wafer style or threaded lug style cast iron body, EPDM seat liner, bronze disc, 403 stainless steel stem, 10 position lever lock handle operator on 150 mm diameter and smaller, handwheel worm gear operator on 200 mm diameter and larger, for installation between Class 125 / 150 flanges.

.2 Acceptable Products:

.1 Wafer style: Apollo 141, Center Line L200W/G200W (EPDM).

.2 Lug style: Apollo 143, Center Line L200L/G200L (EPDM)

.3 With “Victaulic” copper grooved end pipe system, use Victaulic style #608 bronze body grooved valve with an EPDM encapsulated disk, 300 psi rating

.4 With “Victaulic” ductile iron grooved end pipe system, use Victaulic style #300 PPS coated grooved end valve with an EPDM encapsulated disk, 300 psi rating

.4 Globe: (for throttling, bypass and make-up applications)

.1 50 mm and smaller, bronze body, bronze or stainless steel trim, 860 kPa rating.

.2 Acceptable Products:

.1 Solder joint type with bronze bevel type disc: Crane, Jenkins, Kitz 10, Red & White / Toyo 212,

.2 Threaded joint type with composition type disc: Crane, Jenkins, Kitz 03, Red & White / Toyo 220.

.3 265 mm and larger, flanged ends, cast iron body, bronze or cast iron bevel-type disc, bronze or stainless steel trim, rising stem, outside screw and yoke.

.4 Acceptable Products: Crane, Red & White / Toyo 400A, Kitz.

.5 Check: (for horizontal installation)

.1 50 mm and smaller, threaded joint type, bronze body, bronze or stainless steel swing disc holder with Teflon disc, 860 kPa rating.
Acceptable Products: Crane, Jenkins, Kitz 22, Red & White / Toyo 236.

.2 65 mm and larger, flanged ends, cast iron body, bronze or cast iron swing disc, bronze or stainless steel trim, 860 kPa rating.
Acceptable Products: Crane, Jenkins, Kitz 78, Red & White / Toyo 435A.

.6 Balance: (for domestic hot water recirculation)

.1 30 mm and smaller, globe, for maximum system temperature, bronze body and trim, Teflon; polytetrafluoroethylene (PTFE), disc, female by male union connection, 690 kPa rating.

.1 Acceptable Products: Tour and Anderson circuit balance valves.

.7 Vacuum relief: (for hot water tanks installations)

.1 12 mm and larger, 860 kPa rating.

.1 Acceptable Products: 18 mm Watts 36A, Cash Acme

.8 Pressure reducing:

.1 12 mm to 50 mm, 860 kPa rating.

.1 Acceptable Products: Watts 223S, Braukman, Conbraco, Cash Acme, Singer.

.2 65 mm and larger, 860 kPa rating.

.1 Acceptable Products: BCA 317 PR, Clayton 90 or 90B, Singer 106PR.

.9 Pressure reducing valve with integral low flow bypass:

.1 40 mm and larger, 860 kPa rating.

.1 Acceptable Products: Watts PV-10, Clayton, Singer, Wilkins.

.10 Drain Valves and Hose Bibbs:

.1 Hose Bibbs: Lockshield globe type with bronze body and trim suitable for maximum system operating pressure.

.1 Acceptable Products: Dahl 2316.

.2 Drain Valves: Ball type with brass body, cap & chain and chrome plated brass ball.

.1 Acceptable Products: Kitz 58CC, Red & White / Toyo 5046, Dahl.

.3 Stop and Drain Valves: Emco 10151

.11 Solenoid:

.1 Slow closing solenoid valve, forged brass body, Buna "N" disc, stainless steel parts, enclosure to suit environmental conditions, UL and CSA approved, 120 volt.

.1 Acceptable Products: ASCO

.12 Mixing:

.1 On both the up-stream hot and cold supplies, in an accessible location, provide positive swing check valves and strainers. This is a requirement in addition to any check valve device that is common to the mixing valve. Where required, provide an access panel to the check valves and strainers.

2.3 VACUUM BREAKERS

.1 Pressure type:

.1 CSA approved, mechanically independent spring loaded poppet type check valve with a downsteam spring loaded air inlet valve, with upstream and downstream isolation valves and test cocks.

.2 Acceptable Products: Cla-Val 27, Conbraco 40-500, Febco 765, Watts 800, Wilkins 720A, SMR

.2 Atmospheric type:

.1 CSA approved, bronze body, chrome plate finish where exposed.

.1 Acceptable Products: Conbraco 38-100; Febco 710 / 715A; Watts 288A, 288AC; Wilkins 30; Rainbird; SMR.

2.4 BACKFLOW PREVENTION STATIONS

.1 Double check valve assembly (DCV), factory assembled station to CSA B64.5. Acceptable Products: Watts Series 709; Ames 3000 Series.

2.5 STRAINERS

.1 Sized on a 4 to 1 ratio of basket open area to connecting pipe cross-sectional area, 'Y' pattern, 304 stainless steel screen.

.2 6 mm to 50 mm, threaded ends, bronze body, 1034 kPa rating.
Acceptable Products: Red & White / Toyo 380, Crane 988-1/2, Armstrong, Kitz 15.

.3 65 mm and larger, flanged ends, cast iron body, 860 kPa rating.
Acceptable Products: Red & White / Toyo 381A, Crane, Armstrong, Kitz 80.

2.6 WATER HAMMER ARRESTORS

.1 Bellows or piston manufactured style with stainless steel casing and welded stainless steel nesting bellows if of the bellows style. Air chambers are unacceptable.

.2 Acceptable Products: Zurn Z-1700 Series bellows style, Jay R. Smith, Watts, Amtrol, Precision Plumbing Products Inc. piston style.

2.7 TEMPERATURE AND PRESSURE RELIEF VALVES

.1 CSA listed to temperature, pressure and energy input of the system.

.2 Acceptable Products: Cash Acme, Watts.

2.8 PIPE JOINTS

.1 Solders and fluxes having a lead content and self cleaning acid type fluxes shall not be used.

.2 All copper to iron and flanged adaptors shall be brass, not copper.

.3 All unions or similar interconnections between dissimilar metals shall be dielectric couplings.

.1 Acceptable Products: Epco Dielectric Pipe Fittings.

2.9 HYDRANTS AND/OR HOSE BIBBS

.1 Hose Bibb Type 'NFHB-1': (encased non-freeze type):

.1 Encased non-freeze self draining wall hydrant with integral vacuum breaker.

.2 Acceptable Products: Zurn ZN-1305, Watts, Jay R. Smith

.2 Hose Bibb Type HB-1: (interior hose bibb):

.1 Exposed anti-siphon wall hydrant with integral backflow preventer, stainless steel face with operating key.

.2 Acceptable Products: Zurn ZN-1333, Watts, Jay R. Smith

2.10 TRAP SEAL PRIMERS

.1 Provide flow actuated type priming device piped to nearest fixture so that device will introduce regulated amount of water into trap whenever fixture is used.
Acceptable Products: Watts A200-T, Zurn, Jay R. Smith

.2 Provide pressure actuated type priming device piped where the nearest fixture is remote to the floor drain requiring trap priming.
Acceptable Products: Precision Plumbing Products Model P-1

2.11 DOMESTIC WATER HEATER [DHWT-1 & DHWT-2]

.1 Glass-lined, propane fired domestic water heater, ASME construction, CSA listed, rated for 1034 kPa working pressure.

.2 Extra density, vermin proof, glass fibre insulation with heavy gauge steel jacket finished with baked enamel finish over bonderized under coat.

.3 Magnesium anode protection, heavy duty magnetic contactors, fuse protection against excessive current flows.

.4 Recovery of 250 lph at a 55^{o}C temperature rise.

.5 Storage capacity of 280 litres.

.6 Natural Gas input rating of 76 MBH.

.7 Acceptable Products: John Wood JW3-75-3NC

2.12 EXPANSION TANK FOR HOT WATER SYSTEM [ET-2]

.1 Carbon steel thermal expansion tank of welded construction, ASME model, 24.2 litre total volume, brass or stainless steel connections, heavy duty butyl diaphragm, rigid polypropylene liner, NSF-61 listed for potable water systems.

.2 Acceptable Products: Amtrol ST-12-C Therm-x-trol, Expanflex.

2.13 RECIRCULATION PUMPS [P-5]

.1 Building recirculation pumps.

.1 Bronze body, bronze impeller.

.2 Spring loaded coupler between motor and pump shaft, drip proof.

.3 Bronze sleeve type bearing, resilient-mount.

.4 Capacity of 19 lpm at 4.9 metres of head.

.5 Power - 125 watts, 1750 rpm, 115 volt single phase 60 Hz.

.6 Acceptable Products: Bell & Gosset Model 1" P.R., Armstrong, Taco, Grundfos.

3 EXECUTION

3.1 CONCEALED SUPPLY PIPING

.1 Concealed water supply piping to plumbing fixtures, trim items, equipment, hose bibbs, etc. shall be installed using cast brass 90 degree drop ear elbow or drop ear tees as the piping design dictates.

.2 Blocking shall be provided within the concealed space and the elbows and tees shall be secured to the blocking using brass screws to provide a rigid installation.

3.2 VALVE INSTALLATION

.1 General:

.1 Where possible, disassemble solder end joint valves before soldering.

.2 Where disassembly and the subsequent reassembly is impossible, the contractor shall give special regard to solder jointing in order not to damage, melt or deform and valve parts.

.2 Shut Off Valves:

.1 Install shut-off or isolation valves whether shown on the drawings or not at the following locations:

.1 At each main branch supply point; provide a valve on each outlet leg from the tee or cross.

.2 At each single plumbing fixture (i.e. normally this requirement is satisfied by the provision of the angle valve specified with the specific fixture).

.3 At each single piece of equipment.

.4 At all points as indicated on the drawings.

.5 At all points where the plumbing code requires same.

.3 Circuit Balancing Valves:

.1 Install circuit balancing valves in hot water recirculating branch mains and branch connections to return mains whether indicated on drawings or not as well as at the discharge of the recirculation pump.

.4 Pressure Reducing Valves:

.1 Pressure reducing valve stations, as a minimum shall consist of the following:

.1 A high flow or main pressure reducing valve; which shall be one pipe size smaller than the incoming or outflowing building service, and shall be provided with a strainer, a reducer and a shut off valve on the inlet side and a reducer and a shut off valve on the outlet side.

.2 A low flow pressure reducing valve; which shall be 25 mm in size, and shall be provided with a strainer and a shut off valve on the inlet side and a shut off valve on the outlet side.

.3 A bypass around both pressure reducing valves with a normally closed globe valve; which shall be of the same pipe size as the incoming or outflowing building service, and a valved pressure gauge on each side of the globe valve.

.4 Where a pressure reducing valve with integral low flow bypass is used the piping, fittings and accessories shall be arranged as described in 3.2.4.1.1 and .3 and above.

.2 Set main pressure reducing valve at 350 kPa outlet pressure.

.3 Set small flow pressure reducing valve at 35 kPa higher outlet pressure than main pressure reducing valve.

.5 Drain Valves:

.1 Install drain valves 19 mm minimum, or line size where the piping is smaller than 19 mm.

.2 Install a hose-end adaptor on the discharge side of each drain valve or pipe to drain where indicated.

.6 Mixing:

.1 On both the up-stream hot and cold supplies, in an accessible location, provide positive swing check valves and strainers. This is a requirement in addition to any check valve device that is common to the mixing valve. Where required, provide an access panel to the check valves and strainers.

3.3 VACUUM BREAKER INSTALLATION

.1 Install at each fixture or item of equipment where contamination of the domestic water system can occur.

.2 Vacuum breaker installation shall be in complete accordance with the manual "Cross Connection Control Manual" published by the Pacific Northwest Section of the American Water Works Association.

.3 All atmospheric type vacuum breakers shall be installed at least 300mm above flood level rim of fixture.

.4 Fume hoods .

.5 Provide drain pan with water deflecting enclosure on concealed pressure type vacuum breakers with drain line to appropriate drain.

.6 Complete testing of all vacuum breakers shall be carried out under this section of the work prior to final acceptance of plumbing systems. A certificate shall be submitted duly signed and witnessed that testing was satisfactory.

3.4 FLANGES AND UNIONS

.1 Provide on all connections to pumps, reducing valves, control valves, fixtures, and equipment.

.2 Connections up to and including 50 mm size shall be all bronze union, 1,035 kPa rating with ground seat; larger connections shall be flanged.

3.5 WATER HAMMER ARRESTORS

.1 Size in accordance with the Plumbing and Drainage Institute PD1-WH-201 sizing procedures.

.2 Install on branch lines to flush valves, and solenoid valves.

3.6 PIPE JOINTS

.1 Install dielectric type couplings where copper piping and accessories connect to plumbing equipment such as steel storage tanks or pressure reducing stations.

.2 Where the water service enters the building terminate at the edge of the building and excavation with a Smith Blair standard sleeve coupling having stainless steel nuts and bolts. Bridge the excavation with ductile iron pipe.

.3 Tie rods shall only be used in conjunction with fittings possessing integral tie lugs.

.4 Tie rods complete with their associated nuts and bolts shall be coated with two coats of asphaltic paint after installation.

3.7 HOSE BIBBS

.1 Provide operating keys to the Departmental Representatvie for all hose bibbs that do not possess an attached handle.

.2 Provide an isolating shut-off valve upstream of all hose bibbs.

3.8 TRAP SEAL PRIMERS VALVES

.1 Provide floor drain trap primers in accordance with the plumbing code and as designated on the drawings.

.2 Provide at locations that are readily accessible by the building maintenance staff.

3.9 HOT WATER TANKS

.1 Provide temperature and pressure relief valve. Install such that probe properly senses temperature. Pipe relief port full outlet size to drain. Position discharge at drain to prevent splash-over.

.2 Provide vacuum relief valve and check valve on cold water supply.

.3 Provide isolating valves at all tank and heater water connections.

.4 Provide a corrosion resistant water tight pan under any hot water storage tank and/or hot water heater/storage tank.

3.10 RECIRCULATION PUMPS

.1 Building recirculation pump:

.1 Coordinate with the Electrical Division for the provision of a manual switch with wiring to pump.

.2 Provide check valve on the recirculation pump discharge.

3.11 TESTING

.1 Testing shall consist of hydraulic pressure testing at 1375 kPa for 8 hours.

3.12 FLUSHING AND CHLORINATION OF WATER LINES

.1 Thoroughly flush all water piping so that it is free from scale, sediment and debris as soon as possible after the system is filled with water.

.2 On completion of laying and testing, all water piping shall be pre-flushed, chlorinated and flushed again in accordance with AWWA C-601.

.3 Retain a reputable firm qualified to supervise and inspect the chlorination and flushing procedures and perform chemical and biological tests as required.

.4 The mains shall be chlorinated so that a chlorine residual of not less than 10 ppm remains in the water after standing for 24 hours. Hypochlorite and water is recommended as a disinfectant. AWWA C-601 recommends the amount of chlorine required.

.5 Submit to the Departmental Representative a certificate form the testing firm stating the chlorination and flushing has been successfully completed.

END OF SECTION

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 SCOPE OF WORK

.1 Interior sanitary waste and vent piping shall be provided as depicted on the drawings to plumbing fixtures that will discharge sanitary waste and shall be connected to discharge to the exterior sanitary building service as depicted on the drawings and specified in Division 2

2 PRODUCTS

2.1 INTERIOR DRAIN, WASTE AND VENT PIPE AND FITTINGS

.1 Buried pipe and fittings:

- .1 Class 4000 cast iron mechanical joint pipe and fittings with mechanical joint stainless steel couplings to CSA B70.
- .2 Acrylonitrile-Butadiene-Styrene (ABS) Drain Waste and Vent Pipe Fittings conforming to CSA B181.1
- .3 Polyvinyl Chloride (PVC) Drain Waste and Vent Pipe and Pipe Fittings conforming to CSA B181.2.
- .4 Cellular core ABS pipe is not permitted.

.2 Above ground pipe and fittings:

- .1 Class 4000 cast iron mechanical joint pipe and fittings with mechanical joint stainless steel couplings to CSA B70 up to 200 mm.
- .2 DWV copper drainage pipe with cast brass or wrought copper drainage pattern fittings with 50/50 Sn/Pb recessed solder joints.

.3 Additional requirements:

- .1 Use acceptable reduced outside diameter DWV piping in confined locations inside the building; wall spaces, duct spaces, ceiling spaces, etc. where there is not sufficient room for cast iron pipe.
- .2 Plastic (PVC or ABS) piping where used underground shall adapt to approved non-plastic material prior to penetration above the building slab.
- .3 Vent terminals shall be complete with 180o return bends.
- .4 Class 4000 mechanical joint cast iron soil pipe and mechanical joint couplings shall be of one manufacturer.
- .5 Copper to cast iron joints shall be male brass adaptors to tapped fittings.
- .6 Nipples shall be cast iron or heavy brass.

2.2 FLOOR DRAINS

.1 Floor Drains: strainer standard: nickel bronze in finished areas, galvanized or lacquered cast iron in service areas.

- .1 Type FD-1 Mechanical room:
  - .1 Cast iron with adjustable head, integral seepage pan and flanges, integral backwater valve, cast iron strainer and oval funnel and trap primer connection.
  - .2 Acceptable products: Zurn Z-415-BFP, Watts, Jay R. Smith.

.2 Type FD-2 Administration areas:

.1 Cast iron with integral seepage pan and flange, clamping collar and adjustable head, nickel bronze strainer, and trap primer connection.

.2 Acceptable products: Zurn ZN-415BP, Watts, Jay R. Smith.

.3 Type FD-3 Cell areas:

.1 Cast iron with integral seepage pan and flange, clamping collar and adjustable head, heavy duty nickel bronze strainer with maximum 12mm openings, vandal proof screws (series 262) with liquid thread lock, and trap primer connection.

.2 Acceptable products: Zurn ZXN-415-AP-VP, Watts, Jay R. Smith.

.4 Type FD-4 Parking Area Drain:

.1 Extra heavy duty cast iron floor drain with hinged grate and sediment bucket.

.2 Acceptable Products: Zurn Z-610-H, Watts, Jay R. Smith.

2.3 OIL INTERCEPTOR [OI-1]

.1 The oil interceptor shall be a steel body oil interceptor, equipped with rectangular non-skid steel lid, removable internal flow control, baffles, cadmium plated handles and adjustable oil drawoff.

.2 Unit shall be equipped with flow control devices at inlet to unit installed as recommended by the manufacturer.

.3 Unit shall be sized to accommodate a flow rate of 57 lpm.

.4 Valve controlling the oil waste drawoff from interceptor shall be rising stem, threaded ends, double discs, threaded bonnet, 1030 kPa gate valve suitable for use with oil.

.5 Acceptable Products:

.1 Oil Interceptor - Zurn Z-1186-E-HD, Jay R. Smith, Watts

.2 Valve - OPW 376 or 676 series.

.6 Terminate no-corrode riser above valve at an OPW #104-AN 300 mm [12"] cast iron manhole and set assembly in concrete collar flush with finish grade. Manhole cover plate shall be marked "WASTE OIL VALVE".

3 EXECUTION

3.1 FLOOR DRAINS

.1 Install floor drains set low to provide proper drainage.

.2 Water piping from trap primer to floor drain to be protected in a polyethylene sleeve where buried below slab.

3.2 OIL INTERCEPTOR

.1 Install oil interceptor such that cover is flush with finish grade and with suitable extensions to obtain gravity flow.

.2 Mount oil interceptor on 300 mm thick gravel base.

3.3 FLASHING AND VENT TERMINALS

.1 Terminate all vent terminals a minimum of 75 mm above the water level at which roof drainage overflows through roof overflow scuppers or drains but not less than 300 mm above the main roofing membrane.

.2 All cleanouts passing through walls or floors subject to hydrostatic pressure and waterproofed by means other than a membrane shall be provided with clamping collars and flashings of 25 kg/m ^{2} lead.

.3 Chloraloy 240 lining material may be used as an alternate to lead at floor drains and cleanouts. Materials shall be solvent welded to manufacturer's installation instructions. Dow reinforced sheeting 45R may be used as an alternative to lead in all applications except in areas in which a rubberized or plastic membrane must be clamped to a drain.

.4 Supply and fix 25 kg/m² sheet lead flashings to all cleanouts and drains. Securely fix to flashing clamps and extend 300 mm beyond edge of cast iron fittings.

.5 Vent flashing minimum 450 mm x 450 mm base dimension shall terminate flush with the top of 300 mm high vent pipe and the gap between the flashing and pipe shall be closed with a 25 kg/m² separate lead cap 75 mm high. The main flashing shall not be turned over the pipe.

3.4 INSULATION

.1 Provide 25 mm pipe insulation and vapour barrier jacket to all sanitary vent piping routed through unheated spaces including the unheated attic, and 3 meters back into the heated portion of the building.

3.5 TESTING

.1 Tests on the sanitary waste and storm drainage systems shall consist of hydraulic pressure testing of 3000 mm for 8 hours.

.2 An air test in accordance with the Plumbing Code may be used during freezing conditions.

END OF SECTION

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 Also refer to Section 33 51 00 Natural Gas Distribution for site underground natural gas piping where required.

1.2 SCOPE OF WORK

.1 Connect to the utility company's natural gas meter set.

.2 Provide all natural gas piping, fittings, valves, pressure regulators, unions, hangers and supports, and all other components as required for a complete installation generally as depicted on the drawings.

.3 Distribute natural gas to all natural gas outlets, appliances and equipment that require natural gas service including boilers, domestic water heaters, natural gas fired air handling units, kitchen equipment, laboratory equipment and plant equipment.

.4 Connect natural gas piping to existing natural gas piping at locations indicated on the drawings.

.5 Remove all unused or redundant natural gas piping throughout the renovated or demolished areas of the project where access is readily available, or cap off and abandon in place as referenced on the drawings.

1.3 QUALITY ASSURANCE

.1 Submit to the Provincial Gas Inspection Department documentation and detailed drawings as required, pay for and obtain a permit and approval for the natural gas installation prior to commencing work.

.2 All materials and installations shall comply with CAN/CSA B149.1-05 Natural Gas and Propane Installation Code.

1.4 PAINTING AND COLOR CODING

.1 Painting of all natural gas piping, equipment and material installed under this Division of the specification shall be included under this Division of the work.

.2 Paint all exterior piping including the section of piping from the gas meter to the building entry, piping installed above the roof, piping installed in underground parking garages and all exterior pressure regulating valve vent piping.

.3 Painting shall consist of one coat of Rust-Oleum 769 damp proof red primer, one coat of Rust-Oleum 960 zinc chromate and two finish coats of Rust-Oleum 850 grey enamel paint.

.4 Provide yellow color coding identification banding of the natural gas piping as required by the gas code. Also refer to Section 22 05 53 Identification for Plumbing Piping and Equipment.

1.5 GAS UTILITY CONNECTION

.1 Arrange and pay for the natural gas connection to the gas utility's distribution system. The contractor shall obtain shop drawings for all gas fired appliances and equipment and supply all gas input load information based upon the actual equipment being supplied and installed.

.2 Coordinate with the gas utility company for natural gas service including installation of a meter set located as shown on the drawings.

.3 Connect to the gas utility's natural gas meter set and enter the building above grade. Seal the space around the pipe with backer rod and silicone sealant to provide a weatherproof seal and leave a neat finished appearance.

2 PRODUCTS

2.1 BELOW GROUND PIPING

.1 No gas piping shall be installed below the building.

.2

.3 Refer to Section 33 51 00 Site Work Natural Gas Distribution for any required below grade exterior piping.

2.2 ABOVE GROUND PIPING

.1 Schedule 40 seamless carbon steel to ASTM A53 and CSA B-63.

2.3 FITTINGS

.1 Screwed fittings up to 50 mm [2”] diameter shall be malleable iron with beaded ends, Class 150 to ANSI B16.3.

.2 Welded fittings 65 mm [2 ½”] and larger shall be forged steel of the same weight as the connecting pipe. Steel butt weld fittings to ANSI B16.9a. Steel pipe flanges and flanged fittings to ANSI B16.5.

.3 Unions shall be malleable iron with ground joints to ANSI B16.3.

.4 Thredolets or Weldolets: - Acceptable Products: Grinnell, Anvil, CCTF, Bonny Forge.

.5 Provide dielectric fittings where a buried service enters and connects to the building piping.

2.4 JOINT MATERIALS

.1 Screwed: Thread lubricant or Teflon paste.

.2 Teflon tape is unacceptable.

.3 Flanged: Full faced gasket materials to ANSI B16.20, ANSI B16.21 or ANSI B21.11, flanged steel weld neck, raised face type, carbon steel (ASTM A307) square headed bolts with hexagon nuts to ANSI B18.2.1 and ANSI B18.2.2. Bolts shall be full diameter of bolt holes.

2.5 MANUAL ISOLATION VALVES

.1 Provincial Gas Department approved and suitable for the temperature to which they are exposed.

.2 Screwed end valves up to 50 mm [2”] and flanged end valves 65 mm [2 ½”] and larger.

.3 Acceptable Products: Red & White / Toyo 5044A, Kitz 58, Homestead 601, Emco, Mueller, Rockwell, DeZurik..

2.6 PRESSURE REGULATING VALVES

.1 High tensile iron body with synthetic rubber diaphragm and valve disc.

.2 CSA listed for use in natural gas piping systems.

.3 Acceptable Products: Rockwell, Fischer.

2.7 SEISMIC ACTUATED SHUT-OFF VALVES

.1 Seismic actuated automatic shut-off valves, 20 mm to 150 mm:

.1 CSA, UL and State of California certified seismic gas shut-off valve with acceleration trigger mechanism, soft seat construction, visual open/close indicator and a manual reset capable of operating between -23°C to 65°C.

.2 The sensing means of the valve shall actuate the shut off within 5 seconds when subjected to a horizontal sinusoidal oscillation having a peak acceleration of 0.3 G (2.94 metres/second^2 [9.65 feet/second^2]) and a period of 0.4 seconds.

.3 Acceptable Products: Koso.

3 EXECUTION

3.1 PIPE JOINTING

.1 Install all piping in accordance with CSA B149.1-05, Natural Gas and Propane Installation Code.

.2 Cut pipe ends square utilizing proper pipe cutting tools. Ream pipe ends and clean scale and dirt from inside and outside the pipe before and after assembly.

.3 Protect all openings in piping and equipment, by capping or plugging to prevent the entry of dirt or debris during construction.

.4 Slope piping down in the direction of flow to low points and provide dirt legs with capped ends.

.5 Interior gas piping - screw or weld up to 50 mm ; weld 65 mm and larger.

.6 Interior gas piping located in unvented spaces, in supply or return air ceiling plenums, or operating at 35 kPa [5 psi] pressure or higher - weld all sizes.

.7 Exterior gas piping - weld all sizes except for polyethylene pipe which shall have no joints other than those allowed in CSA B149.1-05, Natural Gas and Propane Installation Code.

.8 Use welding tees to make all branch connections, except those less than half the diameter of the main. Branch connections less than half the diameter of main may be made with weldolets or threadolets.

.9 Use eccentric reducers at changes in pipe size, to provide for positive drainage.

.10 Remake all leaking joints.

.11 Do not paint dielectric isolating couplings.

.12 Provide pressure regulators and lockable shut-off valves at the discharge of the gas meter before entry into the building.

.13 Provide heat shrink factory extruded polyethylene sleeves over bare metallic pipe at welds.

3.2 CONNECTIONS TO EQUIPMENT, APPLIANCES AND SPECIALTY COMPONENTS

.1 Provide a manual isolation valve on each branch line to an individual piece of equipment, appliance and gas outlet or specialty component upstream of dirt legs, unions and flanges.

.2 Install unions or flanges on connections to all pressure regulators, equipment, appliances and specialty components.

.3 Arrange piping connections to allow ease of access and for removal of equipment.

.4 Align and independently support piping connections to prevent piping stresses being transferred to equipment.

3.3 MANUAL ISOLATION VALVES

.1 Install natural gas manual isolation valves complete with handles at the following locations:

.1 At all locations shown on the drawings.

.2 At each branch supply line from a common meter set.

.3 At the service entry point to each building immediately prior to entry.

.4 At each branch or riser connection from the main.

.5 Immediately upstream of all pressure regulating valves.

.6 At each service to each laboratory (install valves in readily accessible locations).

.7 At each service to each laboratory bench (install valves in readily accessible locations).

.2 All building isolation valves shall possess locking lugs.

3.4 SEISMIC ACTUATED SHUT-OFF VALVES

.1 Install natural gas seismic actuated automatic shut-off valves at the service entry point to each building immediately prior to entry.

3.5 PRESSURE REGULATING VALVES

.1 Install pressure regulating valves in each equipment room or at each piece of equipment where the natural gas supply pressure exceeds low pressure ("W.C.).

.2 Pipe the relief vent ports full diameter to atmosphere in accordance with the requirements of CSA B149.1-05, Natural Gas and Propane Installation Code.

3.6 NATURAL GAS OUTLETS

.1 Provide natural gas outlets at all locations shown on the drawings.

3.7 EMERGENCY GAS CONTROL VALVES

.1 Provide emergency natural gas control valves at all locations shown on the drawings.

3.8 VENT TERMINALS

.1 Terminate vent outlets to atmosphere at the following minimum lateral distances:

.1 1.5 meters from any door, openable window or building opening including building mechanical exhaust openings and louvers.

.2 3.0 meters from any mechanical forced air intake.

.2 Terminate vents with 180 degree down turn elbows complete with insect screens.

3.9 ABOVE GROUND EXTERIOR PIPING

.1 Allow for expansion with suitable anchors, guides and expansion loops to prevent undue stress on any part of the system. Rigidly fasten anchors and guides to structural members through the roof deck for roof mounted piping. Set roof supports in sheet metal gum pans wrapped into the roofing. Coordinate with the roofing subtrade.

.2 All piping shall be welded with approved flexible connectors at the point of connection to gas fired equipment.

.3 Paint exterior piping as noted above.

3.10 TESTING

.1 Pressure test all piping in accordance with CSA B149.1-05, Natural Gas and Propane Installation Code.

.2 Examine all joints for leaks and remake all leaking joints with new materials.

.3 Purge all piping after pressure tests in accordance with CSA B149.1-05, Natural Gas and Propane Installation Code.

.4 Submit copies of pressure test reports for all sections of piping.

END OF SECTION

1 GENERAL

1.1 GENERAL

.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 CODES AND STANDARDS

.1 All fixtures shall display CSA (Canadian Standards Association) approval where a CSA standard is available and in effect.

.2 Plumbing fittings shall be to CAN/CSA B125, Plumbing Fittings.

.3 Plumbing fixtures shall be to CAN/CSA B45, 'General Requirements for Plumbing Fixtures',

.4 Vitreous china plumbing fixtures shall be to CAN/CSA B45.1, 'Ceramic Plumbing Fixtures',

.5 Porcelain enamelled steel plumbing fixtures shall be to CAN/CSA B45.3, 'Porcelain Enamelled Steel Plumbing Fixtures',

.6 Stainless steel plumbing fixtures shall be to CAN/CSA B45.4, 'Stainless Steel Plumbing Fixtures'.

1.3 COLOUR

.1 Vitreous china fixtures shall be white unless otherwise noted.

.2 Stainless steel fixtures shall be satin and/or mirror finish or a combination thereof.

.3 Exposed plumbing brass and metal work shall be heavy triple chromium plated.

1.4 QUALITY

.1 Similar plumbing fixtures shall be of one manufacturer.

.2 Plumbing fixture supply brass shall be of one manufacturer unless otherwise specified.

.3 Fixtures shall be free from flaws or blemishes. Surfaces shall be clear, smooth and bright and have dimensional stability.

.4 Plumbing fixtures and trim shall be brand new unless otherwise noted.

.5 All visible or exposed parts, trim, supplies, traps, tubing, nipples escutcheons, check valves on diverter supply lines and valves to sanitary and/or kitchen fixtures shall be chrome plated finish unless otherwise noted.

.6 All fittings shall have heavy duty stems.

.7 American Standard, Crane or Kohler equivalent vitreous china fixtures are acceptable.

.8 Acorn or Willoughby equivalent security ware fixtures are acceptable.

2 PRODUCTS

2.1 WATER CLOSETS

.1 WC-1

.1 Bowl: 432 mm high vitreous china, syphon jet action, close coupled, floor mounted, closet type with elongated rim, bolt caps, insulated tank and seat bumper.

.2 Tank: vitreous china complete with fittings, flapper type flush valve, bolt down top.

.3 Supply: 9.5 mm chrome-plated angle stop closet supply with collar and escutcheon.

.4 Seat: open front, moulded solid plastic with cover and self-sustaining stainless steel hinges and plate and solid brass post insert.

.5 Acceptable products:

.1 Bowl: Crane 3954 Hymont, American Standard.

.2 Tank: Crane 3546 Deluxe Radcliffe, American Standard.

.3 Supply: Emco Ri712DL CP, Crane.

.4 Seat: Centoco, Olsonite.

.2 WC-2

.1 Bowl: 362 mm high vitreous china, syphon jet action, close coupled, floor mounted, closet type with elongated rim, bolt caps, insulated tank and seat bumper.

.2 Tank: vitreous china complete with fittings, flapper type flush valve, bolt down top.

.3 Supply: 9.5 mm chrome-plated angle stop closet supply with collar and escutcheon.

.4 Seat: open front, moulded solid plastic, self-sustaining stainless steel hinges and plate and solid brass post insert.

.5 Acceptable products:

.1 Bowl: Crane 3244 Deluxe Radcliffe, American Standard.

.2 Tank: Crane 3546 Deluxe Radcliffe, American Standard.

.3 Supply: Emco Ri712DL CP, Crane.

.4 Seat: Centoco, Olsonite.

.3 WC/LAV

.1 Combination water closet and lavatory for prison cell, floor type wall waste outlet one piece unit with welded components of 1.8 mm 304 stainless steel, anti suicide skirt, 1.8 mm vertical cabinet enclosure reinforced with 3 mm steel plate, angles and wall sleeve completely sound deadened. Exposed surfaces #4 finish.

.2 Water closet bowl: elongated, blowout type with back inlet and outlet, with integral flushing rim, complete with min. 76 mm trap seal, capable of passing a 64 mm ball and free of burrs, crevices and projections. Jet located at lowest point of upward leg trap.

.3 Lavatory top bowl: of one piece construction with perforated fast drain outlet and raised edges around rim and back, integral trap. lavatory back with keyed depression for push button escutcheon and fastened with lock nut to prevent removal from room side. Hot and cold vandal proof suicide resistant push button valves complete with lavatory spout. The water shall discharge from the suicide resistant spout in a downward direction, and not upward.

.4 Self draining soap dish, bolts, nuts and mounting angles shall be included with the unit. No exposed fasteners in room allowed, all piping concealed.

.5 Concealed penal flush meter with remote controlled cast brass adjustable flush diaphragm valve, pressure loss check, vacuum breaker, renewable seat, flush connection for 40 mm back spun and universal 25 mm I.P./copper sweat inlet wheel handle angle stop.

.6 Acceptable products:

.1 Fixture: Willoughby ECW-1806-R/L-MOD-RCMP, Acorn 1440.

.2 Flush valve: Sloan 603-1.6, Zurn Z6603-WS1.

.3 Mixing valve: Acorn, Symmons.

2.2 LAVATORIES

.1 LAV-1

.1 Basin: counter mounted porcelain on steel, self rimming, supplied on 100 mm centers.

.2 Faucet: lavatory centre set with blade handles and aerator.

.3 Waste: chrome plated cast brass offset fitting with removable grid strainer, P-trap and escutcheon. Provide insulation to the waste.

.4 Supplies: angle stop with flexible riser and escutcheon.

.5 Acceptable products:

.1 Lavatory: Crane 1-310, American Standard.

.2 Faucet: Delta Commercial Teck 21T144, Crane.

.3 Waste: Emco 32 mm offset open grid strainer c/w 32 mm cast brass CP union P-trap w/ slip joint & cleanout.

.4 Supplies: Emco CRiglgA CP.

.2 LAV-2

.1 Basin: wall hung vitreous china with low shelf back, supply openings on 200 mm oc, contoured front, shallow front with front overflow, drilled to accommodate concealed arm supports.

.2 Trim: supply fitting with gooseneck spout, aerator, 162 mm indexed blade handles.

.3 Waste: 32 mm offset waste assembly with perforated open strainer, 32 mm cast brass P-traps and escutcheons. Provide insulation to the waste.

.4 Supplies: 10 mm diameter x 300 mm long, chrome plate, 10 mm angle valve and escutcheons.

.5 Size: 530 mm wide x 603 mm front to back by 387 mm deep.

.6 Acceptable products:

.1 Lavatory: Crane 1H360S c/w Watts TCA-411-WC lavatory carrier floor supported.

.2 Trim: Delta Commercial Teck 23T344.

.3 Supplies: Emco CRigigA CP.

.4 Waste: Emco 32 mm offset open grid strainer, 32 mm cast brass CP union P-trap w/ slip joint & cleanout.

.3 LAV-3

.1 Basin: wall hung vitreous china with ledge back, supply openings on 100 mm oc, semi-oval basin, front overflow, drilled to accommodate concealed arm supports.

.2 Trim: deck mount supply fitting with 114mm long spout, aerator, single lever handle.

.3 Waste: 32 mm waste assembly with perforated open strainer, 32 mm cast brass P-traps and escutcheons. Provide insulation to the waste.

.4 Supplies: 10 mm diameter x 300 mm long, chrome plate, 10 mm angle valve and escutcheons.

.5 Size: 483 mm wide x 432 mm front to back by 368 mm deep.

.6 Acceptable products:

.1 Lavatory: Crane 1320V c/w Watts TCA-411 lavatory carrier floor supported.

.2 Trim: Delta 500-DST.

.3 Supplies: Emco CRigigA CP.

.4 Waste: Emco 32 mm offset open grid strainer, 32 mm cast brass CP union P-trap w/ slip joint & cleanout.

2.3 URINALS

.1 UR-1

.1 Wall hung vitreous china washout urinal with integral trap stainless steel strainer, and steel hangers.

.2 Valve: exposed chrome plated with integral vacuum breaker, oscillating handle and screwdriver stop.

.3 Acceptable products:

.1 Urinal: Crane 7397, American Standard.

.2 Valve: Sloan Royal #186-1.0.

2.4 JANITORS SINKS

.1 MS-1

.1 One piece moulded stone with 25 mm wide shoulders, stainless steel drain body and strainer.

.1 Size: 600 mm x 600 mm x 300 mm high.

.2 Acceptable material: Fiat TSB-l00.

.2 Trim: built-in elevated vacuum breaker, cast brass spout, 1.4 meter long rubber hose, indexed cross handles, escutcheons, union inlets, heavy cast brass spout with pail hook, braced to wall, integral stop valves.

.1 Acceptable products: Fiat 830-AA.

2.5 SHOWERS

.1 SH-1

.1 Mixing valve and shower head: pressure actuated with lever handle integral check and service stops, and shower head.

.2 Shower enclosure, single piece acrylic unit: enclosure to come with integral shelf, soap dish, drain fittings and strainer.

.1 Colour: bone.

.2 Size: 965 mm x 838 mm x 2184 mm high.

.3 Shower curtain rod with snap hooks, holdback hood, chain and end ring.

.3 Acceptable products:

.1 Shower enclosure: Fiat Model MS 3600.

.2 Mixing valve and shower head: Symmons 1-100-151X, Powers, Acorn.

.2 SH-2

.1 Shower enclosure, single piece acrylic unit: enclosure to come with integral shelf, soap dish, drain fittings and strainer.

.1 Colour: bone.

.2 Size: 965 mm x 838 mm x 2184 mm high.

.3 Shower curtain rod with snap hooks, holdback hood, chain and end ring.

.4 Acceptable product: Fiat Model MS 3600.

.2 Shower assembly: type 302 stainless steel with pushbutton operated single temperature metering valve and 9.5ℓ shower head suitable for recessed installation in concrete block wall with a stainless steel pipe space access panel.

.3 Floor drain to be cast iron body with round strainer with security screws.

.4 Acceptable products:

.1 Shower assembly: Acorn 1743-3-CSH-PBH, Willoughby.

.2 Floor drain: Zurn ZXN-415 WP, Jay R. Smith.

2.6 EMERGENCY EYE WASH

.1 Emergency Eye Wash EW-1

.1 Eyewash:

.1 Haws model 7260 wall mount eyewash unit.

.2 Includes a 275 mm diameter green ABS plastic receptor, twin Soft-Flo ABS plastic anti-surge eyewash heads with dust covers, 12 mm IPS connection, in-line strainer, 4.5 litre per minute flow control and stay open ball valve activated by a push-on stainless steel flag.

.3 Certified by CSA to meet ANSI Z358.1 Standard for Emergency Eyewash and Shower Equipment.

.4 Universal wall mount sign.

.5 Mount the receptor at heights per ANSI recommendations.

.2 Thermostatic mixing valve:

.1 Lawler thermostatic tempered water mixing valve specifically designed for emergency eye wash applications.

.2 Cold water bypass, positive shut off on cold water failure, capacity to 38 litres per minute, dial thermometers reading 0C to 50C and union angle check stops on inlets.

.3 Certified by CSA to meet ANSI Z358.1 Standard for Emergency Eyewash and Shower Equipment.

2.7 SINKS

.1 SK-1

.1 Sink: single compartment type 302 stainless steel bowl, 1.0 mm thick, self rimming, with ledge back, under-coated, go mm crumb cup strainer with cast brass locknuts and brass 40 mm tailpiece, for countertop installation with clamps.

.2 Supplies: ledge type single lever handle, swing spout, aerator, anti-clog diverter 10 mm copper inlet tubing and with hose and spray sink fitting, 203 mm centres, chrome and stainless steel finish.

.3 Waste: cast brass union P-trap with escutcheons and cleanout.

.4 Size: nominal 510 mm wide, 521 mm front to back, 178 mm deep.

.5 Acceptable products:

.1 Sink: Kindred QSL 2020/7

.2 Faucet: Waltec 25F743.

.3 Trap: American Standard GH-7000, Crane C-5103.

.2 SK-2

.1 Sink: double compartment type 302 stainless steel sink with back ledge and self-rimming edge.

.2 Faucet: deck mounted mixing faucet with swing spout aerator and indexed lever handles, with spray fitting.

.3 Waste: cast brass union P-trap with escutcheons and cleanout.

.4 Supplies: angle stops with flexible risers and escutcheons.

.5 Acceptable products:

.1 Sink: Kindred QDL 2031/8.

.2 Faucet: Waltec 25F743.

.3 Supplies: Brass Craft R-192oARGH.

2.8 MIXING VALVES

.1 TMV-1

.1 Shower valve assembly: thermostatic mixing valve complete with thermometer mounted in a stainless steel box suitable for recessed installation, with piano hinge and lockable door.

.1 Size: 340 mm x 560 mm.

.2 Acceptable products: Acorn 1752, Powers .

2.9 SOLENOID VALVES

.1 Forged brass body for potable cold and hot water service.

.2 Normally open (N.O.) valves, close when energized, open when de-energized, 120/1/60 electrical.

.3 Suitable for a maximum service temperature of 100C.

.4 Sizes as shown on the drawings.

.5 Acceptable Products: ASCO

3 EXECUTION

3.1 FIXTURE INSTALLATION

.1 Connect fixtures complete with specified trim, supplies, drains accessory piping, vented traps, stops or valves, reducers, escutcheons and fittings for the proper installation of all fixtures and their respective supply fittings.

.2 Provide necessary hangers, supports, brackets, reinforcement, steel back-up plates and floor flanges to set fixtures level and square. Mount fixtures so that 90 kilogram mass will not loosen or distort mounting.

.3 Waterclosets

.1 Water closets shall be connected to waste utilizing brass or cast iron floor flanges with lead stub or mechanical joint connections and wax seals.

.2 Polished chrome flexible supplies with metal compression rings are acceptable for tank type water closets. Supply shall incorporate 12 mm inlet x 9 mm compression outlet angle stop complete with a 300 mm long flexible riser to fixture.

.4 Lavatories and Sinks

.1 Polished chrome flexible supplies with metal compression rings are acceptable. Supply shall incorporate 12 mm inlet x 9 mm compression outlet angle stop complete with a 500 mm long flexible riser to fixture.

.2 Double waste fittings for lavatories and sinks shall be a double sanitary tee.

.3 Control handles for all two handle mixing faucets shall be positioned with the cold control on the right and the hot control on the left. Activation shall be accomplished by rotating the cold control handle clockwise and the hot control handle counterclockwise.

.4 Faucets shall be complete with nuts and tailpieces.

.5 Provide appropriate gaskets and/or sealing washers that will prevent the entry of water into fixture trim or faucet holes or punchings in millwork.

.6 Gooseneck spouts shall have a clearance of 200 mm from nozzle tip to countertop, unless otherwise specified.

.7 Plastic control handles and spouts are unacceptable.

.8 Lavatory and sink P-traps shall be complete with either a cleanout or possess slip joint connections.

.9 See drawings for sinks where P-traps are not required as a result of being indirectly connected to waste.

.5 Urinals

.1 Piping, fittings and p-traps from urinals shall not be copper; vents above the urinal rim may be copper.

.2 Urinals shall have individual wastes; double waste fittings are unacceptable.

3.2 FIXTURE TRIM HOLES OR PUNCHINGS

.1 Fixture punchings for faucets or other trim shall not contain more punchings than necessary for the specified trim.

.2 Drilling holes and cutting cutouts for the installation of plumbing fixture trim and faucets including the forming of recesses or grooves in the underside of countertops or the provision of extension pieces for faucet nipples is the responsibility of this section of the work.

3.3 WALLS AND FLOORS

.1 Fixtures mounted on glazed tile surfaces shall have ground faces to finished surface.

.2 Where plumbing fixtures come in contact with walls and floors, joints shall be sealed with Dow Corning anti-mildew 786 building sealant, made watertight and beaded smooth in a neat and workmanlike manner.

3.4 WATER HAMMER ARRESTORS

.1 Provide water hammer arrestors or shock absorbers on fixtures with flush valves and/or quick closing valves.

3.5 HANDICAP FIXTURES

.1 Water Closets

.1 Install all water closets designated for handicap use such that the top of the seat is 400 mm to 460 mm above the finished floor level.

.2 Lavatories and Sinks

.1 Offset p-traps shall be installed with the run of the P-trap parallel to and close to wall.

.2 Supplies on handicap lavatories shall be offset to accommodate the offset P-trap.

.3 P-traps and waste arms at all handicap accessible lavatories and sinks shall be insulated with a manufactured insulation kit or 12 mm of fiberglass insulation and finished with a polyvinyl chloride jacket in a neat and workmanlike manner.

.4 Acceptable Manufactured Products: Truebro 'Handi Lav-Guard', Brocar Products Inc. 'Trap Wrap', Sexauer 'Handi Lav-Guard' Plumberex 'Handy Shield'

END OF SECTION

1 GENERAL

1.1 CONFORMANCE

.1 The General Conditions, Supplements and Amendments shall govern this Division (read in conjunction with Instructions to Tenderers / Bidders). This section covers items common to all sections of Division 21, 22, 23 and is intended to supplement the requirements of Division 01.

1.2 WORK INCLUDED

.1 Provide complete, fully tested and operational mechanical systems to meet the requirements described herein, in complete accordance with applicable codes and ordinances.

.2 The word "Provide" shall mean "Supply and Install" the products and services specified. "As Indicated" means that the item(s) specified are shown on the drawings.

.3 Provide materials, equipment and plant, of specified design, performance and quality; and, current models with published certified ratings for which replacement parts are readily available.

.4 Provide project management and on-site supervision to undertake administration, meet schedules, ensure timely performance, ensure coordination, establish orderly completion and the delivery of a fully commissioned installation.

.5 Follow manufacturer's recommended installation details and procedures for equipment, supplemented by requirements of Contract Documents.

.6 The most stringent requirements of this and other mechanical sections shall govern. Should inconsistencies exist such as the drawings disagreeing within themselves or with the specifications, the better quality and/or greater quantity of work or materials shall be estimated upon, performed and furnished unless otherwise ordered by the Departmental Representative in writing during the bidding period.

.7 All work shall be in accordance with the PROJECT Drawings and Specifications and their intent, complete with all necessary components, including those not normally shown or specified, but required for a complete installation.

.8 Provide seismic restraints for all required equipment, piping and ductwork.

.9 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by the Departmental Representative. Uncrate equipment, move in place and install complete; start-up and test. Include all field assembly of loosely/separately packaged accessories

1.3 STANDARD OF ACCEPTANCE

.1 Means that item named and specified by manufacturer and/or catalogue number forms part of specification and sets standard regarding performance, quality of material and workmanship and when used in conjunction with a referenced standard, shall be deemed to supplement the standard.

.2 Acceptable Product manufacturers are listed in the list of Equipment Manufacturers in Section 23 06 03.

.3 Where two or more manufacturers are listed, the manufacturer's name shown underlined or shown with a model name and/or number was used in preparing the design. Tenders may be based on any one of those named, provided that they meet every aspect of the drawings and specifications.

.4 Where other than the underlined manufacturer or scheduled/specified manufacturer is selected or approved, include for the cost of any resulting work (both under this Division and other Divisions) and any necessary redesign of installation or structure. Submit redesign drawings for review with Shop Drawings. Maintain installation, access and servicing clearances. Redesign drawings shall be to scale and of a standard equal to the Project Drawings.

.5 Where two or more items of equipment and/or material, of the same type, are required, provide products of a single manufacturer.

.6 Install and test all equipment and material, in accordance with the detailed recommendations of the manufacturer.

.7 A visible manufacturer's nameplate shall indicate manufacturer's name, model number, serial number, capacity data, electrical characteristics and approval stamps.

1.4 TENDER INQUIRIES

.1 All contractor queries during the tender period shall be made in writing to the Departmental Representative. Contractor queries will be collected and suitable addenda will be issued for clarification. No verbal information will be issued by the Departmental Representative's office during tender. All tender queries may be e-mailed, faxed, mailed or couriered to the Departmental Representative's office. No telephone questions will be answered.

1.5 EQUIPMENT LIST

.1 Submit a completed Equipment List, showing the make of equipment and material included in the Tender, including the names of the subtrades, 10 days after the award of the Contract.

.2 The equipment list shall be a full list of materials intended for installation.

1.6 DETAILED PRICE BREAKDOWNS

.1 10 days after the award of contract submit price breakdowns on photocopies of the Price Breakdown Forms included in Section 23 06 02. Submit a separate breakdown for each section of the mechanical work listed on the Progress Claim Summary Form in Section 23 06 02.

.2 In particular cases more detail may be necessary to properly assess a change order or progress claim. This additional information, which could include all suppliers and all sub-contractors, shall be supplied when requested by the Departmental Representative.

.3 Mark-up information is required for change orders but is optional on the original tender price.

1.7 PROGRESS CLAIMS

.1 Submit with each progress claim a progress claim summary based on the Progress Claim Summary Form included in Section 23 06 02.

.2 Submit detailed price breakdowns on a photocopy of the Detailed Price Breakdown Form for each section of the mechanical work listed on the Progress Claim Summary Form and for each separate mechanical change order item exceeding $20,000.00.

1.8 SCHEDULING

.1 Coordinate with Division 1, Construction Schedule.

.2 Incorporate within the Construction Schedule, a complete and realistic schedule, integrated with, and recognizing the reliance on, other divisions of the work. Take into account the lead time for the review of operating and maintenance manuals, commissioning, verification of system operation by the Departmental Representative and the demonstration and instruction to the Departmental Representative. The schedule shall include but not limited to the following items:

.1 Installation and testing of piping systems and equipment.

.2 Installation and cleaning of duct systems and equipment.

.3 Chemical cleaning and treatment of piping.

.4 Control system installation.

.5 Air/Water balancing

.6 Connection of electrical services to equipment by electrical contractor.

.7 Start-up of mechanical equipment and systems.

.8 Check-out of control systems.

.9 Commissioning of mechanical systems.

.10 Demonstration of systems and equipment to Departmental Representative.

.11 Preparation of maintenance manuals and as-built drawings.

.12 Submission of the various documents required prior to substantial performance.

1.9 RESPONSIBILITIES

.1 Visit the site before tendering. Examine all local and existing conditions on which the work is dependent. No consideration will be granted for any misunderstanding, of work to be done, resulting from failure to visit the site.

.2 Ensure that equipment does not transmit noise and/or vibration to other parts of the building, as a result of poor installation practice.

.3 Where the Contract Documents do not contain sufficient information for the proper selection of equipment for bidding, notify the Departmental Representative during the tendering period. If clarification is not obtainable, allow for the most expensive arrangement. Failure to do this shall not relieve the Contractor of responsibility to provide the intended equipment.

.4 Examine carefully the mechanical, electrical, structural and architectural drawings and confirm that the work under this Sub-Contract can be satisfactorily carried out without changes to the building as shown on these plans.

.5 Be responsible for prompt installation of this work in advance of concrete pouring or similar work. Provide and set sleeves where required.

.6 During freezing weather, protect all materials in such a manner that no harm can be done to installations already in place and/or to materials and equipment on the job.

.7 On completion of the work, all tools and surplus and waste materials shall be removed and the work left in a clean and perfect condition.

1.10 COORDINATION

.1 Check drawings of all trades to verify space and headroom limitations for work to be installed. Coordinate work with all trades and make changes to facilitate a satisfactory installation. Make no deviations to the design intent involving extra cost to the Owner, without the Departmental Representative's written approval.

.2 The drawings indicate the general location and route to be followed by the piping and ductwork. Where details are not shown on the drawings or only shown diagrammatically, the pipes and ductwork shall be installed in such a way as to conserve head room and interfere as little as possible with the free use of space through which they pass. Service lines shall run parallel to building lines. All ducts and pipes in the ceiling shall be kept as tight as possible to beams or other limiting members at high level. All pipes and ducts shall be coordinated in elevation to ensure that they are concealed in the ceiling or structural space provided unless detailed otherwise on drawings.

.3 Work out jointly all interference problems on the site with other trades and coordinate all work before fabricating, or installing any material or equipment. Where necessary produce interference drawings showing exact locations of mechanical equipment within service areas, shafts and the ceiling space. Ensure that all materials and equipment fit into the allotted spaces and that all equipment can be properly serviced and replaced, if and when required. Advise the Departmental Representative of space problems before fabricating, or installing any material or equipment. Demonstrate to the Department of Representative on completion of the work that all equipment installed can be properly, safely serviced and replaced, if and when required. Remove and replace improperly installed equipment to satisfaction of the Departmental Representative at no extra cost. Extras for improper coordination and removal of equipment to permit remedial work shall not be allowed.

.4 When open web structural joists are used, obtain structural shop drawings to ensure adequate space is available for installation of pipes and ductwork.

1.11 HOISTS AND SCAFFOLDS

.1 Provide all necessary interior movable or roller scaffolds, platforms, lifts and ladders for the installation of the mechanical work.

1.12 FIELD REVIEW OF WORK

.1 The Departmental Representative shall review all work prior to it being concealed. All piping below ground must be reviewed prior to covering.

.2 All work shall be approved by all authorities having jurisdiction.

.3 All openings shall be sealed appropriately in particular in fire rated walls and floors. Sealing shall be inspected prior to covering.

.4 Provide minimum five (5) days notice prior to Departmental Representative Field Review.

.5 The Contractor shall provide digital photographs to the Departmental Representative of all work as requested.

1.13 PERMITS

.1 Obtain all required permits and pay all fees therefore and comply with all Provincial, Municipal and other legal regulations and bylaws applicable to the work.

.2 Arrange for inspection of all Work by the authorities having jurisdiction. On completion of the Work, furnish final unconditional certificates of approval by the inspecting authorities.

1.14 CODES, REGULATIONS AND STANDARDS

.1 Division 21, 22, 23 work shall conform to the following codes, regulations and standards, and all other codes in effect at the time of award of Contract, and any others having jurisdiction. The latest revision of each code and standard shall apply unless otherwise specified in the contract documents:

.1 Building Code

.1 National Building Code (2006).

.2 Local Building Bylaws.

.3 Energy Bylaw.

.2 Canadian Gas Association

.1 National Standard of Canada CAN/CGA-B149.1-00. - Natural Gas Installation Code.

.2 National Standard of Canada CAN/CGA-B149.2-M95. – Propane Installation Code.

.3 Canadian Standards Association

.1 CSA Standard C22.1-1998, Canadian Electrical Code.
.2 CSA Standard B51-97, Boiler, Pressure Vessel and Pressure Piping Code.
.3 CSA Standard B52-99, Mechanical Refrigeration Code.
.4 Province of British Columbia
.1 B.C. Safety Authority Power Engineers, Boiler, Pressure Vessel and Refrigeration Safety Regulation.
.2 B.C. Code Amendments, Gas Safety Act & Regulations.
.3 B.C. Industrial Health & Safety Regulations, Workers' Compensation Board of British Columbia.
.4 B.C. Fire Code 1998.
.5 SMACNA Publications
.1 H.V.A.C. Duct Construction Standards, First Edition 1985.
.2 Fire, Smoke and Radiation Damper Installation Guide, Fourth Edition 1992.
.3 Guidelines for seismic restraints of mechanical systems.

.2 Where these specifications specifically indicate requirements more onerous than the aforementioned codes, these specifically indicated requirements shall be incorporated into the work.

1.15 WARRANTY

.1 Use of installed equipment during construction shall not shorten or alter the warranty period as specified in the General Conditions.

.2 Take note of any extended warranties specified.

.3 Refer to Section 23 09 01 for Control System warranty requirements.

.4 Furnish a written warranty stating that all work executed under this Division will be free from defects of material and workmanship for a period of one (1) year from the date of substantial performance, which shall include one (1) complete summer and one (1) complete winter of uninterrupted operation. Warranty shall include any part of equipment, units or structures furnished hereunder that show defects in the works under normal operating conditions and/or for the purpose of which they were intended.

.5 The above parties further agree that they will at their own expense promptly investigate any mechanical or control malfunction, and repair or replace all such defective work, and all other damages thereby which becomes defective during the time of the guaranty-warranty.

1.16 ASBESTOS

.1 All material / products installed shall be free of asbestos.

1.17 WORKMANSHIP

.1 Workmanship shall be in accordance with well-established practice and standards accepted and recognized by the Departmental Representative and the Trade.

.2 The Departmental Representative shall have the right to reject any item of work that does not conform to the Contract Documents and accepted standards of performance, quietness of operation, finish and appearance.

.3 Employ only tradesmen holding valid Provincial Trade Qualification Certificates. Tradesmen shall perform only work that their certificate permits. Certificates shall be available for inspection by the Departmental Representative.

1.18 PERFORMANCE VERIFICATION OF INSTALLED EQUIPMENT

.1 Installed mechanical equipment whose performance is questioned by the Department of Representative, may be subject to performance verification as specified herein.

.2 When performance verification is requested, equipment shall be tested to determine compliance with specified performance requirements.

.3 The Departmental Representative will determine by whom testing shall be carried out. When requested, the contractor shall arrange for services of an independent testing agency.

.4 Testing procedures shall be reviewed by the Department of Representative.

.5 Maintain building comfort conditions when equipment is removed from service for testing purposes.

.6 Promptly provide the Departmental Representative with all test reports.

.7 Should test results reveal that originally installed equipment meets specified performance requirements, Owner will pay all costs resulting from performance verification procedure.

.8 Should test results reveal that equipment does not meet specified performance requirements, equipment will be rejected and the following shall apply:

.1 Remove rejected equipment. Replace with equipment, which meets requirements of Contract Documents including specified performance requirements.

.2 Replacement equipment will be subject to performance verification as well; using the same testing procedures on originally installed equipment.

.3 Contractor shall pay all costs resulting from performance verification procedure.

1.19 DRAWINGS AND MEASUREMENTS

.1 Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of work and are not detailed installation drawings. Do not scale the drawings. Obtain accurate dimensions from the Architectural and Structural drawings.

.2 Consult the architectural drawings and details for exact locations of fixtures and equipment. Obtain this information from the Departmental Representative where definite locations are not indicated.

.3 Take field measurements, where equipment and material dimensions are dependent upon building dimensions.

.4 Where imperial units have been indicated in brackets [ ] following the requirements in SI units, the conversion is approximate and provided for convenience. The SI units shall govern.

1.20 SHOP DRAWINGS/PRODUCT DATA

.1 Process

.1 Shop drawings/product data shall be submitted as listed in Section 23 06 03, H.V.A.C. Equipment Suppliers Schedule and as specified in Plumbing Sections.

.2 Shop drawings/product data shall be reviewed, signed and processed as described in the General Conditions, in Division 1.

.3 Installed materials and equipment shall meet specified requirements regardless of whether or not shop drawings are reviewed by the Departmental Representative.

.4 Do not order equipment or material until the Departmental Representative has reviewed and returned shop drawings.

.5 Shop drawings shall be reviewed by the General Contractor and Mechanical Sub-Contractor indicating that the shop drawings have been reviewed, co-ordinate with the work and that the shop drawings are submitted without qualifications. Shop drawings shall bear the 'reviewed' stamp dated and initialed by the General Contractor and Mechanical Sub-Contractor prior to submitting the shop drawings to the Departmental Representative. Shop drawings, which do not bear the contractors and sub-trades 'reviewed' stamp, initials and date will be rejected and sent back as 'not reviewed'.

.6 Submit samples, in addition to drawings, of all items, which in the Departmental Representative 's judgment, can be better examined for capacity, quality, finish or detail by sample rather than by drawings. Samples shall be submitted before equipment or material is ordered.

.7 If shop drawings are rejected technically after 3 submissions, the Contractor at no additional expense to the Departmental Representative shall revert to the specified product and manufacturer for this project.

.2 Content

.1 Shop drawings submitted title sheet.

.2 Data shall be specific and technical.

.3 Identify each piece of equipment.

.4 Information shall include all scheduled data.

.5 Material for maintenance and operating manuals is not suitable.

.6 Advertising literature will be rejected.

.7 The project shall be identified on each document.

.8 Information shall be given in S.I. units.

.9 The shop drawings/product data shall include:

.1 Clearly mark submittal material using arrows, underlining or circling to show differences from specified ratings, capabilities and options being proposed. Cross out non-applicable material. Specifically note on the submittal specified features such as special tank linings, pumps, seals, material, or painting.

.2 Dimensioned construction drawings with plans and sections showing size, arrangement and necessary clearances, with mounting point loads.

.3 Weights of all major equipment for review by the appropriate Departmental Representative.

.4 Mounting arrangements.

.5 Detailed drawings of bases, supports and anchor bolts.

.6 Capacity and performance characteristics indicated on performance curves for fans and pumps.

.7 Sound Power Data, where requested.

.8 Motor efficiencies on motors 1H.P. and larger.

.9 List of the manufacturers and figure numbers for all valves, traps and strainers.

.10 Control explanation and internal wiring diagrams for packaged equipment.

.11 Control system drawings including a written description of control sequences relating to the schematic diagrams. Refer to additional requirements in Section 23 09 00.

.12 Submit as a shop drawing, an electrical equipment list for any equipment supplied by the mechanical contractor or his subtrades. The list is to be submitted in a timely fashion so that the electrical contractor can utilize the list

as a final check prior to ordering motor control centres, starters, or disconnects. The list is to indicate the following:

.1 The horsepower size and number of motors.

.2 The minimum circuit amps (MCA) for packaged equipment such as roof top units.

.3 The voltage and phase of the motors.

.4 Whether or not a starter or a disconnect is included as part of the package.

.3 Format

.1 Black line prints 216 mm x 280 mm [8-1/2" x 11"] or 280 mm x 430 mm [11" x 17"].

.2 Larger drawings may be submitted on reproducible sepia with space for stamps and signatures - master set plus one working copy.

.3 An assembly of related components, e.g. grilles, registers and diffusers or radiation with sheet metal cabinets, etc. between covers with the contents, identified by model number, listed on the front cover with item identification numbers.

.4 A brochure for plumbing fixtures between covers with the contents named with model numbers listed on the front cover with item identification numbers.

.4 No. of copies

.1 Provide number of copies indicated in Section 010150 with a minimum of two (2) copies for the Departmental Representative.

.5 Coordination

.1 Where mechanical equipment requires electrical connections, power or other services, the shop drawings shall also be circulated through the Electrical Contractor (or other "services" contractor(s)) prior to submission to the Departmental Representative.

.2 Submit shop drawings and product data in accordance with Section 010150 - Shop Drawings, Product Data, Samples and Mock-ups. In addition to transmittal letter referred to in Section 010150 - Shop Drawings Product Data and Samples: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

.6 Keep one [1] copy of shop drawings and product data, on site, available for reference.

1.21 DUCT AND PIPE MOUNTED CONTROL EQUIPMENT

.1 The following automatic control equipment will be supplied by the Controls Contractor but installed by the appropriate trade sections of the Mechanical Contract:

.1 Automatic control valves.

.2 Temperature control wells.

.3 Pressure tappings.

.4 Flow switches.

.5 Automatic control dampers.

.6 Static pressure sensors.

1.22 TEMPORARY HEATING

.1 Obtain written permission from the Department of Representative if it is desired to use the plant for temporary heat.

.2 The main air handling supply units shall <u>not</u> be used for temporary heat.

.3 Use of permanent systems for temporary heat shall not modify terms of warranty.

.4 During the temporary heating period, comply with the following conditions:

.1 Maintain the systems.

.2 Lubricate all equipment operated.

.3 Operate systems only with cleaned piping systems.

.4 Maintain chemical treatment of piping systems.

.5 Keep mechanical rooms broom clean.

.6 Operate fans at proper resistance with filters installed. Change filters at regular intervals.

.7 Operate with proper safety devices and controls installed and fully operational.

.8 Where air systems are used during temporary heating, provide filter media on return and exhaust air outlets

.5 Before handing the systems over to the Departmental Representative, comply with the following conditions:

.1 Bring plant to as-new conditions.

.2 Where pumps are used for temporary heating, replace mechanical seals, regardless of condition, with new mechanical seals. All bearings for equipment used shall be checked, re-greased, oiled and cleaned to bring it back to an "As-New" condition.

.3 Replace all panel type air filters installed under this contract with new filters.

.4 Re clean ductwork and heating/cooling coils as necessary and provide a report from the approved duct cleaning agency certifying that the ductwork is clean.

1.23 TEMPORARY OR TRIAL USAGE

.1 Temporary or trial usage by the Departmental Representative of mechanical equipment supplied under this contract shall not represent acceptance.

.2 Repair or replace permanent equipment used temporarily.

.3 Repair or otherwise rectify damage caused by defective materials or workmanship during temporary or trial usage.

1.24 SPARE PARTS

.1 Provide spare parts as follows:

.1 One glass for each gauge glass installed.

.2 One set of V-belts for each piece of machinery.

.3 One filter cartridge for each filter installed (pre and final filters).

1.25 PROJECT CLOSE-OUT REQUIREMENTS

.1 The project closeout requirements are specifically listed in each section of this specification. The following is a summary of those requirements. Refer to detailed specifications in each section for further, detailed requirements. Also refer to Section 23 06 02 (Forms MF-188 and MF189) for list of required HVAC and Plumbing substantial completion submissions. Items designated with an asterisk are required to be submitted one week prior to required date of Schedule C. All life safety systems must be operational and tested and demonstrated to Departmental Representative prior to issuance of Schedule C. This includes items such as sprinklers, (as applicable).

.1 Controls:

.1 Controls system completion report (check sheets).

.2 Controls system final electrical approval certificate.

.3 As built control drawings.

.4 Control training signed off by Professional Engineer (Indicate dates of training in letter and attendance).

.5 List of control manuals and documents turned over.

.6 Printed copy of control program and database. Printed to disk in word format acceptable.

.7 Disc of control system database.
.8 Calibration report for refrigeration, carbon monoxide and CO sensors.
.9 Airflow station start up and calibration report.

.2 Heating/Cooling
.1 Boiler Inspection Branch certificate.
.2 Gas fired appliances/gas line/pressure piping certificate.
.3 Registration certificates for all pressure vessels.
.4 Pressure test reports for heating, chilled and refrigeration lines.
.5 Vibration isolation report.
.6 Seismic inspection report.
.7 Valve tag chart.
.8 As built drawings.
.9 Welding certificate and x-ray reports.
.10 Flushing and cleaning of piping report.

.3 HVAC
.1 Fire damper test report letter and schedule.
.2 As built drawings.
.3 Duct cleaning certificate.
.4 Fume hood verification/air balance

.4 Miscellaneous
.1 Identification Schedules.
.2 Demonstrations to Departmental Representative signed off by Professional Engineer.
.3 List of incomplete or deficient work prepared by each sub trade.
.4 Contractor's Letter of Guarantee
.5 Signed-off substantial completion inspection report.
.6 Power Smart documentation for VSD’s etc.
.7 List of spare parts signed off by Departmental Representative.

.5 Plumbing
.1 Final plumbing acceptance inspection report from city/municipality.
.2 Valve tag chart for plumbing system.
.3 Pressure test reports for sanitary, storm and domestic water.
.4 Back flow prevention test reports.
.5 As built drawings.

.6 O&M information.
.7 Final gas inspection acceptance inspection.
.8 Inside water service chlorination report.

.6 Sprinkler System
.1 Sprinkler material and test certificate.
.2 Sprinkler contractor's schedule 'C' letter.
.3 Final sprinkler acceptance inspection report from municipality.
.4 Valve tag chart and low point drains.
.5 Back flow prevention test reports.
.6 As built documents.
.7 O&M information. Spare sprinklers, cabinet and wrench.

.7 Manufacture start up and other reports including:
.1 Air and Water Balance.
.2 Commissioning.
.3 Fire stop letter of assurance.
.4 Boilers
.5 Heating chemical treatment.
.6 VFD's

1.26 SUBSTANTIAL PERFORMANCE REQUIREMENTS

.1 Before the Departmental Representative is requested to make an inspection for substantial performance of the work:
.1 Commission all systems and prove out all components, interlocks and safety devices.
.2 Submit a letter certifying that all work (including calibration of instruments and balancing of systems) is complete, operational, clean and all required submissions have been completed. Form MF190 in Section 23 06 02 should be used for this purpose.
.3 A complete list of incomplete or deficient items shall be provided. If, in the opinion of the Departmental Representative, this list indicates the project is excessively incomplete, a substantial completion inspection will not be performed.

.2 The work will not be considered to be ready for use or substantially complete until the following requirements have been met:
.1 All reported deficiencies have been corrected.
.2 Testing and balancing completed.
.3 Operating and Maintenance Manuals completed.
.4 "As Built" Record Drawing ready for review.
.5 System Commissioning has been completed and has been verified by Departmental Representative.
.6 All demonstrations to the Departmental Representative have been completed.
.7 All documents required on Form MF189, Section 23 06 02 have been submitted.

.3 Letters of assurance will not be issued until the following requirements have been met:
.1 All items listed in .1 and .2 above have been completed.
.2 Certificate of Fire Damper Installation (MF172).
.3 Certificate of Penetrations through separations (MF173).
.4 Gas Inspection - Certificate of inspection.
.5 Seismic Departmental Representatives letter of Assurance and final inspection report.

.6 Certificate of Substantial Performance (MF190).

.7 Signed off copy of final inspection report.

.8 Sprinkler and fire alarm test verification, sprinkler materials and test certificate and Departmental Representative's letter of Assurance.

.9 Plumbing Inspection report / card.

.10 Certificate of Backflow Prevention device.

1.27 DEFICIENCY HOLDBACKS AND DEFICIENCY INSPECTIONS

.1 Work under this Division which is still outstanding when substantial performance is certified will be considered deficient and a sum equal to at least twice the estimated cost of completing that work will be held back.

.2 It is expected that outstanding work will be completed in an expeditious manner and the entire holdback sum will be retained until the requirements for Total Performance of Division 21, 22, 23 work have been met and verified.

2 PRODUCTS

2.1 ACCESS DOORS

.1 Supply flush mounted access doors, for installation by Building Trades in furred ceilings and walls, to permit servicing of mechanical equipment and accessories, inspection of life safety or operating devices, and where specifically indicated.

.2 Unless otherwise noted, access doors shall be minimum: 450mmx450mm [18"x18"] for body entry; 300mmx300mm [12"x12"] for hand entry; 200mmx200mm [8"x8"] for cleanout access. Access doors in building surfaces shall be at least as large as duct access panels accessed through them and shall be oversized when necessary. Size to suit masonry modules when located in a masonry wall.

.3 Locate access doors so that all concealed items are readily accessible for adjustment, operation and maintenance. Locate in service and storage areas wherever possible. Do not locate in panelled, feature or special finish walls, without prior approval of the Departmental Representative.

.1 Access doors in fire separations of 3/4 hour rating, and higher, and firewalls shall have a compatible fire rating and a ULC label with tamper-proof latch, self closing.

.4 Minimum Requirements:

.1 180 degree door swing, mitred rounded safety corners flush welded, concealed hinges, screwdriver latches, and anchor straps or lugs to suit construction, all steel prime coated.

.2 Plaster or wet wall construction: 14 gauge bonderized steel flush with wall or ceiling type with concealed flange.

.1 Acceptable Product: Acudor PS-5030.

.3 Masonry or drywall construction: 16 gauge for 400 mm [16"] x 400 mm [16"] and smaller, 14 gauge for 450 mm [18"] x 450 mm [18"] and larger bonderized steel face of wall type with exposed flange.

.1 Acceptable Product: Acudor UF-5000.

.4 Tile, ceramic tile, marble, terrazzo, plaster or wet wall construction in washrooms and other special areas: 14 gauge stainless steel flush with wall or ceiling type with concealed flange.

.1 Acceptable Product: Acudor PS-5030 stainless.

.5 Acoustical tile ceiling and similar block materials: 14 gauge bonderized steel recessed ceiling type.

.1 Acceptable Product: Acudor AP-5010 or AT-5020.

.6 Feature wall construction: Recessed wall type that is selected to complement and conform with the architectural module, treatment, or panelling. The size shall conform to adjacent finishes.

.7 Access panels in fire separations and fire walls shall have a compatible fire rating and ULC label. (ie. Acudor Fire Rated FW-5050 or FB-5060).

.5 Standard of Acceptance : Zurn, Wade, Acudor, Can-Aqua, Milcor, Maxam, Van-Met.

2.2 OPERATING AND MAINTENANCE MANUALS

.1 Provide operation and maintenance data in both hard copies and electronic copies for incorporation into manual specified in Section 010150 - Operation and Maintenance Manual. Manuals to be prepared by an approved independent contractor specializing in operating and maintenance manuals.

.2 Definition: detailed information and records of individual products provided by manufacturer or supplier as part of project requirements, and of systems, describing operation and maintenance of each item.

.3 Operating data to include:

.1 Environmental and other control schematics for each system.

.2 Description of each system and its controls.

.3 Description of operation of each system at various loads together with reset schedules and seasonal variances.

.4 Operating instruction for each system and each component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.4 Maintenance data shall include:

.1 Servicing, maintenance, operating and trouble-shooting instructions for each item of equipment.

.2 Equipment manufacturer's performance data sheets.

.3 Equipment performance verification test results.

.5 Approvals:

.1 Submit 2 drafts of Operating and Maintenance Manual to Department of Representative for approval. Submission of individual data will not be accepted unless so directed by Departmental Representative.

.2 Make any changes in submission as may be required and re-submit as directed.

2.3 MAINTENANCE PROGRAM

.1 Employ the agency, which is preparing the operating and maintenance manuals, to prepare a Preventative Maintenance Program.

.2 The maintenance program shall include maintenance schedules and an equipment record card system.

.1 Maintenance Schedules

.1 The maintenance schedules shall be made up of card stock to detail preventative maintenance procedures and their required frequency (daily, weekly, monthly, quarterly, half yearly, yearly and seasonally) for each system, such as glycol/hot water heating, chilled water, condenser water, heat pump water, steam and refrigeration systems.

.2 Major items of equipment, such as boilers, chillers and cooling towers shall be listed on individual cards.

.2 Equipment Maintenance Record Cards

.1 A record card shall be prepared for each piece of equipment (including major plumbing equipment) stating its identifying name, unit number, manufacturer, model number, local supplier, serial number and all data relative to its operation and maintenance. Adequate space must be provided on each card for recording service details.

.3 After substantial performance has been declared, the agency shall visit the site, to explain and instruct the representative designated by the Departmental Representative on the use of the maintenance program.

.4 The record cards shall be suitable for filing in the existing filing system.

2.4 RECORD DRAWINGS

.1 Comply with requirements indicated in Section 010150.

.2 Maintain one set of contract drawing white prints, including all supplementary and revision drawings on site, solely for the purpose of recording, in red, any change and/or deviation from the Contract Drawings as it occurs. Include elevations and detailed locations of buried services.

.3 The set of white prints will be provided to the contractor by the Departmental Representative at the contractors cost.

.4 The marked-up set of prints shall be reviewed on site monthly by the Departmental Representative during the construction process. This review will form a requirement for approval of the monthly progress claim.

.5 Back filling shall not occur until underground services dimensions are marked on the prints,

.6 The Record Drawings shall include, but not limited to, the following changes and shall be recorded daily:

.1 Size, location, arrangement, routing and extent of ductwork, piping, terminal units, equipment, fixtures, clean-outs, valves, rough-in, etc. above and below grade inside the building and including dimensioned locations of buried piping from building walls

.2 Location of fire dampers.

.3 Location of back flow preventers.

.4 Location of water hammer arrestors.

.5 Water lines: Invert elevations to be recorded at each junction, changes of direction and every 30 m [100 ft] run.

.6 Sanitary Sewers: Invert elevations and locations to be recorded at each clean-out.

.7 Storm Drains & Sewers: Invert elevations to be recorded at each manhole, clean-out, changes of direction and every 30 m [100 ft] run.

.8 Gas Lines: Invert elevations to be recorded at each junction, at building entry point and at changes of direction.

.9 All services located below ground level and in or below a building slab.

.10 All valve stations, trap stations, coils dampers and ductwork not easily accessible.

.11 Location, tagging and numbering of all valves as specified in Section 23 05 54.

.7 CAD Drafting:

.1 Refer to Section 01020 for “Preparation of Record Drawings – Cash Allowance” for cost of preparing record drawings.

.2 Purchase a set of CAD files from the Departmental Representative. Allow a single per project cost of $500.00 for all Mechanical Project CAD files. Obtain the services of the Departmental Representative or an approved CAD draftsperson to transfer all changes to amend the CAD files in the latest version of AutoCAD.

.3 Include all details from revision drawings, addenda, and change orders. Label each drawing in the lower right corner in letters of at least 12mm [1/2"] high as follows:

.1 "AS BUILT DRAWINGS", Contractors name and date.

.4 Provide one set of check prints for review by Departmental Representative.

.5 Upon acceptance by the Departmental Representative, provide computer CAD files and one set of plots [0.03 mm mylar sepias plots].

.6 Note: The Contractor will be required to sign a standard Stantec Consulting Ltd. / Contractor agreement entitled "Authorization to Use CAD drawing files". The agreement restricts the use of the CAD files to the purpose of "as-built" only and determines the editing procedures.

3 EXECUTION

3.1 CONCEALMENT

.1 Conceal all piping, ductwork and conduit in partitions, walls, crawlspaces and ceiling spaces, unless otherwise noted.

.2 Do not install piping and conduit in outside walls or roof slabs unless specifically directed, in which case, install them with the building insulation between them and the outside face of the building.

3.2 ACCESSIBILITY

.1 Install all work so as to be readily accessible for adjustment, operation and maintenance. Furnish access doors where required in building surfaces for installation by building trades. Refer to item "Access Doors".

3.3 PIPING EXPANSION

.1 Install piping with all necessary changes of direction, expansion loops, anchors and guides so that expansion and contraction will not overstress the piping and equipment piping connections.

.2 Expansion loops shall be of all welded construction with long radius elbows; cold sprung 50% and located between anchors.

.3 Anchors shall be fabricated from mild steel plate and structural steel angle and channel sections, in accordance with ANSI B.31.

3.4 PROTECTION OF WORK

.1 Protect equipment and materials, stored or in place, from the weather, moisture, dust and physical damage.

.2 Mask machined surfaces. Secure covers over equipment openings and open ends of piping, ductwork and conduits, as installation work progresses.

.3 Equipment having operating parts, bearings or machined surfaces, showing signs of rusting, pitting or physical damage will be rejected.

.4 Refinish damaged or marred factory finish.

.5 Air systems to have air filters installed before fans are operated. Install new air filters before system acceptance.

3.5 CUTTING, PATCHING, DIGGING, CANNING AND CORING

.1 Lay out all cutting, patching, digging, canning and coring required to accommodate the mechanical services. Coordinate with other Divisions.

.2 Refer to structural drawings for permissible locations of openings and permissible opening sizes in concrete floors and walls. Openings through structural members of the building shall not be made without the approval of the Departmental Representative.

.3 Be responsible for correct location and sizing of all openings required under Division 21, 22, 23, including pipe sleeves and duct openings. Allow oversized openings for fire dampers and pipe penetrations where insulation is specified.

3.6 FASTENING TO BUILDING STRUCTURE

.1 General:

.1 Do not use inserts in base material with a compressive strength less than 13.79 MPa [2000 psi] [refer to structural drawings].

.2 All inserts supporting piping shall have a factor of safety of 5. All other inserts shall have a factor of safety of 4.

.2 Types:

.1 Cast-in-place type:

.1 Channel type - Burndy, Canadian Strut, Unistrut, Cantruss or Hilti Channel.

.2 Wedge type galvanized steel concrete insert, Grinnell Fig. 281 for up to 200 mm [8"] pipe size.

.3 Universal type malleable iron body insert, Grinnell Fig. 282 for up to 200 mm [8"] pipe size.

.4 Screw concrete insert, Grinnell Fig. 152 for up to 300 mm [12"] pipe size.

.2 Drilled, mechanical expansion type:

.1 Hilti HSL or UCAN LHL heavy duty anchor for use in concrete with compressive strength not less than 19.6 MPa [2840 psi].

.2 Hilti Kwik-Bolt or UCAN WED stud anchor for concrete. (Do not use in seismic restraint applications).

.3 Hilti HDI or UCAN IPA drop-in anchor for concrete.

.4 Hilti or UCAN Sleeve Anchor (medium and light duty) for concrete and masonry.

.5 Hilti ZBP or UCAN Zamac pin bolt (light duty) for concrete and masonry.

.3 Drilled, adhesive type:

.1 Hilti HVA or UCAN Adhesive Anchor consisting of anchor rod assembly with a capsule containing a two-component adhesive, resin and hardener.

.2 Hilti HY150 consisting of anchor rod with a 2 part adhesive system.

.3 For use in concrete housekeeping bases (in vertical downward position) where the distance to the edge of the concrete base could cause weakness if a mechanical expansion type anchor were used.

.4 Rod assemblies shall extend a minimum of 50 mm [2"] into the concrete slab below the housekeeping bases.

.3 Note:

.1 All drilling for inserts shall be performed using the appropriate tool specifically designed for the particular insert. The diameter and depth of each drilled hole shall be to the exact dimensions as specified by the insert manufacturer.

.2 Refer to manufacturer's recommendations for tightening torques to be applied to inserts.

.3 Where specifically called for, drills shall include a dust vacuum system, Hilti SAV Dust Vacuum System.

3.7 SERVICE PENETRATIONS IN RATED FIRE SEPARATIONS

.1 All piping, tubing, ducts, wiring, conduits, etc. passing through rated fire separations shall be smoke and fire proofed with ULC approved materials in accordance with CAN4-S115-M85 and ASTM E814 standards and which meet the requirements of the Building code in effect. This includes new services, which pass through existing rated separations, and also all existing services, which pass through a new rated separation or existing separations whose rating has been upgraded.

.2 Fire resistance rating of installed firestopping assembly shall not be less than fire resistance rating of surrounding assembly indicated on Architectural drawings.

.3 All smoke and fire stopping shall be installed by a qualified Contractor who shall submit a letter certifying that all work is complete and in accordance with this specification. Mechanical Form MF173 in Section 23 06 02 should be used for this purpose.

.4 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions in formed, sleeved or cored penetrations.

3.8 SERVICE PENETRATIONS IN NON-RATED SEPARATIONS

.1 All piping, tubing, ducts, wiring, conduits, etc. passing through non-rated fire separations and non-rated walls and floors shall be tightly fitted and sealed on both sides of the separation with silicon sealant to prevent the passage of smoke and/or transmission of sound. Refer to "pipe sleeve" clause in this section for packing and sealing of pipe sleeves.

3.9 PIPE SLEEVES

.1 Provide pipe sleeves for all piping passing through rated walls and floors. Sleeves to be concentric with pipe.

.2 Pipes and ducts passing through fire rated separations that have no fire resistance (non-rated separations) do not require a sleeve, but the insulation at the separation should be wrapped with 0.61 [24 ga] thick galvanized sheet steel band to which to apply the flexible caulking compound to.

.3 Pipe sleeves for floors and interior walls shall be minimum 0.61 [24 ga] thick galvanized sheet steel with lock seam joints.

.4 Pipe sleeves for perimeter walls and foundation walls shall be cast iron sleeve or Schedule 40 steel pipe with annular fin continuously welded at midpoint and protruding 150 mm [6”] beyond sleeve diameter. Annular fin shall be embedded into centre of wall.

.5 Pipe sleeves for wet or washdown floor areas such as washrooms, janitors rooms, laboratories and mechanical equipment rooms shall be Schedule 40 steel pipe.

.6 Except as otherwise noted pipe sleeves are not required for holes formed or cored in interior concrete walls or floors.

.7 Pipe sleeves shall extend 50 mm [2"] above floors in unfinished areas and wet areas and 6 mm [1/4"] above floors in finished areas.

.8 Pipe sleeves shall extend 25 mm [1"] on each side of walls in unfinished areas and 6 mm [1/4"] in finished areas.

.9 Pipe sleeves shall extend 25mm [1"] beyond exterior face of building. Caulk with flexible caulking compound.

.10 Sleeve Size: 12 mm [1/2"] clearance all around, between sleeve and pipe or between sleeve and pipe insulation.

.11 Paint exterior surfaces of ferrous sleeves with heavy application of rust inhibiting primer.

.12 Packing of Sleeves:

.1 Where sleeves pass through foundation walls and perimeter walls the space between sleeve and pipe or between sleeve and pipe insulation shall be caulked with waterproof fire retardant non-hardening mastic.

3.10 ESCUTCHEONS AND PLATES

.1 Provide on pipes passing through finished walls, partitions, floors and ceilings.

.2 Plates shall be stamped steel, split type, chrome plated, or stainless steel, concealed hinge, complete with springs, suitable for external dimensions of piping/insulation. Secure to pipe or finished surface. For all pipes passing through suspended ceilings and uninsulated piping passing through walls. Outside diameter shall cover opening or sleeve.

.3 Where pipe sleeve extends above finished floor, escutcheons or plates shall clear sleeve extension.

.4 Do not install escutcheons and plates in concealed locations.

3.11 EQUIPMENT SUPPORTS

.1 Provide stands and supports for equipment and materials supplied.

.2 Lay out concrete bases and curbs required under Division 21, 22, 23. Coordinate with Division 3. All concrete work is under Division 3.

.3 Concrete bases shall be a minimum of 100 mm [4"] thick, or as noted and shall project at least 150 mm [6"] outside the bedplate, unless otherwise directed. Bases and curbs shall be keyed to the floor and incorporate reinforcing bars and/or steel mesh. Chamfer edges of bases at 45 degrees.

.4 Equipment with bedplates shall have metal wedges placed under the edges of the bedplates to raise them 25 [1"] above the base after levelling. The wedges shall be left permanently in place. Fill the space between the bedplate and the base with non-shrink grout - Embeco or In-Pakt.

.5 Construct equipment supports of structural steel or steel pipe. Securely brace. Employ only welded construction. Bolt mounting plates to the structure.

.6 Support ceiling hung equipment with rod hangers and/or structural steel.

3.12 EQUIPMENT RESTRAINT

.1 It is the entire responsibility of equipment manufacturers 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.

3.13 EQUIPMENT INSTALLATION

.1 Provide unions and flanges to permit equipment maintenance and disassembly and to minimize disturbance to piping and duct systems and without interfering with building structure or other equipment.

.2 Provide means of access for servicing equipment including permanently lubricated bearings.

.3 Pipe equipment drains to floor drains.

.4 Line up equipment, rectangular cleanouts and similar items with building walls wherever possible.

3.14 ANCHOR BOLTS AND TEMPLATES

.1 Supply anchor bolts and templates for installation by other divisions.

3.15 MISCELLANEOUS METAL

.1 Be responsible for all miscellaneous steel work relative to Division 21, 22, 23 of the Specifications, including but not limited to:

.1 Support of equipmen.

.2 Hanging, support, anchoring, guiding and relative work as it applies to piping, ductwork, hot water storage tanks, expansion tanks, fans and mechanical equipment.

.3 Earthquake restraint devices - refer to Section 23 05 49.

.4 Access platforms, ladders and catwalks.

.5 Pipe anchor and/or support posts.

.6 Ceiling ring bolts - secure to structure or steel supports.

.2 All steel work shall be prime and undercoat painted ready for finish under Division 9. Refer to drawings for details.

3.16 FLASHING

.1 Flash and counterflash where mechanical equipment passes through weather or water proofed walls, floors, and roofs.

.2 Flash, vent and soil pipes projecting 75 mm [3”] minimum above finished roof surface with lead worked 25 mm [1”] minimum into hub, 200 mm [8”] minimum clear on side with minimum 600 x 600 mm [24” x 24”] sheet size. For pipes through outside walls turn flange back into wall and caulk.

.3 Flash floor drains over finished areas with lead 250 mm [10”] clear on sides with minimum 900 x 900 mm [36’” x 36”] sheet size. Fasten flashing to drain clamp device.

.4 Provide curbs for mechanical roof installations 200 mm [8”] minimum high above roof insulation. Flash and counterflash with galvanized steel, soldered and made waterproofed.

.5 Provide continuous lead or neoprene safes for built-up mop sinks, and shower stalls located above finished rooms. Solder at joints, flash into floor drains and turn up 150 mm [6”] into walls or to top of curbs and caulk into joints.

3.17 DIELECTRIC COUPLINGS

.1 On all "OPEN" systems provide wherever pipes of dissimilar metals are joined.

.2 Provide insulating unions for pipe sizes NPS 2 and under and flanges for pipe sizes over NPS 2.

.3 Provide felt or rubber gaskets to prevent dissimilar metals contact.

.4 Standard of Acceptance: Capital, Walter Vallet, EPCO.

3.18 LUBRICATION OF EQUIPMENT

.1 Lubricate all new equipment prior to being operated, except sealed bearings, which shall be checked.

.2 Use the lubricant recommended by the manufacturer for the service for which the equipment is specified.

.3 Extend lubricating connections and sight glasses to the outside of housings, where lubricating positions are not readily accessible.

.4 Submit a check list, showing that all operated equipment has been lubricated prior to and during any temporary heating period and the demonstration and instruction period.

3.19 PAINTING

.1 Clean exposed bare metal surfaces supplied under Division 21, 22, 23 removing all dirt, dust, grease and millscale. Apply at least one coat of corrosion resistant primer paint to all supports and equipment fabricated from ferrous metal.

.2 Paint all pipe hangers and exposed sleeves, in exposed areas, with a rust inhibiting primer, as they are installed.

.3 Repaint all marred factory finished equipment supplied under Division 21, 22, 23, which is not scheduled to be repainted, to match the original factory finish.

.4 Propane gas and fire protection piping shall be painted for identification purposes over their entire lengths throughout all exposed areas and in the mechanical room(s) as follows:

.1	Gas: Yellow	C.G.S.B.	505-101
.2	Fire: Red	C.G.S.B.	509-102

.5 Coordinate with Division 9.

.6 Painting of all equipment and materials, supplied under Division 21, 22, 23, installed in mechanical equipment areas and inside finished areas of the building or exposed outside the building, is included under Division 9 of the Specification.

.7 Painting by Division 9 shall be in accordance with the following Colour Schedule for Mechanical Equipment Areas:

Item	**Primer (Note **)**	**Colour Finish**
Air Handling Units	1. Damp-proof Red 2. Zinc Chromate	Grey
Air Compressor, Bases and motors	1. Damp-proof Red 2. Zinc Chromate	Blue
Boiler Shells and Boiler Control Panels	1. Damp-proof Red 2. Zinc Chromate	Blue
Boiler Heads and Ancillaries thereon	1. Damp-proof Red 2. Zinc Chromate	Aluminum (high temp.)
Boiler Supports	1. Damp-proof Red 2. Zinc Chromate	White
Breeching (uninsulated)	Red Primer	Aluminum (high temp.)
Catwalks and Ladders	1. Damp-proof Red 2. Zinc Chromate	Grey
Ductwork, Plenums and Miscellaneous Steel		

Item	Primer (Note **)	Colour Finish
• not galvanized	1. Damp-proof Red 2. Zinc Chromate	Grey
• galvanized	Clear blue undercoat	White (2 coats)
• plenum access doors and 200 mm around doors	Clear blue undercoat	Grey
Exposed Misc. Metal (supplied under this contract)	1. Damp-proof Red 2. Zinc Chromate	To be determined on site
Fan Casings and Bases	1. Damp-proof Red 2. Zinc Chromate	Grey
Fire hose cabinets and sprinkler control cabinets		Painted inside and out to match wall finish or as determined by Architect.
Guards – Belt and Coupling	1. Damp-proof Red 2. Zinc Chromate	To match equipment
Handrails	Red Primer	Aluminum
Insulation Covering (on piping, tanks, heat exchangers, breeching, etc.)	White Primer	White
Motors (electric)		To match associated quipment
Piping (uninsulated)		
• fire lines (standpipes, sprinklers)	Red Primer	Red
• gas (natural)	Red Primer	Yellow
• safety valve vents (steam)	Red Primer	Aluminum (high temp.)
• services other than above	Red Primer	White
Pot Feeders (Chemical)	Red Primer	Aluminum
Pump Bodies (uninsulated) and bases		Blue
Tanks (steel), Air Receivers and Supports	1. Damp-proof Red 2. Zinc Chromate	White
Tanks (galvanized) and Supports	1. 3269 Primer 2. 3286 Grey	White
Valve Bodies (uninsulated)		
• services other than above	Red Primer	To match associated piping

Note ** 1. denotes first primer coat and 2. denotes second primer coat.

3.20 EQUIPMENT PROTECTION AND CLEAN-UP

.1 Protect equipment and material in storage, on site and after installation until final acceptance. Leave factory covers in place. Take special precautions to prevent entry of foreign material into working parts of piping and duct systems.

.2 All mechanical equipment stored on site shall be kept in a dry, heated and ventilated storage area.

.3 Thoroughly clean piping, ducts and equipment of dirt, cuttings, and other foreign material.

.4 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.

.5 Provide, install and maintain 30% efficient temporary filters to return and exhaust air openings from ceiling spaces to prevent air born dust from entering ducts, plenums and coils. Install filters to return air grilles when fans are operated and building is not at a clean condition.

3.21 START-UP

.1 Before starting the plant, provide a certificate stating that the plant is ready for start-up and the following conditions have been met. (See forms in Section 23 06 02).

.1 All safety controls installed and fully operational.

.2 Qualified personnel available to operate the plant.

.3 Permanent electrical connections made to all equipment.

.4 Boiler(s) started up and adjusted by manufacturer's representatives.

.5 All air filters installed.

.6 Pump and fan drives properly aligned by a journeyman millwright.

.7 All mechanical equipment rooms, including plenums, vacuum cleaned.

3.22 DEMONSTRATION AND INSTRUCTION TO OPERATING STAFF

.1 Provide certified personnel to demonstrate plant operation and to instruct operating staff on operation of mechanical equipment. Provide maintenance specialist personnel to instruct operating staff on maintenance and adjustment of mechanical equipment and any changes or modification in equipment made under terms of guarantee.

.2 The demonstration shall include:

.1 Operation and sequencing of all automatic control dampers and automatic temperature control devices.

.2 Operability of randomly selected fire dampers.

.3 Operation and maintenance requirements of all equipment and systems under each mode of operation including:

.1 Automatic controls including air compressors.

.2 Glycol heating system.

.3 Fire protection systems.

.4 Fans.

.5 Coils.

.6 Pumps.

.3 Provide instruction during regular work hours prior to acceptance and turn-over to operating staff for regular operation.

.4 Use Operating and Maintenance manuals for instruction purposes.

.5 Submit the proposed instructional agenda for approval.

.6 Finalize demonstration and instructions by obtaining a signed statement from the Departmental Representative that the demonstration and instructions have been given satisfactorily. Forms in Section 23 06 02 should be used for this purpose.

END OF SECTION

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 QUALITY ASSURANCE

.1 Motors shall be UL listed and CSA certified.

.2 Full Voltage Start Applications:

.1 All motors shall be in accordance with NEMA standards, and CSA C390-93, or the latest version insofar as it is applicable. Motors also shall comply with the applicable portions of the Canadian Electrical Code.

.3 Variable Frequency Drive and soft start applications:

.1 All motors shall be in accordance with NEMA standards (MG-1) Part 31, and inverter duty class, or the latest version insofar as it is applicable. Motors also shall comply with the applicable portions of the Canadian Electrical Code.

.2 Motors connected to VFD(s) shall be wound using inverter spike resistant magnet wire capable of 1600V.

.4 The noise level of each motor shall comply with NEMA standards, less than 80 dBA at 1 meter.

1.3 SUBMITTALS

.1 Submit data of test method used and motor efficiencies with shop drawings.

2 PRODUCTS

2.1 ELECTRIC MOTORS - GENERAL

.1 Provide motors for mechanical equipment as specified.

.2 Unless noted otherwise, provide open drip-proof, ball or roller bearing motors with grease fittings.

.3 Motors shall have standard voltage ratings consistent with the project distribution voltages. Motors less than 1/2 H.P. to be 120 volt, 60 cycle, single-phase power. Motors 1/2 H.P. and larger to be 3 phase power and for the scheduled voltage. Confirm electric voltage, phase and starter requirements with the electrical specification.

.4 All motors shall be designed and manufactured to operate with ±10% voltage and ±5% frequency variations of the nameplate ratings. Combined voltage and frequency variation shall not exceed ±10%.

.5 Motors will be rated for a 1.15 service factor in a 40°C ambient environment.

.6 All motors to be standard 1800 RPM unless specifically scheduled otherwise.

.7 Provide all motors with terminal boxes, suitable for power connections.

.8 Provide screw adjustable bases on all belt-connected motors.

.9 Motors to be of the capacitor start type when they may be manually cycled from a starting switch, which is located in the finished space.

.10 Motors exposed to outdoor temperature to be lubricated with lubricants suitable for operation at 6 deg. C. below the lowest temperature recorded by ASHRAE or the Climatic Information (Supplement to the National Building Code), for the location in which they are installed.

2.2 ELECTRIC MOTORS – ENERGY EFFICIENT

.1 All Motors, 1 H.P. motors and larger, shall be energy efficient design and have a minimum and nominal full load efficiency, which will meet or exceed the values listed in accordance with IEEE

Test Procedure 112, Method B. Also see table below. The minimum efficiency shall be guaranteed. See table below for minimum efficiencies.

HP	Energy Efficient - Minimum Efficiency (%)		
	3600 RPM 2 Pole	1800 RPM 4 Pole	1200 RPM 6 Pole
1	75.5	82.5	80.0
1.5	82.5	84.0	85.5
2	84.0	84.0	86.5
3	85.5	87.5	87.5
5	87.5	87.5	87.5
7.5	88.5	89.5	89.5
10	89.5	89.5	89.5
15	90.2	91.0	90.2

2.3 ELECTRIC MOTORS – PREMIUM EFFICIENT

.1 All motors shall be provided with premium efficiency classification with non-wicking leads, class 'B' for O.D.P. motors (pumps only) and class 'F' for TEFC motors insulation (minimum).

.1 Premium efficiency open drip-proof motors shall have the following typical full load efficiencies (nominal):

HP	Premium Efficient - Minimum Efficiency (%)		
	3600 RPM 2 Pole	1800 RPM 4 Pole	1200 RPM 6 Pole
1	80.0	85.5	82.5
1.5	84.0	86.5	86.5
2	85.5	86.5	87.5
3	86.5	89.5	88.5
5	91.0	89.5	90.2
7.5	88.5	91.0	92.4
10	90.2	91.7	91.7
15	91.0	93.0	92.4

.2 Premium efficiency totally enclosed fan cooled motors shall have the following typical full load efficiencies (nominal).

HP	Premium Efficiency - Minimum Efficiency (%)		
	3600 RPM 2 Pole	1800 RPM 4 Pole	1200 RPM 6 Pole
1	N/a	86.5	81.5
1.5	85.5	85.5	86.5
2	85.5	85.5	87.5
3	87.5	88.5	88.5
5	89.5	89.5	89.5
7.5	91.0	91.7	91.7
15	91.7	92.4	91.7
10	91.7	91.7	91.7

Acceptable Manufacturers - premium efficient motors: Hyundai Crown Triton Series Inverter Shield, TEFC, Premium Efficiency; Marathon Electric XRI Series, ODP, Premium Efficiency.

2.4 BELT DRIVES

.1 Provide belt drives to the following requirements:

.1 Provide steel, cast iron or aluminum sheaves for motors less than 3/4 H.P.

.2 Provide steel or cast iron sheaves keyed to shafts, for motors 3/4 H.P. and larger.

.3 For motors less than 10 H.P. provide standard adjustable pitch drive sheaves having +/- 10% range. Use mid-position of range for specified RPM.

.4 For motors 10 H.P. and larger, provide fixed pitch drive sheaves with split tapered bushing and keyway. Provide final drive sheaves of size to suit final balancing.

.2 Match drive and driven sheaves.

.3 V-belts shall conform with the American Belt Manufacturers standards. Multiple belts shall be matched sets.

.4 Not less than a 2-belt configuration is required for each drive for motors 3/4 H.P. and larger.

.5 Synchronous (Poly Chain GT) belt drives shall be used on all motors 10HP and larger.

.6 Minimum drive rating shall be 150% of nameplate rating of motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Motor slide rail adjustment baseplate with double draw bolt, shall allow for centre line adjustment.

.8 Tension belts to manufacturers recommendations before start up and after 100 hours of operation using calibrated belt tensioning gauge.

.9 Provide one spare set of belts for each piece of equipment with each belt separately identified for the equipment item to be served.

2.5 SHAFT COUPLINGS

.1 Shaft couplings shall be of the pin or jaw neoprene insert type, gear type, or flexing steel insert type and shall allow coupling inserts to be easily removed without disassembly of the equipment.

2.6 GUARDS

.1 Provide removable protective guards on all exposed V-belt drives and shaft couplings in accordance with Worker's Compensation Board requirements.

.2 Guards for drives shall have:

.1 1 mm [18 ga.] expanded metal screen welded to 25 mm [1"] steel angle frame.

.2 1.5 mm [16 ga.] thick galvanized sheet metal tops and bottoms.

.3 Removable side[s] for servicing.

.4 38 mm [1-1/2"] dia. holes on both shaft centres for insertion of tachometer.

.5 Sectionalize if necessary so one man can handle removal.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Fabricate and install belt guards for V-belt drives to permit movement of motors for adjusting belt tension and for belt slap.

.5 Provide removable "U" shaped guards for flexible couplings with 2.5 mm [12 ga.] thick galvanized frame and 1.2 mm [18 ga.] thick expanded mesh face.

.6 Provide guards on all unprotected fan inlets and outlets. Guards to be provided by fan manufacturer.

.7 Prime coat guards and finish paint to match equipment.

.8 Secure guards to equipment allowing for ease of removal.

3 EXECUTION

3.1 ELECTRIC MOTORS

.1 Unless otherwise noted starters and protection devices will be included under the Electrical Division of the Specification.

.2 Assist Division 26 to ensure proper connection, correct thermal overload protection and correct motor controls.

.3 Where starters are included in this Division as an integral part of packaged equipment, they shall contain thermal overload protection in all ungrounded lines.

.4 Equipment, which has more than one voltage rating, shall be fed from a single power source through a disconnect switch.

.5 If delivery of specified motor will delay delivery or installation of any equipment, install an acceptable motor for temporary use. Final acceptance of equipment will not be given until specified motor is installed.

3.2 SETTING AND ALIGNMENT

.1 Employ a journeyman millwright to align all V-belt drives and/or shaft coupling drives prior to initial start up. The millwright shall also check that centrifugal fan wheels are properly centered on fan shafts.

.2 Align shaft couplings, using a dial indicator, to within +/-0.051 mm [0.002"] after grouting is complete and the piping system is operational.

.3 Align V-belt drives using a straight edge.

.4 Submit a certificate from the millwright employed, certifying that all shaft couplings and V-belt drives have been aligned and centrifugal fan wheels centered prior to initial start up and checked again after final system balance adjustment.

END OF SECTION

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 SCOPE

.1 Flexible pipe connections.

.2 Expansion joints and compensators.

.3 Pipe loops, offset and swing joints.

1.3 REFERENCE STANDARD

.1 Conform to Standard of "Expansion Joint Manufacturers Association" and manufacturer's recommendations.

1.4 SHOP DRAWINGS

.1 Product data shall include manufacturer; model number; pressure and temperature rating; axial, lateral, angular movement handled; nominal size and dimensions; details of construction and assembly.

1.5 GENERAL REQUIREMENTS

.1 Examine piping layout and notify the Departmental Representative of additional anchors or expansion joints required to adequately protect system.

.2 Make provision for expansion and contraction of all pipe work. All piping shall be anchored and supported in such a manner that strain and/or weight does not come upon any apparatus and pipe branch connections. Expansion joints and compensators shall be installed and guided as per manufacturer's recommendations. All equipment shall be connected with unions or flanges to provide for easy removal. Where piping passes through walls or floor slabs, the sleeves shall be of sufficient size to accommodate the expansion and the pipe insulation without binding or crushing the insulation, or preventing the expansion of the piping.

2 PRODUCTS

2.1 FLEXIBLE HOSES - BRAIDED

.1 Phosphor bronze convoluted bellows with braided bronze sleeve or stainless steel convoluted bellows with braided stainless steel sleeve.

.2 Suitable for system operating temperature and pressure.

.3 Connections:

- .1 NPS 2 and under, screwed connections.
- .2 NPS 2-1/2 and over, flanged connections.

.4 Length shall be as recommended by manufacturer, unless noted otherwise.

.5 Acceptable Products:

- .1 Flexonics Flex Con, Flextech Industries, Hydro Flex, Keflex, Vibra-Flo.

2.2 FLEXIBLE PIPE CONNECTORS

.1 Flexible pipe connectors complete with control rods, manufactured from polyester tire cords and bridge bearing quality neoprene or EPDM; cover and liner to CSA Standard CAN3-S6-M88, Section 11.5.8.3. Provide flanges, bolts, etc. for outdoor installation. Do not make attachments between equipment and piping other than on equipment side of flexible connector.

.2 Twin sphere design with reinforcing ring.

.3 Suitable for a maximum temperature of 40oC [140oF] (chilled and condenser water systems only).

.4 Safety factor for burst and flange pullout shall be a minimum of 3:1.

2.3 EXPANSION JOINTS

.1 Bellows Type:

.1 Application: for axial, lateral or angular movements.

.2 Bellows type, corrugated, packless.

.3 Designed for maximum operating pressure and temperature of 1034 kPa and 115oC

.4 Internalstainless steel guide sleeves.

.5 External machined cast iron control rings, full circumference.

.6 With external guide rods.

.7 Welded ends.

.8 Shrouds over external surfaces for insulation.

.9 Two sets of alignment guides on each side of expansion joint, spaced to manufacturers recommendations, complete with guiding cylinder and base, cast or fabricated spider.

.10 Departmental Representative reserves right to compress one or more of each size of joint to its solid height to ensure that nameplate traverse is met. After which, joint shall be expanded to its shipping face to face dimension and rechecked hydrostatically. On joint failing, joints shall be removed as unacceptable.

.11 Acceptable Products:

.1 Adsco, Anaconda, Flexonics, Hydro-Flex, Tube Turns, United Flexible, Vibra-Flo

.2 Sleeve Type

.1 Application: for axial movement.

.2 Slip type, located centrally between two anchors without bases.

.3 Designed for 1034 kPa.

.4 Sleeve ends bevelled for welding.

.5 With drip connections.

.6 Accessories to permit repacking under full line service from one side.

.7 Two sets of alignment guides on each side of expansion joint, spaced to manufacturer's requirement.

.8 Acceptable Products:

.1 Badger, Flexonics, Tube Turn, Yarway.

2.4 ANCHORS

.1 Anchors shall be fabricated from mild steel plate and structural steel angle and channel sections, in accordance with ANSI B.31.

.2 Anchors shall securely attach piping to structural members. Size the anchors to accommodate the forces due to the pipe expansion and weight.

.3 Where bolts secure anchor to the structure, weld the bolts to the plate. Arrange anchors so that bolts are in shear not in tension.

.4 Provide anchors on both sides of expansion devices, as indicated on the drawings, and as required to control the flexing of the piping system.

2.5 GUIDES

.1 Pipe alignment guides shall be Hyspan Series 9500 or equal. Size to accommodate pipe insulation.

3 EXECUTION

3.1 INSTALLATION

.1 Install all piping systems with due regard and provision for expansion avoiding strain or damage to equipment and building. Pay particular attention to piping running horizontal across building expansion joints and provide adequate expansion and contraction for all such piping.

.2 Only major expansion configuration and fittings have been shown on the drawings. Provide all required additional compensators, loops and swing connections.

.3 Where necessary provide 2 pipe guides per side of expansion joint or expansion loop so that movement takes place along axis of pipe only.

.4 Install expansion loops, cold sprung 50% of the calculated expansion.

.5 Install at least three [3] elbows in all branch connections. Where space does not permit 3 elbows, install braided flexible pipe connectors in accordance with manufacturers recommendations. Three [3] elbow branch connections shall have sufficient developed length to ensure that excessive stresses are not generated in the piping and in no case less than 900 mm [36"].

3.2 EXPANSION JOINTS

.1 Install expansion joints, where shown on the drawings, in strict accordance with the manufacturers detailed installation instructions.

.2 Take care to be aware of the temperature at which the expansion compensator is installed to properly establish the length.

.3 Ensure that expansion joints are not damaged during hydrostatic testing.

.4 The piping shall be tested hydrostatically with the expansion joints in place using cold water.

.5 Bellows Type:

.1 Install a union at one end of each screwed expansion joint.

.2 Remove slippage bolts and spacers after installation.

.3 Locate expansion joint[s] centrally between anchors and position guides to manufacturers specific requirement. Provide structure as required to properly mount guides.

.4 Ensure that piping is properly aligned through expansion joint[s], over the full travel.

.5 Adjust the installed length of the expansion joint[s] to suit the ambient temperature at the time of installation.

.6 Sleeve Type:

.1 Locate expansion joint[s] centrally between anchors and position guides to manufacturer's specific requirement. Provide structure as required to properly mount guides.

.2 Set and secure base, if base mounted. Provide structure as required.

.3 Ensure that piping is properly aligned through the expansion joint[s], over the full travel.

.4 Adjust the installed length of the expansion joint[s] to suit the ambient temperature at the time of installation.

.5 Pack the joint[s] for service.

3.3 FLEXIBLE HOSES - BRAIDED

.1 Install braided flexible hoses where shown on the drawings and as the flexible connections to designated heating/cooling terminal units.

.2 On screwed connections, install a union on one end.

.3 Take care not to torque the hose.

.4 Ensure braided flexible hoses are not damaged during hydrostatic testing.

END OF SECTION

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 PRODUCTS

2.1 FLOW MEASURING DEVICES - LIQUID

.1 Flow measuring device, to be sized to provide a readout signal between 2488 and 9954 Pa [10" to 40" W.G.].

.2 Where the required minimum straight pipe lengths cannot be provided for in-line devices, use elbow or venturi type devices.

.3 Each element shall be complete with instrument shut-off valves with finger tight connections and identification tag and chain.

.4 Each element shall be c/w a chained metal tag showing element size, location, volume, and differential signal.

.5 Acceptable Products:

.1 Elbow Type - Measurell.

.1 NPS 2 and under: cast bronze elbow, screwed ends, 860 kPa [125 psig].

.2 NPS 2-1/2 and over: steel elbow, welded ends, 860 kPa [125 psig].

.3 Schedule 40: all fluids closed circuit.

.2 In-line type - Verabar, Accutube, Flo-Probe, Preso, Valitube.

.1 NPS 1-1/2 and under: Verabar, Model C050 series, Schedule 40 pipe nipple with factory installed sensing probe.

.2 NPS 2 and over: Verabar, Model C100 series, standard insert sensor with 12 mm [1/2"] threaded weld coupling.

.3 Venturi type - Gerand, Preso.

.1 NPS 2 and under: brass screwed.

.2 NPS 2-1/2 and over: cast iron or steel, flanged, butt-welded or roll grooved couplings where permitted.

.6 Provide a direct readout dial type meter complete with connecting hoses, and calibration charts to read the measured flow. Flow meter shall be calibrated in Pascals or mm of water column and shall be suitable for water/glycol. Calibrate for water systems and provide correction data for 50% 40% glycol.

.1 Acceptable Products:

.1 Eagle Eye, Gerand, Preso, Western Meter Model SCL101.

2.2 FLOW MEASURING DEVICES - LIQUID (ELECTRONIC OUTPUT)

.1 All flow meters shall be manufactured by Annubar. Model No. 1151DP consisting of flow sensor, transducer, gauges, mounting flange and all accessories.

.2 Accuracy shall be plus or minus 0.2% of calibrated span and ± 1% zero error per 1310F. Permanent pressure loss shall not exceed 25% of the pressure differential reading. Accuracy shall be constant to turndown ratio 25 to 1. Flow fitting shall be diamond shape.

.3 Each flow fitting shall be complete with an identification tag, conversion chart, quick disconnect gauge fittings and shut-off cocks.

.4 One differential meter shall be complete with hoses, shut-off fittings, bleed valves and carrying case.

.5 Flow meters shall be selected for the temperature and pressure of installation. Transducer shall be selected for maximum pressure drop range.

3 EXECUTION

3.1 FLOW MEASURING DEVICES - LIQUID

.1 Install the flow measuring devices in the piping circuits to establish the operational flow rates. Measuring devices shall be located where shown on the drawings.

.2 Install in accordance with the manufacturer's installation instructions and in the correct size of pipe. Reduce pipe size as required. Particular attention to be paid to required upstream and downstream straight pipe lengths.

.3 Install isolating globe, ball or needle valves with 6 mm (1/4") male end SAE flare connection on pressure tapping connections.

.4 Provide and install quick-connect gauge couplings.

END OF SECTION

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 PRODUCTS

2.1 GENERAL

.1 Select thermometers and pressure gauges so that their operating range falls in the middle half of the scale range.

2.2 THERMOMETERS - PIPING

.1 Acceptable Manufacturers:

.1 Marsh, Moeller, Trerice, Weiss, Weksler, Winters.

.2 Minimum Requirements:

.1 All thermometers to be in accordance with Canadian General Standards Board CGSB 14.4 - M88.

.2 Pipe mounted stem type - mercury actuated, adjustable angle type.

.3 Refer to flow schematics for location of pipe mounted thermometers and wells.

.3 Case:

.1 Stem type - cast aluminum alloy, either anodized or coated with baked enamel. The case shall be provided with a clear glass or heat resistant plastic window.

.4 Scale:

.1 Stem type - 225 mm [9"] scale length.

.2 White background with temperature range in black.

.3 Dual Celsius and Fahrenheit scale.

2.3 THERMOMETERS - DUCT/PANEL MOUNTED

.1 Acceptable Manufacturers:

.1 Marsh, Moeller, Trerice, Weiss, Weksler, Winters.

.2 Minimum Requirements:

.1 All thermometers to be in accordance with Canadian General Standards Board CGSB 14-GP-2a.

.2 Duct mounted dial type - solid liquid filled with remote capillary element.

.3 Panel mounted dial type (surface) type - vapour filled direct mounting.

.4 Panel mounted dial type (flush) type - remote liquid filled capillary element.

.3 Case:

.1 Dial type - cast aluminum, black enamel steel or stainless steel with stainless steel or chrome-plated face ring.

.4 Scale:

.1 Dial type - nominal 115 mm [4-1/2”] unless otherwise indicated.

.2 White background with temperature range in black.

.3 Dual Celsius and Fahrenheit scale.

2.4 PRESSURE GAUGES - PIPING

.1 Acceptable Manufacturers:

.1 Marsh, Moeller, Trerice, Weiss, Weksler, Winters.

.2 Minimum Requirements:

.1 All gauges to be in accordance with ANSI B40.1 Grade "A" level.

.2 115 mm [4-1/2"] cast aluminum, black steel or stainless steel case, with stainless steel or chrome plated face ring.

.3 White background with pressure range in black.

.4 Dual kilopascal and psig scale.

.5 Phosphor bronze bourdon tube, silver brazed tip and socket 1/4" NPT lower connection.

.6 Rotary type bushed movement, silicone dampened to prevent pointer oscillation.

.7 Gauges to be registered with Provincial Boiler and Pressure Vessel Safety Branches with CRN number.

.8 ULC listed for use on fire protection systems.

.9 Accuracy shall be 1% off full scale over the middle half of the scale.

.3 Accessories:

.1 Install a needle valve ahead of each gauge.

2.5 TEST PLUGS FOR PRESSURE / TEMPERATURE

.1 Provide 6mm [1/4"] NPT solid brass test plug fitting c/w brass chain where indicated.

.2 Test plugs shall be capable of receiving either a pressure or temperature 3mm [1/8"] O.D. Dual seal core shall be Nordel suitable for temperature of 177oC [350oF] and shall be rated zero leakage from vacuum to 6895kPa [1000psi).

.3 Provide 1 master test kit containing 2 - test pressure gauge of suitable range, 1 gauge adaptor 3mm [1/8"] O.D. probe and 2 - stem pocket testing thermometers of suitable range.

.4 Acceptable Products:

.1 Sisco P/T Plugs.

.2 Flow Design - Superseal.

2.6 TEST THERMOMETER

.1 Hand over a test thermometer in protective case to the Departmental Representative during the Departmental Representative's Demonstration and Instruction Period. Provide the same make and type as the permanently installed thermometers suitable for use with pipe mounted wells. Range 0 deg. C. to 115 deg. C. [30 deg. F. to 240 deg. F.].

.2 Obtain two signed receipts from the Departmental Representative certifying that the test thermometer has been received. Hand one over to the Departmental Representative.

2.7 THERMOMETER WELLS

.1 For copper pipe use copper or bronze. For steel pipe use brass, separable socket, 3/4 NPT.

.2 Thermowell to be registered with Provincial Boiler and Pressure Vessels Safety Branch with CRN number.

3 EXECUTION

3.1 GENERAL

.1 Install thermometers and gauges so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading thermometers and gauges.

.2 Install engraved lamicoid nameplates as specified in (Section 23 05 53 - Identification) identifying medium.

3.2 THERMOMETERS

.1 Install the separable well so as to minimize the restriction to flow and, if necessary, install in a section of oversized pipe.

.2 Install wells where indicated for use with test thermometers.

.3 Install in locations as indicated and on inlet and outlet of:

- .1 Water heating and cooling coils.
- .2 Water boilers.
- .3 Chillers - condenser and chilled water.

.4 Use extensions where thermometers are installed through insulation.

3.3 PRESSURE GAUGES

.1 Install in following locations:

- .1 Suction and discharge of pumps.
- .2 Upstream and downstream of PRV's.
- .3 Inlet and outlet of waterside of coils (excluding terminal unit coils).
- .4 In other locations as indicated.

.2 Use extensions where pressure gauges are installed through insulation.

.3 Where a single gauge is used to measure multiple points provide needle valves to isolate each point, including pressure gauge.

END OF SECTION

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 Refer to Section 23 05 49 for required seismic restraint of piping.

1.2 GENERAL

.1 Provide hangers and supports to secure equipment in place, prevent vibration, protect appropriate against damage from earthquake, maintain grade, provide for expansion and contraction and accommodate insulation.

.2 Provide insulation protection saddles on all insulated piping.

.3 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP58.

.4 Set inserts in position in advance of concrete work. Use grid system in equipment rooms.

.5 Support from (top of) structural members. Where structural bearings do not exist or inserts are not in suitable locations, suspend hangers from steel channels or angles. Provide supplementary structural members, as necessary.

.6 Do not suspend from metal deck.

.7 Hangers for copper pipe shall be copper plated or plastic dipped unless pipe hangers bear on piping insulation (cold services).

2 PRODUCTS

2.1 UPPER ATTACHMENTS

.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.

.3 Drilled concrete insert shall be Hilti Model HSL or HVA.

.4 All inserts shall be ICBO approved. Use only ICBO design load ratings.

.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 - Grinnell/Anvil fig. 60.

.2 Cold piping NPS 2-1/2 and larger and all hot piping: steel washer plates with double locking nut, carbon steel clevis and malleable iron socket - 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.

2.2 MIDDLE ATTACHMENTS (ROD)

.1 Carbon steel black (electro-galvanized/cadmium plated for mechanical rooms) continuous threaded rod - Grinnell/Anvil fig. 146 or Myatt fig. 434.

2.3 PIPE ATTACHMENTS

.1 Cold piping, steel or cast iron: hot piping steel, with less than 25 mm [1"] horizontal movement; hot piping, steel, with more than 300 mm [12"] middle attachment (rod) length: adjustable clevis - Grinnell/Anvil fig. 260.

.2 Cold copper piping; hot copper piping with less than 25 mm [1"] horizontal movement; hot copper piping with more than 300 mm [12"] middle attachment (rod) length: adjustable clevis copper plated - Grinnell/Anvil fig. CT-65.

.3 Suspended hot piping, steel and copper, with horizontal movement in excess of 25 mm [1"]; hot steel piping with middle attachment (rod) 300 mm [12"] or less; 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, steel and copper: 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.

2.4 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized carbon steel - Grinnell/Anvil fig. 261 or Myatt fig. 182.

.2 Copper pipe: carbon steel copper finished - Grinnell/Anvil fig. CT-121.

2.5 SADDLES AND SHIELDS

.1 Cold piping NPS 2 and under: protection shield with pipe insulation under shield with uninterrupted vapour barrier – Kingspan “K Block” – high density insulation

.2 Cold piping NPS 2-1/2 and over: protection shield with high density insulation under shield with uninterrupted vapour barrier – Kingspan “K Block” – high density insulation.

.3 Hot piping NPS 3 and under: insulation over pipe hanger.

2.6 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 - Burndy, Canadian Strut, Cantruss or Unistrut - (arrangement to be acceptable to B.C. Boiler Inspection Department).

2.7 FLOOR SUPPORTS

.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. Refer to Section 23 05 49 Seismic Restraints.

3 EXECUTION

3.1 HANGER SPACING

.1 Spacing and middle attachment (rod) diameter as specified in paragraphs below or as in table below, whichever is more stringent.

.1 Plumbing piping: most stringent requirements of the Plumbing Code or authority having jurisdiction.

.2 Fire protection: to applicable fire code; toggle hangers are unacceptable.

.3 For Gas Piping refer to Gas Code CAN/CGA-B149.1.

.4 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

.5 Within 300 mm [12"] of each horizontal elbow, tee, joints, etc.

.2 Maximum hanger spacing table.

Pipe Size: NPS	Rod Diameter mm [ins]	MAXIMUM SPACING Steel Pipe m [ft]	Maximum Spacing Copper Pipe m [ft]
½	10 [3/8]	1.8 [6]	1.5 [5]
¾, 1	10 [3/8]	2.4 [8]	1.8 [6]
1¼ , 1½	10 [3/8]	3.0 [10]	1.8 [6]
2	10 [3/8]	3.0 [10]	3.0 [10]
2½ , 3, 4	12 [1/2]	3.0 [10]	3.0 [10]
5, 6, 8	16 [5/8]	3.0 [10]	

3.2 HANGER INSTALLATION

.1 Offset hanger so that rod is vertical in operating position.

.2 Adjust hangers to equalize load.

.3 Install hanger to provide minimum 12 mm [½"] clear space between finished covering and adjacent work.

.4 Support vertical piping at every other floor.

.5 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.6 Where practical, support riser piping independently of connected horizontal piping.

.7 Install plastic inserts between steel studs and piping.

.8 For beam clamps, extend hanger rod tight to underside of beam with top bolt and washer.

3.3 INSERTS

.1 Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

.2 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying piping over 100 mm (4”) or ducts over 1500 mm (60”) wide.

.3 Where concrete slabs form finished ceiling, finish inserts, flush with slab surface.

.4 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square plate and nut above slab, in concealed locations.

.5 Provide a test mock up for review.

.6 Provide inserts for above pumps to permit equipment servicing. Provide an eyebolt.

.7 Inserts shall be installed in accordance with manufacturers recommendations and in no case closer than 2.1 m (7 ft.) apart.

END OF SECTION

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 Provide vibration isolation on all motor driven equipment, piping and ductwork such that noise transmitted to occupied space by any other path than airborne is less than airborne noise transmitted from mechanical space to occupied space. The following are considered minimum requirements to meet this criterion.

1.2 REGULATORY REQUIREMENTS

.1 Supply isolators and seismic restraints meeting the structural requirements of the 2006 National Building Code cluding Section 4.1.8.17 with respect to seismic snubbers, or provide equivalent requirements where integral seismic restraint is provided in isolators / bolting.

.2 Include 1998 British Columbia Building Code Section Vancouver By-Law 6.2.1.9(2). Vibration isolator housings are considered a safety guard with respect to isolated equipment and any contained compressed springs. Include "Fail Safe" seismic restraint in all vibration isolation designed to hold mechanical equipment and springs in place.

1.3 SHOP DRAWINGS, QUALIFICATIONS AND SUBMITTALS

.1 Anchorage of all equipment shall be certified by a B.C. registered professional structural engineer who specializes in seismic restraint of resiliently mounted systems. All seismic integral isolation mounts or snubbers shall be O.S.H.P.D. (Office of Statewide Health and Planning Department – State of California) approved and the associated OSHPD number clearly indicated on the seismic device. Where OSHPD certification is not available for a particular restraint device, results of tests consistent with OSHPD procedures and approvals shall be submitted and certified by a B.C. registered professional structural engineer.

.2 Obtain all relevant equipment information and provide shop and placement drawings for all vibration isolation elements and steel bases for review before materials are ordered.

.3 Provide attachment to both the equipment and the structure meeting the specified forces involved. Attachment details to the structure to be reviewed by the structural Departmental Representative for the project.

.4 Submit samples of materials required to complete the work of this section for inspection and review, if and when requested.

1.4 GENERAL

.1 Provide vibration isolation on all motor driven equipment with motors of 1/2 HP and greater power output (as indicated on the motor nameplate) and on piping and ductwork, as specified herein. For equipment less than 1/2 HP, provide vibration isolation grommets at the support points.

.2 Provide seismic restraint for all equipment including all seismic restraint related hardware (bolts and anchors) from point of attachment to equipment through to and including attachment to structure. The required anchors shall be indicated on the shop drawings and shall be clearly identified for the correct location and so as to be readily identified after installation. Provide clear instructions for their installation. Refer to Section 23 05 49, Seismic Restraints.

.3 Place isolators under equipment so that the minimum distance between adjacent corner isolators is at least equal to the height of the centre of gravity of the equipment. Include height of centre of gravity on shop drawings. Otherwise, design for increased forces on the supports, and submit design calculations with shop drawings for approval. In particular, provide chiller isolation meeting this requirement.

.4 Ensure isolation systems have a vertical natural frequency no higher than one third of the lowest forcing frequency, unless otherwise specified. Use dynamic stiffness correction factors for elastomers and do not exceed 60 durometer.

.5 Isolators and restraining devices, which are factory supplied with equipment, shall meet the requirements of this section. Isolation supplier to check with pump supplier for number and location of isolators and if there is a requirement for structural or inertia bases.

.6 Provide concrete inertia bases or structural steel bases, where specified or required by equipment manufacturers, located between vibrating equipment and the vibration isolation elements, unless the equipment manufacturer certifies direct attachment capabilities. Coordinate with Division 3 for the provision of concrete work.

.7 Coordinate with Division 3 for the provision of housekeeping pads at least 100 mm [4"] high under all isolated equipment, or greater thickness where specified. Provide at least 300 mm [12"] clearance between drilled inserts and edge of housekeeping pads. Housekeeping pads to be tied to structure with reinforcement to meet Code seismic requirements.

.8 For isolated equipment, design anchors, bolts, isolators and bases to meet Code requirements. For larger isolators, where the Code requirement cannot be met by the isolator housing, provide Type 6 seismic snubbers or Type 6P where post-disaster requirement is specified.

.9 Use ductile materials in all vibration and seismic restraint equipment.

.10 Follow structural engineer instructions for drilled inserts re: installation of anchors.

.11 Coordinate with Section 23 33 00 "Duct Connectors – Vibration Isolation" for all ductwork connections to fans or plenums.

.12 Provide flexible connectors between equipment and piping where required by manufacturers to protect equipment from stress and reduce vibration in the piping system. Meet connector manufacturer's installation specifications as well as equipment manufacturer's requirements.

.13 Coordinate with Electrical Division 16 [26] for the provision of a minimum 180^{o} hanging loop of flexible conduit for all electrical connections to isolated equipment.

.14 Supply all isolators fully assembled and clearly labelled with full instructions for installation by the contractor.

2 PRODUCTS

2.1 ISOLATORS - GENERAL

.1 Supply all of the vibration isolation equipment by one approved supplier with the exception of isolators, which are factory installed and are standard equipment with the machinery. Confirm with manufacturer that these factory-installed isolators meet the seismic requirements of this specification.

.2 Select isolators at the supplier's optimum recommended loading and do not load beyond the limit specified in the manufacturer's literature.

.3 Design springs in accordance with the Society of Automotive Engineer Handbook Supplement 9 entitled "Manual on Design and Application of Helical and Spiral Springs - SAE - 1975". Provide neoprene isolators and components using maximum 60 duro "Bridge bearing quality neoprene", as defined by CSA Standard CAN3-S6-M78 Section 11.10. Ensure design of isolation and restraint elements allows adequate clearance to avoid binding.

.4 Design springs "iso-stiff" (kx/ky = 1.0 to 1.5) with a working deflection between 0.3 and 0.6 of solid deflection.

.5 Provide hot dipped galvanized housings and neoprene coated springs, or other acceptable weather protection, for all isolation equipment located out of doors or in areas where moisture may cause corrosion.

2.2 ISOLATORS - TYPE 1, PADS

.1 Neoprene or neoprene / steel / neoprene pad isolators. Select Type 1 pads for a minimum 2.5 mm [0.1"] static deflection or greater. Use hold down bolts selected for seismic loads. Isolate bolts from base of unit using neoprene hemi-grommets. Avoid over-compressing grommets (e.g. use Hilti HVA adhesive set bolts, or equal, with steel washers and lock nuts, adjusted finger tight to the hemi-grommets). Size bolt and hemi-grommet for minimum lateral clearance. Use grommets only on light-weight equipment.

.2 Standard of Acceptance:

.1 Mason WMW, Super W pads

.2 Mason Industries Type HG Hemi-Grommets

.3 EAR Grommets

2.3 ISOLATORS - TYPE 4, HANGER MOUNTS

.1 Spring hangers, c/w 6 mm [1/4"] thick neoprene cup/bushing sized for 1.3 mm [.05"] minimum deflection, or neoprene hangers.

.2 Standard of Acceptance:

.1 Mason HD, HS.

2.4 PIPE RISER GUIDE / ANCHOR - TYPE 8

.1 Telescoping all direction acoustical pipe anchor consisting of two concentric steel tubes separated by 12 mm thick neoprene isolation material. Hot application isolators.

.2 Standard of Acceptance:

.1 Mason ADA and VSG (H).

.2 Generator exhausts, PRV stations, etc - CMT VA 50247/25 Cushions, CMT W302 isolators.

2.5 FLEXIBLE CONNECTORS – TYPE 9

.1 Twin sphere flexible connectors with floating flanges c/w control rods

.2 Standard of Acceptance:

.1 Mason MFTNC Connector.

.2 Mason ACC Control Cables.

2.6 CONCRETE INERTIA BASES

.1 Concrete inertia bases to be a minimum of 1.5 times the weight of the isolated equipment. Generally base thickness shall be 1/12 of the longest dimension of the base, but not less than 150 mm [6"]. Include with base a steel channel concrete form with required steel reinforcement (as determined necessary by suppliers' registered professional engineer). Provide additional steel as required by sleeves or inserts to receive equipment anchor bolts.

.2 Use height saving brackets in all mounting locations to maintain a 35 mm [1-1/2"] clearance below the base.

.3 Bases to be furnished with built-in motor slide rails. Motor location as specified/scheduled.

.4 Standard of Acceptance:

.1 Mason type K.

2.7 STEEL BASES

.1 Construct structural steel bases sufficiently rigid to keep deflection and misalignment within acceptable limits as determined by the equipment manufacturer.

.2 Use height saving brackets in all mounting locations to provide a base clearance of 35 mm [1-1/2"].

.3 Bases to be furnished with built-in motor slide rails. Motor location as specified/scheduled.

.4 Steel bases supplied as integral part of equipment to be supplied meeting the above requirements.

.5 Standard of Acceptance:

.1 Mason type WF.

3 EXECUTION

3.1 INSTALLATION

.1 Execute the work in accordance with the specifications and, where applicable, in accordance with the manufacturer's instructions and only by workmen experienced in this type of work.

.2 For all equipment mounted on vibration isolators, provide a minimum clearance of 50 mm [2"] to other structures, piping, equipment, etc.

.3 Before bolting isolators to the structure, start equipment and balance the systems so that the isolators can be adjusted to the correct operating position before installing (seismically rated) anchors and/or welding.

.4 After installation and adjustment of isolators verify deflection under load to ensure loading is within specified range and isolation is being obtained.

.5 Where hold down bolts for isolators or seismic restraint equipment penetrate roofing membranes, provide "gum cups" and sealing compound to maintain waterproof integrity of roof. Ensure sealing compound is compatible with isolator components such as neoprene. Co-ordinate with roofing section of specifications and with roofing subcontractor.

.6 Use Type 1 pads only where specified.

.7 Select Type 4 spring hangers for a minimum static deflection of 25 mm [1"] for all ceiling hung fans, and air handling units, emergency generator exhaust piping and silencers, steam PRV's and any other vibrating sources.

.8 Provide Type 4 resilient hangers on all piping, tanks, etc. connected to a vibrating source, if the piping is in excess of NPS 1-1/2 dia. Provide the hangers for a distance of 6.0 m [20 ft] for a NPS 2 pipe and 12 m [40 ft] for a NPS 10 pipe and chiller pipes. Isolate other pipe sizes for a proportionate distance. Isolate all piping serving cooling tower and chiller, including air-cooled chillers.

.9 Isolate pumps and axial fans rotating at more than 1170 RPM on type 2 isolators.

.10 Use the lowest RPM scheduled for two-speed equipment in determining isolator deflection.

.11 Provide concrete inertia bases on base mounted pumps unless pump manufacturer certifies that inertia base is not required. Only use a pedestal support at pump intake pipe where inertia or steel base is large enough to support pedestal. Otherwise support piping using resilient hangers only.

.12 Provide concrete inertia bases on centrifugal fans where specified.

.13 Ensure that pumps are installed and aligned such that no piping loads are imposed on the pump. Pumps and piping should be independently supported and aligned prior to final connection.

.14 Where ductwork, piping or boiler exhaust stacks, etc., connected to or serving noise generating equipment, is routed through walls, floors, piping chases, etc. position ductwork, piping, stacks, etc. to avoid contact with the concrete structure, future framing, drywall and other finishes which may radiate noise. Use Type 2 and Type 8 mounts. Submit proposed details to meet this requirement. This requirement includes piping from cooling tower, chiller and emergency generator exhaust.

.15 Make no connections between mechanical room equipment and drywall partitions, adjoining occupied spaces. Mount all equipment designed for wall mounting on non-critical, block work or concrete walls. Connect hangers to concrete structure only. Where structure is steel, connect to major structural beams only, or to structural angles with gussets attached to concrete shear walls. Do not attach to light framing members such as OWSJ's. Do not connect to edge of beam flange (e.g. with clips). Weld nut or threaded sleeve to bottom flange at centre, directly below web, to accommodate threaded hanger rod.

.16 Provide Type 8 resilient elements in pipe anchors, where pipe anchors are within 12 m [39 ft.] of a vibrating source or if located in pipe chases.

.17 Be responsible for ensuring that flexible duct connections (see Section 23 33 00) are installed with a minimum of 40 mm [1-1/2"] metal-to-metal gap. Use flanges to ensure that flexible connectors are clear of the airstream.

.18 Isolate variable frequency drive controller using isolators or soft grommets such that structure borne noise transmission to occupied space is less than airborne noise transmission. Controller supplier to provide all isolation, including wiring connections, to control flanking noise transmission. Provide isolation meeting all seismic requirements.

.19 Provide stabilizing springs limiting movement at flexible connections to 25% of fabric width under steady state conditions and 40% at start up.

.20 Slab on grade mounted equipment: For equipment mounted on a slab on grade mount on type 2 isolators unless otherwise specified.

.21 Pumps: Mount in-line pumps on two (2) Type 2 isolators under each support foot.

3.2 INSPECTIONS

.1 The supplier shall provide assistance to the contractor as necessary during the course of installation of isolation equipment.

.2 The supplier shall inspect the complete installation after system startup and establish that the isolators for each piece of equipment are properly installed and adjusted. Correct any mal-performance. The supplier shall submit a statutory declaration to the Departmental Representative stating that the complete vibration isolation installation is installed in accordance with his drawings and instructions and operates to his satisfaction. Form MF175 in Section 23 06 02 should be used for this purpose.

END OF SECTION

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 REGULATORY REQUIREMENTS

.1 Restraints shall meet the requirements of the National Building Code Section e.g. 2006 article 4.1.8.17.

1.3 SEISMIC RESTRAINT DESIGN AND INSPECTION

.1 Arrange and pay for the services of a B.C. registered professional structural engineer who specializes in the restraint of building elements. This structural engineer, herein referred to as the seismic engineer shall provide all required Engineering services related to seismic restraints of non-vibration isolated equipment, ductwork and piping as indicated below.

.2 The seismic engineer shall provide assistance to the contractor as necessary during the course of restraint of equipment, ductwork and piping.

.3 The seismic engineer shall inspect the completed seismic installation and shall submit a statutory declaration to the engineer stating that the complete seismic installation is installed in accordance with his drawings and instructions and it complies with the regulatory requirements. Form MF174 in Section 23 06 02 should be used for this purpose. Prior to substantial performance, the seismic engineer shall provide letters of assurance for all mechanical, plumbing and fire protection systems.

1.4 SUBMITTALS

.1 Submit shop drawings of all restraining devices, not covered in the SMACNA Guidelines, including details of attachment to the structure, either tested in an independent testing laboratory or approved by a B.C. registered professional engineer.

.2 Proposed inserts or connections to structure to follow directions of project structural engineer.

1.5 APPLICATION

.1 Provide cable restraints on all isolated equipment and seismic restraint on all other equipment, piping and ductwork, all in general accordance with SMACNA Guidelines (see Products).

1.6 SCOPE OF WORK

.1 Provide restraint on all piping, ductwork, equipment and machinery, which is part of the building mechanical service systems to prevent injury or hazard to persons and equipment and to retain equipment in its normal position in the event of an earthquake. This specification covers equipment, which is not specifically covered in SMACNA.

.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 When equipment is mounted on concrete housekeeping pads, and / or concrete curbs the anchor bolts shall extend through the pad into the structure.

.4 It is the entire responsibility of equipment manufacturers 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.

.5 Seismic restraints may only be omitted where permitted by SMACNA.

2 PRODUCTS

2.1 GENERAL

.1 Mason Type SCB (Seismic Cable Brace) slack cable restraints supplied by Vibra-Sonic Control.

.2 Restraint systems as indicated in 1998 SMACNA "Seismic Restraint Manual Guidelines for Mechanical Systems" (second edition), Seismic Hazard Level SHL A. If lesser restraint than recommended by SMACNA SHL A is proposed to meet local Code seismic requirements, provide shop drawings of details certified by a B.C. registered structural engineer.

3 EXECUTION

3.1 GENERAL

.1 It is the responsibility of the contractor to ascertain that an appropriate size device be selected for each individual piece of equipment.

.2 The following are guidelines for some items not covered in SMACNA but certified shop drawings should still be submitted. Note that this list is not intended to cover all equipment requiring restraints.

3.2 AIR TERMINALS

.1 Where air terminals are installed in mechanical grid ceilings, provide at least two 12 ASWG galvanized steel wire seismic security bridles per air terminal tied either to the building structure or to ceiling hanger wires.

.2 Attach security bridles at opposite corners of each air terminal and in such a manner that the air terminal cannot fall.

.3 Provide all necessary brackets for attachment of security bridles to the air terminals.

3.3 RADIANT CEILING PANELS.

.1 Provide 12 ASWG galvanized steel wire seismic security bridles from radiant ceiling panel cross brace to building structure or to ceiling hanger wires at maximum 1200 mm [4 ft.] O.C.

3.4 NON-ISOLATED FLOOR MOUNTED EQUIPMENT

.1 Bolt all non-isolated equipment and machinery, e.g. floor mounted tanks, heat exchangers, boilers, etc. to the structure. Design anchors and bolts for seismic force applied horizontally through the centre of gravity. For equipment, which may be subject to reasonances, use a nominal 2.0g seismic force.

3.5 ISOLATED PIPING AND EQUIPMENT

.1 Install cables using appropriate grommets, shackles, and other hardware to ensure alignment of the restraints and to avoid bending the cables at connecting points.

.2 Connect slack cable restraints to ceiling hung equipment in such a way that the axial projection of the wires passes through the centre of gravity of the equipment.

.3 Orient restraint wires on ceiling hung equipment at approximately 90 degrees to each other (in plan), and tie back to the ceiling slab at an angle not exceeding 45 degrees to the slab.

.4 On piping systems, provide transverse slack cable restraints at a maximum spacing of 12 m [40 ft] and longitudinal restraints at 24 m [80 ft] maximum spacing, or as limited by anchor/slack cable performance. For pipes greater than NPS10, reduce transverse restraint spacings to 6.0 m [20 ft]. Small pipes may be rigidly tied to big pipes for restraint, but not the reverse.

.5 Transverse bracing for one pipe section may also act as longitudinal bracing for the pipe connected perpendicular to it, provided the bracing is installed within 600 mm [24”] of the elbow or T, and if the connected pipe is the same or smaller in size. Do not use branch lines to restrain main lines.

.6 Provide flexibility in piping joints or sleeves where pipes pass through building seismic or expansion joints.

.7 At vertical pipe risers, wherever possible, support the weight of the riser at a point or points above the centre of gravity of the riser. Provide lateral guides at the top and bottom of the riser, and at intermediate points not to exceed the transverse spacings discussed above for horizontal pipes, with guide clearance not exceeding 3 mm [1/8”].

.8 Vary adjacent spacing of restraints on a piping run by 10% to 30% to avoid coincident resonances.

.9 Install restraints at least 50 mm [2"] clear of all other equipment and services.

.10 Adjust restraint cables such that they are not visibly slack, or such that the flexibility is approximately 40 mm [1-1/2"] under thumb pressure for a 1.5 m [5 ft] cable length (equivalent ratio for other cable lengths). Adjust the clearance at cable strap/spacer piece restraints to not exceed 6 mm [1/4"].

.11 Provide transverse and axial restraints as close as practical to a vertical bend.

.12 At steel trusses, connect to top chords and follow truss manufacturer's instructions.

.13 The maximum spacing between transverse and longitudinal restraints for piping and ductwork shall be 25% less than specified in SMACNA for SHL A.

END OF SECTION

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 EQUIPMENT IDENTIFICATION

.1 Manufacturer's Nameplates

.1 Each piece of manufactured equipment shall have a metal nameplate, with raised or recessed letters. Mechanically fasten plate to equipment.

.2 Manufacturer's nameplates shall indicate manufacturer's name, equipment model, size, serial number and electrical characteristics and pertinent information for any other services connections.

.3 Include ULC, (Underwriters' Laboratories Canada) or CSA, (Canadian Standards Association) registration logos and those of other agencies, as required by the respective agencies.

.4 Nameplates shall be located so that they are easily read. Do not insulate or paint over nameplates.

.2 System Nameplates

.1 Each piece of equipment shall be identified with its equipment schedule identification, e.g. supply fan SF-1, pump P-1.

.2 Identification letters shall be 50 mm [2"] high black letters on a white background, sized to suit the label or, provide laminated plastic plates with black face and white centre of minimum size 90 mm x 40 mm x 2.5 mm [3-1/2" x 1-1/2" x 3/32"] engraved with 6 mm [1/4"] high lettering. Use 25 mm [1"] high lettering for major equipment.

.3 Apply nameplates securely in conspicuous places, on cool surfaces.

.4 Identify systems, and areas or zones of building being serviced.

1.3 PIPING IDENTIFICATION

.1 Piping Identification

.1 Each piping system shall be colour coded for identification and labelled with the system identification code letters, including temperature and pressure, if applicable, and directional flow arrows in accordance with the Pipe Identification Colour Schedule. See diagram for sizes of lettering and bands.

.2 Identify piping (pipe markers and direction arrows) at the following locations:

.1 Adjacent to major valves and where valves are in series at no more than 2 m [6'-6"] intervals.

.2 At least once in each room and at 15 m [50 ft.] maximum spacing in open areas. Exception: gas piping to be identified at 2 m [6'-6"] intervals in ceiling plenums.

.3 On both sides where piping passes through walls, partitions and floors.

.4 Adjacent to all major changes in direction.

.5 At point of entry and leaving each pipe chase and/or confined space and piping accessible at each access opening.

.6 At the beginning and end points of each run; and, at each piece of equipment in each run.

.3 Identification labels may be stencilled. Identification arrows labels and letters may be vinyl cloth (Brady B500) or vinyl film (Brady B946), with adhesive compatible with the surface temperature.

.4 Identification colour bands for primary and secondary colours to indicate the type and degree of hazard shall be applied to overlap a minimum of 150 mm [6"]. Ends to be stapled. Bands shall be Brady B550 vinyl cloth tape or Brady B946 vinyl tape, with adhesive compatible with the surface temperature.

.2 Valve Tags

.1 Provide valve identification tags and secure them using non-ferrous chain braided band or plastic band (suitable for temperature). Tags may be of brass, aluminum, metalphoto, lamicoid or fiberglass, stamped or engraved, of 25 mm [1"] minimum diameter.

.2 Valves to be tagged include:

.1 Valves on all main piping circuits.

.2 Valves on all major branch lines.

.3 Valves on minor branch lines in horizontal service spaces, vertical service spaces and mechanical equipment rooms.

.4 DO NOT TAG valves on control valve stations, fixture stops, system drain valves.

.5 Drain valves and hose bibbs on systems containing glycol.

.6 Control valves.

.3 Schedule the valve numbers using a sequential numbering system indicating location, service and normal position (open or closed). Numbers shall be prefixed by the letter "P" or the letter "H" indicating that the valve is on plumbing or heating service.

1.4 DUCTWORK IDENTIFICATION

.1 Identify plenum access doors as to accessed items, e.g. Filter F-1, Supply Fan SF-1.

.2 Stencil on all plenum doors, downstream from air filter bank. "Do not open when fan operating".

.3 Identify all ductwork in mechanical equipment rooms to denote system and/or zone served and an air flow direction arrow.

.4 Identify automatic control dampers concealed in ductwork. Identify the "open" and "closed" position of the operator arm on the outside of the duct or duct insulation.

.5 Identification letters shall be 50 mm [2"] high black letters on white background. Flow arrows shall be 50 mm [2"] wide by 150 mm [6"] long black arrows on a white background. Stencil over final finish only.

1.5 CEILING ACCESS IDENTIFICATION

.1 Secure 6 mm [1/4"] self adhesive coloured dots, (Brady Quik Dots or Avery Data Dots), to the ceiling, to identify the location of access to equipment concealed above the ceiling according to the following schedule:

	Colour
Concealed equipment and cleaning access	Yellow
Control equipment, including control valves, dampers and sensors	Black
Fire and smoke dampers	Red
Fire protection including sprinkler equipment including drains	Red
Heating, DCW, DHW isolation valves	Green
Pipe mounted equipment, other than fire, smoke and sprinkler equipment	Green

.2 When T-bar ceilings are installed adhere coloured dots to T-bar framing, adjacent to panel to be removed.

1.6 DUCT ACCESS IDENTIFICATION

.1 Secure 50 mm [2"] high, Gothic style self-adhesive stick on-letters, (Letrasign or Brady Quick-Align) on duct access panels to identify their usage, according to the following schedule:

	Colour	**Letters**
Cleaning and service access	black.	C.A
Controls including sensors	black	C
Dampers, (backdraft, balance and control)	black	D
Fire dampers	red	F.D.

1.7 TAGGING IDENTIFICATION

.1 Secure engraved laminated plastic identification tags (black face and white centre) on the following items:

.1 Temperature control instruments, gauges and panels, coordinated with control diagrams identification.

.2 Electrical switchgear supplied under the Mechanical Division 15 [21, 22, 23].

.3 Refer also to the Controls Section.

1.8 IDENTIFICATION SCHEDULES

.1 Submit schedules of the following for review, prior to framing:

.1 Pipe Identification Colours.

.2 Valves.

.3 Ceiling Access Identification Colours.

.4 Duct Access Identification Colours.

.2 Schedules will be required in each major mechanical room and at least one schedule will be required on each floor having a minor mechanical room. Frame schedules under glass in matching frames and hang where directed.

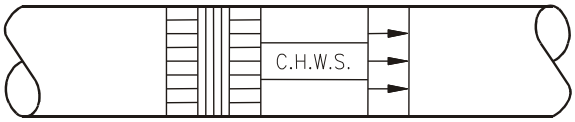
.1 Include one copy of schedules in each operating and maintenance manual.

1.9 PIPE IDENTIFICATION COLOUR SCHEDULE

Service	**Identification Lettering**	**Primary Colour**	**Secondary Colour**
Ammonia	Amm.	yellow	magenta
Boiler Blow Off Piping	-	yellow	black
Boiler Blowdown	-	yellow	black
Boiler Feed Water	B.F.W.	yellow	black
- open spaces	CO2	red	white
- confined spaces	CO2	red	yellow
Cold Water Service	C.W.	green	-
Domestic H.W. Recirc.	D.H.W.R.	yellow	black
Domestic H.W. Supply	D.H.W.S.	yellow	black
82°C [180°F]	82°C [180°F]		
Domestic H.W. Supply	D.H.W.S.	yellow	black
60°C [140°F]	60°C [140°F]		
Fire lines W.S.	W.S.	red	white
Glycol Heating Return	GLR - do not drain	yellow	black
Glycol Heating Supply	GLS - do not drain	yellow	black

Service	Identification Lettering	Primary Colour	Secondary Colour
Heat Recovery (cool)	HRC - do not drain	yellow	black
Heat Recovery (warm)	HRW - do not drain	yellow	black
Hot Water Return	H.W.R.	yellow	black
Hot Water Supply	H.W.S.	yellow	black
Propane	LP GAS	yellow	orange
Sprinkler lines	S.P.R.	red	white
Wet Vacuum (cleaning)	W. Vac.	green	-

1.10 PIPE IDENTIFICATION BANDING COLOURS



.1 LETTERS:
- .1 13 mm [1/2"] high - 1-1/4 NPS pipe & smaller.
- .2 25 mm [1"] high - 1-1/2 NPS up to 2-1/2 NPS pipe.
- .3 50 mm [2"] high - 3 NPS and larger pipe.

.2 BANDS:
- .1 38 mm [1-1/2"] wide, except arrow bands 50 mm [2"] wide.

.3 COLOURS:
- .1 horizontally hatched - primary colour.
- .2 vertically hatched - secondary colour.
- .3 black letters and arrows on yellow primary colour.
- .4 background, white letters and arrows or red, blue or green backgrounds.

END OF SECTION

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 TESTS

.1 Give written 24 hour notice of date for tests.

.2 Do not externally insulate or conceal work until tested and approved. Follow construction schedule and arrange for tests.

.3 Conduct tests in presence of Departmental Representative.

.4 Bear costs including retesting and making good.

.5 Refer to Piping Sections for specific test requirements.

.6 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures.

1.3 TESTING AND BALANCING

.1 Employ an approved independent testing and balancing agency to test and balance the following systems. Prior to finalizing contractual arrangements with the balancing agency, submit the names, qualifications and years of direct field testing and balancing experience in the testing and balancing field for all members of the balancing team that is scheduled to carry out the balancing work. The senior site technologist must have a minimum of five years testing and balancing experience of similar projects. Provide a list of a minimum of ten comparable projects successfully completed by all key members of the balancing team.

- .1 Antifreeze (glycol) system(s) (heating and heat recovery).
- .2 Supply air system(s).
- .3 Return air system(s).
- .4 Exhaust air system(s).

.2 The Agency shall be responsible to the Contractor but report jointly to the Departmental Representative and the Contractor. Report in writing to the Departmental Representative any lack of cooperation and any discrepancies or items not installed in accordance with the contract documents.

.3 Procedures shall be in general accordance with AABC'S National Standards for Field Measurement and Instrumentation and ASHRAE Standards.

.4 The balancing agency shall agree to perform spot checks, where requested, in the presence of the Departmental Representative.

.5 Work with the agency to:

- .1 Ensure that all mechanical systems are complete and ready to be balanced and provide sufficient time for testing and balancing prior to substantial performance.
- .2 Make corrections to achieve system balance without delay, include all corrections made during the balancing procedure on "As Built" Drawings. Mechanical Contractor to provide “As Built” information to the balancing agency before balancing commences.

.3 Adjust fan drives, change blade pitch angles and change sheaves and belts as directed by the agency.

.4 Maintain all systems in full operation during the complete testing and balancing period.

.5 Employ control technicians to make adjustments to the control systems to facilitate the balancing process.

.6 Employ the journeyman millwright to check the alignment of any V-belt drives and/or shaft coupling drives if they have been adjusted during the balancing process. Belt tension correctness to be verified.

.6 Consult with the Departmental Representative to clarify the design intent where necessary or in case there are any problems foreseen as the balancing processes.

.7 Complete air balance before commencing water balance where heating/cooling coils are installed in the air system. Balancing shall not commence until systems have been cleaned and treated and the air removed from within the piping systems.

.8 Accuracy: Balance to maximum flow deviation of 10% at terminal device and to 5% at equipment. Measurements to be accurate to within plus or minus 5% of actual values.

.9 Instrument calibration: At the Departmental Representatives request, the balancing agency shall submit a dated calibration chart for all instruments.

.10 Permanently mark final settings on valves, dampers and other adjustment devices. Set and lock all memory stop balancing devices.

.11 Seal all holes with snap plugs or approved alternate method, used for flow and pressure measurements.

.12 The controls contractor and balancing agency are to allow for checking and making adjustments during the 12 month warranty period, when weather conditions provide natural loads and in cases where complaints arise.

.13 Submit a draft balance report to the Departmental Representative for approval and submit approved copies to the agency preparing the O & M manuals for inclusion in each operating and maintenance manual. Provide field notes in the balancing report to clearly identify unusual conditions, problem areas and report on any cases where the specified flow rates or conditions could not be achieved by adjustment. Identify outstanding problems that cannot be corrected by the balancing team or that will not be corrected by the installing trades (e.g. in cases where additional balancing dampers are required).

.14 Submit a statutory declaration to the Departmental Representative, certifying that the testing and balancing 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 correction of faults and omissions, has been completed and recorded. Form MF170 in Section 23 06 02 should be used for this purpose. Reports to be signed by the senior member of the balancing team..

.15 Employ the testing and balancing agency to test all fire dampers as follows:

.1 Test all fire dampers (including combination smoke/fire dampers). The test shall be made by releasing the fusible link and witnessing closure of the damper. All fire dampers shall be left in the open position.

.2 A set of prints shall be marked up to show that each damper has checked for closure, accessibility and installation or provide schematic mechanical drawing showing all fire damper locations, label all fire dampers on drawing and reference to form MF172. The prints shall be certified correct by the agency and submitted to the Departmental Representative with completed test certificate MF172.

.16 Air Systems - Balancing

.1 Adjust duct and terminal balance dampers, and adjust or change drive sheaves and fan blade pitch angles to obtain design quantities (within +/-10%) at each outlet and inlet.

.2 Use terminal balance dampers to regulate air quantities only to the extent that adjustments do not create objectional air motion or sound levels. The sheet metal sub contractor shall provide additional dampers where required by the balancing agency to achieve a satisfactory balance without creating noise problems.

.3 Make air quantity measurements in ducts by "Pilot Tube" traverse of entire cross-sectional area of duct. Provide a pilot tube traverse test sheet for each major duct branch.

.4 Measure air quantities at each air terminal.

.5 Maintain the design relationship between the supply and exhaust air system quantities.

.6 Check to ensure that supply and return air quantities provide reasonable building pressurization. Test building pressurization levels in variable volume systems throughout full range of fan delivery rates, under both heating and cooling conditions. Exit doors and elevator shafts should be checked for air flow so that exterior conditions do not cause excessive or abnormal pressure conditions. Document abnormal building leakage conditions noted.

.7 Adjust the air terminals to obtain the optimum air distribution pattern. The total airflow through each air valve/mixing box should be adjusted and reported by the balancing agency for maximum and minimum flow conditions.

.8 Controllers on air valves/mixing boxes are to be checked by the controls contractor and the commissioning agent and they shall also verify that room thermostats / sensors are cycling valves/mixing boxes properly.

.9 Air systems shall be balanced with clean filters in place, at a total of 105% to 110% of specified total airflow rates.

.10 Where variable air volume systems are installed, take measurements at maximum and minimum flows. Record the minimum operating duct static pressure set point for each air handling system.

.11 In conjunction with the Controls Contractor set and verify the outdoor air damper minimum position. The balancing agent shall measure the O/A volume during minimum O/A condition when the air valves/mixing boxes are at a simulated minimum system condition.

.12 Balance all air systems for 100% outdoor air and 100% relief air. Upon completion of each system balance, check to ensure that the fan motor does not overload and that the main duct pressure does not change substantially when the system is switched over to minimum O/A condition.

.13 Include in the air balance report:

.1 Date of test, Name and address of building and balancing technician's name.

.2 Range of outdoor air temperature during the balancing period.

.3 System schematics indicating damper positions, design and measured air quantities at each inlet and outlet. Show room numbers and floors.

.4 If installation permits, record both air terminals and fan discharge traverse air volumes to establish system leakage.

.5 Main branch duct traverses. Maximum and minimum outdoor air quantities.

.6 Static pressure across each component in an air handling system at full flow.

.7 Face velocities across major components such as filter or coils.

.8 Static pressure across each fan.

.9 System static pressures at selected points throughout a VAV supply duct system and in main branch ducts in low velocity systems.

.10 Fan and motor speed.

.11 Motor size, starting time, amps and voltage.

.12 Coil air entering and leaving temperatures (D.B. and W.B.).

.13 Maximum and minimum zone supply air temperatures under prevailing conditions at time of test.

.14 Provide fan performance curve for each new air handling system.

.15 Pressure differences between "fire alarm" zones and "non-fire" zones as described under "Commissioning and Performance Tests in Section 23 09 00.

1.4 LIQUID SYSTEMS - BALANCING

.1 Set balance valves and balance fittings to provide required or design flow rates for each system component.

.2 Use installed flow measuring devices to determine flow rates for system balance. Where flow measuring devices are not installed, base flow balance on the air and liquid temperature difference across terminal heating/cooling elements and coils, acknowledging the different design temperature drops/rises used in the design of the systems.

.3 Effect system balance with automatic control valves fully open to heat transfer elements.

.4 Trim pump impellors to match pump performance to system characteristics rather than artificially increasing system pressure drops to match pump characteristics. Additional costs incurred in trimming the impellors will be considered as an extra.

.5 Check air vents to ensure that they are correctly installed and are operating properly. The mechanical contractor shall ensure that all air is removed from within the piping system and that there is flow throughout all piping systems before the balancing is started.

.6 Include in the liquid balance report:

.1 Date of test, Name and address of building and balancing technician's name.

.2 Range of outdoor air temperature during the balancing procedure.

.3 Pumps: Tag, service, location, manufacturer, model and size. Specified and actual flow and head pressure. Motor size, speed, amps and voltage.

.4 Heating/Cooling Coils: Tag, service & location. Specified and actual capacity, flow, liquid pressure drop, liquid entering and leaving temperatures, air-side entering and leaving temperatures.

.5 Flow measuring devices: Flow rates.

.6 Terminal heating/cooling elements: Entering and leaving liquid temperatures.

.7 System schematics: Specified and actual flow rates.

.8 Provide pump performance curve for each new pump system.

END OF SECTION

1 MECHANICAL FORMS

1.1 MF 100 CHECK LIST – SUBMISSIONS TO CONSULTANT

ITEM	CHECKED BY	DATE
10 WORKING DAYS BEFORE CLOSE OF SUBTRADE TENDER – Request for addition of acceptable manufacturers		
10 DAYS AFTER AWARD OF THE CONTRACT – List of equipment suppliers and subtrades – Detailed price breakdown (MF 120, 121, 122)		
A.S.A.P. – Product & Fabrication samples (MF 131) – Shop Drawings		
WITH EACH APPLICATION FOR PROGRESS PAYMENT – Price breakdown (MF 120, 121, 122)		
PRIOR TO CLOSING IN CEILINGS & SHAFTS – Duct and pipe test data - Piping Test Data (MF 141)		
PRIOR TO STARTING SYSTEMS – Checklists for start-up (MF 151, 152, 153)		
PRIOR TO COMMISSIONING SYSTEMS – Checklists for operation (MF 151, 152, 153) – Commissioning schedule		
PRIOR TO DEMONSTRATION OF SYSTEMS – Demonstration agenda		
10 DAYS PRIOR TO SUBSTANTIAL PERFORMANCE INSPECTION – Submission of items listed on Form MF-188		
WHEN REQUESTING INSPECTION OF OUTSTANDING WORK – Certificate of total completion (MF 192) – Checklist of work remaining (MF 191) – Checklists of Demonstrations (MF 181, 182, 183)		

1.2 MF 120 PROGRESS CLAIM SUMMARY – DIVISION 21, 22, 23

CLAIM NO: _____

FOR MONTH OF: _____

ITEM	**PRICE**	**WORK TO DATE**		**PREVIOUS WORK**		**THIS MONTH**	
	$	**%**	**$**	**%**	**$**	**%**	**$**
Base Contract Summary							
- HVAC							
- Plumbing							
- Cash Allowances							
Total Base Contract							
Change Order Summary							
Total Change Orders							
Total Contract:							
Amount due less 10% mechanics lien holdback							

NOTES:

Submit this form as called for on MF 100 for tender price breakdown and for each progress claim.

1.3 MF 121 DETAILED PRICE BREAKDOWN – HVAC

CLAIM NO: _____

FOR MONTH OF: _____

ITEM		**PRICE**	**WORK TO DATE**		**PREVIOUS WORK**		**THIS MONTH**	
Mechanical		$	%	$	%	$	%	$
Mobilization & Permits								
Air Handing Equipment	Matl. Lab.							
HVAC Piping & Equipment:	Matl. Lab.							
Insulation – Piping & Equipment	Matl. Lab.							
SUBTOTAL								
Sheet Metal								
Air Terminal & Access.	Matl.							
Ductwork	Matl. Lab.							
Insulation – Ductwork	Matl. Lab.							
Duct Cleaning:	Lab.							
Testing & Balancing	Lab.							
SUBTOTAL								
Refrigeration	Matl. Lab.							
SUBTOTAL								
Controls	Matl. Lab.							
SUBTOTAL								
Finishing								
Comm. & Demonstration Maintenance Manuals								
SUBTOTAL								
TOTAL								

NOTES:

.1 Submit this form as called for on MF 100 for tender price breakdown and with each progress claim.

.2 Submit a separate form for each item listed on MF 120.

1.4 MF 122 DETAILED PRICE BREAKDOWN - PLUMBING

CLAIM NO: _____

FOR MONTH OF: _____

ITEM		**PRICE**	**WORK TO DATE**		**PREVIOUS WORK**		**THIS MONTH**	
Plumbing		**$**	**%**	**$**	**%**	**$**	**%**	**$**
Sanitary & Storm Drainage	Matl. Lab.							
Domestic Water	Matl. Lab.							
Fixtures & Equipment	Matl. Lab.							
Plumbing Insulation	Matl. Lab.							
Medical Gas	Matl. Lab.							
Fire Protection	Matl. Lab.							
Wet & Dry Vacuum	Matl. Lab.							
Outside Services	Matl. Lab.							
TOTAL								

NOTES:

.1 Submit this form as called for on MF 100 for tender price breakdown and with each progress claim.

.2 Submit a separate form for each item listed on MF 120.

1.5 MF 141 PIPING TEST DATA

SYSTEM: _____ (Heat pump loop water piping, Heating water piping, Chilled water piping, Condenser water piping, Steam piping, Boiler and boiler room piping, Domestic water piping main, Fire protection piping)			
Date:		**Time:**	**AM/PM:**
Section of System Tested:			
Pressure at start of Test: _____ kPa [psi] Pressure at end of Test: _____ kPa [psi]		**TEST:** Length: _____ hrs Medium: water /air / nitrogen	
Test Performed by:			
Name:	Signature:	Company:	
Test witnessed at start:			
Name:	Signature:	Company:	
Test witnessed at end:			
Name:	Signature:	Company:	
Remedial Work / Comments:			

1.6 MF 151 CHECK LIST - START-UP AND OPERATION REQUIREMENTS - AIR SYSTEMS

System: _____

ITEM	CHECKED BY	DATE
Prior To Start-Up Safety Controls Installed & Operational Control And Smoke Dampers Operational Permanent Electrical Connections Made Fan Drives Aligned By Millwright Fan Rooms & Plenums Vacuum Cleaned Equipment Lubricated Building Swept & Clear Of Dust All Filters Installed Operating & Maintenance Data Available		
During Start-Up Qualified Operator In Charge Supply Ducts Blown Out Using Fans R.A. & Exhaust Ducts Blown Out Using Fans		
During Subsequent Operation Qualified Operator In Charge Ensure That The Building Has Remained Clean Equipment Maintained Lubrication Maintained & Logged		

NOTES:

.1 This is a brief checklist and does not cover all procedures, which may be advisable in a particular case. Additional information is available from equipment suppliers.

.2 Prior to starting or operating each system complete the appropriate section of this form and submit it to the Consultant.

.3 Submit completed copies of this form for each system with the certificate of substantial performance.

1.7 MF 152 CHECK LIST - START-UP AND OPERATION REQUIREMENTS – WATER / GLYCOL SYSTEMS

System: _____

ITEM	CHECKED BY	DATE
Prior To Start-Up Safety Controls Installed & Operational Permanent Electrical Connections Made Equipment Lubricated System Flushed Out Operating & Maintenance Data Available Boiler Inspector Notified Chemical Treatment Agency Notified		
During Start-Up Qualified Operator In Charge Chiller Manufacturers Rep. Present		
Prior to Operation Boiler inspectors Approval Obtained Report from Chemical Treatment Agency Submitted		
During Operation Qualified Operator In Charge Equipment Maintained Lubrication Maintained & Logged Chemical Treatment Maintained And Logged		

NOTES:

.1 This is a brief checklist and does not cover all procedures, which may be advisable in a particular case. Additional information is available from equipment suppliers.

.2 Prior to starting or operating each system complete the appropriate section of this form and submit it to the Consultant.

.3 Submit completed copies of this form for each system with the certificate of substantial performance.

1.8 MF 153 CHECK LIST - START-UP AND OPERATION REQUIREMENTS – REFRIGERATION SYSTEMS

System: _____

ITEM	CHECKED BY	DATE
Prior To Start-Up Safety Controls Installed & Operational Permanent Electrical Connections Made Equipment Lubricated System Charged and Tested Operating & Maintenance Data Available Boiler Inspector Notified & Start-up Approved		
During Start-Up Qualified Operator In Charge Manufacturers Rep. Present		
Prior to Operation Inspectors Approval Obtained		
During Operation Qualified Operator In Charge Equipment Maintained Lubrication Maintained & Logged		

NOTES:

.1 This is a brief checklist and does not cover all procedures, which may be advisable in a particular case.

.2 Prior to starting or operating each system complete the appropriate section of this form and submit it to the Consultant.

.3 Submit completed copies of this form for each system with the certificate of substantial performance.

1.9 MF 170 CERTIFICATE OF TESTING AND BALANCING

I hereby declare that I _____

I am an employee/a principal of _____

And certify that the testing and balancing procedures specified under Division 15 [23] have been satisfactorily completed and I hereby certify that complete factual reports have been distributed.

SIGNED _____ DATE _____

NOTES:

.1 This certificate must be submitted prior to substantial performance.

1.10 MF 171 CERTIFICATE OF DUCT CLEANLINESS

I hereby certify that I _____

I am an employee/a principal of _____

And have personally witnessed that the following duct systems have been vacuumed as necessary, are now clean and have been resealed with access panels in place at all cleaning openings in the ductwork.

FAN NO.	SYSTEM DESCRIPTION

SIGNED _____ DATE _____

NOTES:

.1 This certificate must be submitted prior to substantial performance.

1.11 MF 172 CERTIFICATE OF FIRE DAMPER INSPECTION

I hereby certify that I _____

am an employee/a principal of _____

And that all fire dampers have been tested by removing the fusible link and witnessing closure of the damper.

SIGNED _____ DATE _____

- Contract drawings supplied by:_____
- Latest addendum number or date of plans used:_____

NOTES:

1. This certificate must be submitted prior to substantial performance.

1.12 MF 173 CERTIFICATE OF PENETRATIONS THROUGH SEPARATIONS

I hereby certify that I _____

am an employee of _____

And have personally witnessed that all mechanical (HVAC & Plmb.) service penetrations through fire separations (rated & non-rated) and sound separations in the following areas have been properly sealed in accordance with the specified requirements.

AREA	SIGNED	DATE
Level:		
Level:		
Level:		
Level:		
Level:		
Level:		
Level:		
Level:		
Level:		

NOTES:

.1 This certificate must be submitted prior to substantial performance.

1.13 MF 174 CERTIFICATE OF SEISMIC RESTRAINT INSTALLATION

I hereby declare that I _____

am an employee/a principal of _____

And certify that the seismic restraint of all mechanical equipment, piping and ductwork specified under Division 15 [23] has been satisfactorily completed and that the installation meets the requirements of the B.C. Building Code as it relates to seismic restraint.

SIGNED _____ DATE _____

NOTES:

.1 This certificate must be submitted prior to substantial performance.

1.14 MF 175 CERTIFICATE OF VIBRATION ISOLATION

I hereby declare that I _____

am an employee/a principal of _____

And certify that the vibration isolation installation specified under Division15 [23] has been satisfactorily completed.

SIGNED _____ DATE _____

NOTES:

.1 This certificate must be submitted prior to substantial performance.

1.15 MF 180 CHECK LIST & RECORD – ITEMS TO BE HANDED TO OWNER

ITEM	RECEIVED	DATE
C.O. System Portable Calibration Kit		
Chemical Test Kit		
Control Drawings (Framed/Plasticized)		
Electric Humidifier Replacement (Cylinder(s))		
Fan Belts – Spare Sets		
Filters - Spare Sets (Panel and Final)		
Glycol (enough to fill mixing tank when mixed)		
Hydrometer & Specific Gravity Chart		
Identification Schedule (Framed)		
Maintenance Program (Schedules & Cards)		
Master Key For B.A.S. Field Panels		
Rated Access Door Keys		
Salvaged Materials (Attach List)		
Spare Chemicals		
Sprinkler Heads & Cabinet		
Test Thermometer		
Thermostat Keys		
Valve List (Framed)		
Water Cooler Spare Filters		
Water flow meter for liquid flow measuring devices		
Differential Pressure Meter for Circuit Setting Balance Valves		
P/T Plug Master Test Kit		

NOTES:

.1 Copies of this form to be submitted to the consultant and the owner with all items signed off prior to substantial performance.

1.16 MF 181 CHECK LIST – DEMONSTRATION OF AIR HANDLING SYSTEMS

System: _____

	CONTRACTOR		OWNER	
ITEM	**SIGNED**	**DATE**	**SIGNED**	**DATE**
Review of System Concept				
Review of Maintenance Manual				
Review of System Balance				
Troubleshooting				
Points of required Maintenance				
Access to Equipment				
Location of Control Devices				
All Electric Interlocks				
All Alarms				
Temperature Control				
Humidity Control				
Air Pressure Control				
Air Volume Control				

NOTES:

.1 Contractor to submit copies of this form with each appropriate item signed and dated by the person having overall charge of commissioning prior to substantial performance. (See MF 190).

.2 Owners representative to sign off each item during the demonstration.

.3 Contractor to strike out items where they do not apply to the systems being demonstrated.

.4 Interlocks and controls to be demonstrated by following the descriptions and diagrams in the contract documents and proving that all controls function as required.

.5 Where multiple identical controls are installed (thermostats) the owners representative may elect to only witness sample items, but the person having charge of commissioning is expected to have checked all of them.

1.17 MF 182 CHECK LIST – DEMONSTRATION OF WATER / GLYCOL SYSTEM

System: _____

	CONTRACTOR		OWNER	
ITEM	**SIGNED**	**DATE**	**SIGNED**	**DATE**
Review of System Concept				
Review of Maintenance Manual				
Review of System Balance				
Review of Chemical Treatment				
Troubleshooting				
Points of required Maintenance				
Access to Equipment				
Location of Control Devices				
All Electric Interlocks				
All Alarms				
Temperature Control				
Pressure Control				
Volume Control				

NOTES:

.1 Contractor to submit copies of this form with each appropriate item signed and dated by the person having overall charge of commissioning prior to substantial performance (See MF 190).

.2 Owners representative to sign off each item during the demonstration.

.3 Contractor to strike out items where they do not apply to the systems being demonstrated.

.4 Interlocks and controls to be demonstrated by following the descriptions and diagrams in the contract documents and proving that all controls function as required.

.5 Where multiple identical controls are installed (thermostats) the owners representative may elect to only witness sample items, but the person having charge of commissioning is expected to have checked all of them.

1.18 MF 183 CHECK LIST – DEMONSTRATION OF REFRIGERATION SYSTEM

System: _____

	CONTRACTOR		OWNER	
ITEM	**SIGNED**	**DATE**	**SIGNED**	**DATE**
Review of System Concept				
Review of Maintenance Manual				
Review of System Balance				
Troubleshooting				
Points of required Maintenance				
Access to Equipment				
Location of Control Devices				
All Electric Interlocks				
All Alarms				
Temperature Control				
Pressure Control				

NOTES:

.1 Contractor to submit copies of this form with each appropriate item signed and dated by the person having overall charge of commissioning prior to substantial performance. (See MF 190).

.2 Owners representative to sign off each item during the demonstration.

.3 Contractor to strike out items where they do not apply to the systems being demonstrated.

.4 Interlocks and controls to be demonstrated by following the descriptions and diagrams in the contract documents and proving that all controls function as required.

.5 Where multiple identical controls are installed (thermostats) the owners representative may elect to only witness sample items, but the person having charge of commissioning is expected to have checked all of them.

1.19 MF 188 CHECK LIST – SUBSTANTIAL COMPLETION SUBMISSIONS - HVAC

SECTION	ITEM	CHECKED
23 05 00	Boiler Inspection Certificate	
23 05 00	Gas Inspection Certificate	
23 05 00	Equipment Extended Warranties Certificates	
25 05 13	Millwright Setting and Alignment Certificate	
23 05 00	Lubrication of Equipment Checklist	
23 05 00	Penetrations through Separations Certificate (MF-173)	
23 05 93	Air and Liquid Balancing Report	
23 06 02	Testing & Balancing Certificate (MF 170)	
23 06 02	Fire Damper Inspection Certificate (MF 172) and Checked Drawings	
23 08 00	Commissioning Report and Checklists	
23 05 00	Operating & Maintenance Manuals	
23 05 00	Record Drawings	
23 05 00	Maintenance Program	
23 05 00	Demonstration to Operating Staff agenda	
23 05 54	Identification Schedules	
23 06 02	Vibration Isolation Installation Certificate. (MF-175)	
23 06 02	Seismic Restraint Installation Certificate. (MF-174)	
23 25 00	Chemical Treatment and Cleaning Report for Piping Systems	
23 13 00	Fuel Oil Tank and Piping Pressure Test Report	
23 52 00	Boiler Start-up Test Reports	
23 23 00	Refrigeration System Start-up Test Reports	
23 64 00	Chiller Capacity and Efficiency Test Reports	
23 31 00	Duct Leakage Test Reports	
23 31 00	Duct Cleanliness Certificate (MF 171)	
23 06 02	Demonstrations Checklists (MF 181, 182, 183)	
23 06 02	Items handed to Owner Checklist (MF 180)	
23 06 02	Substantial Performance Certificate (MF(190)	
23 06 02	Checklist of work remaining after Substantial (MF 191).	

NOTES:

.1 This list is provided as a checklist and may not include all substantial completion requirements.

1.20 MF 189 CHECK LIST – SUBSTANTIAL COMPLETION SUBMISSIONS- PLUMBING

SECTION	ITEM	CHECKED
	Operating & Maintenance Manuals. (Also 15400 & 15500)	
	Record Drawings. (Also 15400 & 15500)	
	Plumbing Inspection certificate	
	Buried drainage piping. Pipe leakage and bedding tests	
	Buried gas pipe covering report. (Also 02715 & 15400)	
	Water mains chlorination report. (Also 02713 & 15400)	
	Backflow prevention station test certificate	
	Hose Bibb operating keys. Signed receipt from Owner	
	Pipe test reports	
	Spare Water filters. (Also 15450, 15451 & 15452)	
	Backflow prevention (RPPD) test certificate	
	Fire protection system test certificate	

NOTES:

.1 This list is provided as a checklist and may not include all substantial completion requirements.

1.21 MF 190 CERTIFICATE OF SUBSTANTIAL PERFORMANCE DIVISION 21, 22, 23

I hereby certify that I _____
am an employee / a principal /an agent

of _____

and have personally witnessed the following with regard to the mechanical systems work specified on the above project and that to the best of my knowledge except as noted on MF 191 (attached);

- The installation is complete and as specified.
- The systems have been commissioned and operate satisfactorily.
- Every control sequence and every control performs as specified.
- The systems are clean.
- All of the required submissions have been made to the consultant.

SIGNED _____ DATE _____

NOTES:

.1 This certificate must be completed and submitted to the consultant prior to substantial performance.

.2 If it is apparent during this inspection that the systems or their operation are seriously deficient then all reasonable costs of any subsequent inspections shall be deducted from the contract sum.

1.22 MF 191 CHECK LIST – WORK REMAINING AFTER SUBSTANTIAL PERFORMANCE

		COMPLETION		
ITEM NO.	**DESCRIPTION**	**CLAIMED BY**	**DATE**	**VERIFIED DATE**

NOTES:

.1 This form must be filled in and submitted to the Consultant prior to substantial performance.

.2 Items arising out of this inspection will be added to the list by the Consultant. Copies of the complete list will be circulated to the Owner, the Architect and the Contractor.

.3 The Contractor may include estimated values against the outstanding work but determination of the actual amounts to be held will be made by the Consultant.

.4 The Contractor shall sign off each item as it is completed and submit the list monthly to the Consultant. When all items are signed off the completed list shall be submitted with the certificate of total performance MF 192.

1.23 MF 192 CERTIFICATE OF TOTAL PERFORMANCE – DIVISION 21, 22, 23

I hereby certify that I _____
am an employee / a principal / an agent

of _____

and have personally witnessed that each item of outstanding work on the checklist and record of work remaining after substantial completion MF 191 (attached) has been satisfactorily completed and I hereby certify that the Mechanical systems work specified on the above project is complete.

SIGNED _____ DATE _____

NOTES:

.1 This certificate must be completed and submitted to the Consultant prior to substantial performance.
.2 If it is apparent during this inspection that the systems or their operation are seriously deficient then all reasonable costs of any subsequent inspections shall be deducted from the contract sum.

END OF SECTION

ITEM	ACCEPTABLE PRODUCTS / SUPPLIERS / MANUFACTURERS	SHOP DWG.
ACCESS DOORS		
Building Surfaces	Acudor, Cendrex, E.H. Price, Maxam, Milcor, Mifab, Steel Brothers	-
ACCESS PANELS		
Ducts	Nailor, Ventlok	-
AIR BLENDERS	Blender Products	X
AIR CONDITIONING UNITS		
Computer Room	Air Technology Systems, Airflow, Edpac, Hiross, Liebert, Data-Aire	X
Packaged	Carrier, Eng. Air, Lennox, Trane	X
Split Type	Carrier, Mitsubishi, Sanyo Trane,	X
AIR HANDLING UNITS/HRV		
Custom	Haakon, Scott Springfield, York, Trane, Eng. Air.	X
Commercial	Carrier, Eng. Air, Haakon, McQuay, Pace, Scott Springfield, Trane	X
AIR TERMINALS	E.H. Price, Nailor, Titus	X
AIR TERMINAL UNITS		
Air Valves (Non – Bypass)	E.H. Price, Nailor, Titus	X
BACKDRAFT DAMPERS		
Light Duty	E.H. Price CBD, Ruskin B02/A1	X
Medium Duty	Airolite 625, Penn CBD-6, Ruskin CBD-4	X
BOILERS		
Cast Iron	Buderus, Burnham, Hydrotherm, Slant Fin, Wiel McLain	X
CARBON MONOXIDE EXHAUST	Engwald, Nederman	X

ITEM	ACCEPTABLE PRODUCTS / SUPPLIERS / MANUFACTURERS	SHOP DWG.
CHIMNEYS		
Boilers (Positive Pressure)	Ampco, Cleaver Brooks, Metalbestos PS, IPS, Van-Packer DW, Metal-Fab PIC	X
COILS		
DX, Liquid, Steam	Aerofin, Colmac, Eng. Air, McQuay, Trane	X
CONDENSER UNITS		
Air Cooled	Carrier, McQuay, Trane	X
CONDENSING UNITS		
Comfort Cooling	Carrier, McQuay, Trane, Lennox, York	X
CONTROL DAMPERS		
Low Leakage Type	Arrow-Foil PBDAF & OBDAF, Honeywell Moduflow D642 & D643, Johnson Proportion/Aire D-1200 & D-1300, Ruskin CD36, Tamco 1000	X
Round	Ruskin DCRS-25	X
DUCT CONNECTORS FLEXIBLE	Duro Dyne "Durolon", Ventfabrics - "Ventlon"	-
DUCTWORK - SPIRAL	United Sheet Metal, B.C. Ventilating, Spiro-Lok	
DUCTWORK FLEXIBLE		
Plain	Thermaflex SLP10, Flexmaster FAB4, Wiremold 57	X
Insulated – Acoustic	Thermaflex MKE, Glassflex ABL-181, Wiremold WK	X
Insulated - Thermal	Thermaflex MKC, Micro-Aire JFLX SL, Glassflex D-181, Wiremold WGC	X
EXPLOSION / IMPLOSION LATCHES	Brixon	-
EXPANSION JOINTS	Flexonics, Hyspan, Uniroyal, Keflex, Mason, Goodall	

ITEM	ACCEPTABLE PRODUCTS / SUPPLIERS / MANUFACTURERS	SHOP DWG.
FANS		
Cabinet	Acme, Carnes, Cook, Delhi, Greenheck, Lau, Penn	X
Centrifugal (Including Plug)	Barry, Chicago, Northern Blower, Pace, Trane, Twincity	X
In – Line (Round)	Barry	X
In – Line (Square)	Carnes, Cook, Greenheck, Penn	X
Utility	Avaho, Barry, Chicago, Cook, Greenheck, Northern Blower, Pace, Penn, Trane, Twincity	
Propeller	Barry, Carnes, Cook, Coolair, Greenheck, Jenn-Air, Penn	X
Roof / Wall	Carnes, Cook, Delhi, Greenheck, Jenn-Air, Penn	X
Window / Wall	Vent Axia, Xpelair	X
FAN TERMINAL UNITS	E.H. Price, Tempmaster, Titus	X
FILTERS	AAF, Cambridge, Farr	X
FILTERS - Fibreglass Free	Viledon, Tridec	X
FILTER GAUGES	Dwyer, Cambridge	
FIRE DAMPERS		
Folding Shutter Type	Controlled Air, Nailor, NCA, Ruskin	X
Pivoted Blade Type	Controlled Air, Maxam, Pacwest, Ruskin FD35	X
Ceiling Type	Controlled Air, Kerr Hunt, Nailor	X
Register / Fire Damper	E.H. Price VCS-4, Tuttle & Bailey 90A, Airvector	X
FIRE HYDRANTS	Terminal City Iron Works	X
FIRE PROTECTION - Cabinets & Extinguishers	Wilson & Cousins, National, Viking, General	X
FIRE PROTECTION - Sprinklers	Grinnell, Viking, Star, Reliable	X

ITEM	ACCEPTABLE PRODUCTS / SUPPLIERS / MANUFACTURERS	SHOP DWG.
FIRE PROTECTION - FM200, INERGEN	Grinnell, Kiddie	X
FIRE PROTECTION - CO_2	Kiddie	X
FLOW MEASURING DEVICES		
Air (Honeycomb)	Air Monitor, Cambridge	X
Air (Probe Type)	Air Monitor "Volu-Probe", Annubar "Airbar" Paragon Controls	X
Liquid (Probe Type)	Annubar, Accutube, Flo-Probe, Gerand, Measurell, Preso, Valitube	X
Liquid (Venturi Type)	Gerand, Preso	X
FLOW METERS		
Liquid	Eagle Eye, Gerand, Preso, Western Meter	X
FLUSH VALVES	Crane, Cambridge Brass, Sloan, TOTO, Zurn	X
GAS VENTS	Ampco, Ecco, Selkirk Metalbestos	X
GAS DETECTORS - CO & Combustible Gas	C.E.T., QEL	X
GAUGES – AIR PRESSURE	Dwyer 2000	X
GLYCOL MIXING TANK	Mechanical Contractor	X
HEATERS		
Baseboard (Electric)	Chromalox, Chaudair, Ovellet	X
Convector (Liquid / Steam)	Eng. Air, Rosemex, Trane, Sterling	X
HUMIDIFIERS		
Electric	Armstrong, Hygromatik, Nortec	X
INSULATION - DUCT	Fiberglas, Knauf, Johns-Manville, Atlas, PPG, Manson, Certainteed	
INSULATION - PIPING	Fiberglas, Knauf, Johns-Manville, Manson, Atlas, PPG, Certainteed	
LOUVRES	Airolite, Alumavent, Westvent, Ruskin	X

ITEM	ACCEPTABLE PRODUCTS / SUPPLIERS / MANUFACTURERS	SHOP DWG.
MIXING VALVES	Lawler, Leonard, Bradley, Powers, Symmons	X
PIPE CONNECTORS (FLEXIBLE)	Mason	X
PLENUM - LAYOUT DRAWINGS	Mechanical Contractor	X
PLUMBING DRAINAGE ACCESSORIES	J.R. Smith, Enpoco, Zurn, Ancon, Mifab	
PLUMBING TRIM (All CSA approved)	American Standard, Crane, Cambridge, Kohler, Eljer, Alsons, Bradley, Powers, Symmons, Moen, Delta, Brasscraft, T & S Brass, Emco, Acorn, Leonard, Briggs, Chicago, TOTO, Zurn Aquaspec	X
PLUMBING FIXTURES (All CSA approved)	Crane, K.I.L., Fiat, Kohler, Eljer, American Standard, Williams, Metcraft, Wessan/Elkay, Haws, Aquarius, Jacuzzi, Sunroc, Western, Swan, Bradley, Speakman, Valley, Hytec, Watrous, Briggs, Kindred, Waltec, Venco, Encon, Gerber, TOTO, Intersan	X
PRESSURE REDUCING VALVES		
Water (Bypass)	Braukmann, Fulflo, Lonergan	X
Steam	Armstrong, Fisher, Jordon, Leslie, Spirax/Sarco, Spence, Watson McDaniel	X
Water	Bermad, Cashco, Clayton, Conbraco, Singer, Watts, Wilkins	X
PRESSURE RELIEF VALVES		
Water	Cashco, Watts	X
PUMPS		
Boiler Feed	Sihi	X
Pipe Mounted	Armstrong, Bell & Gossett, Grundfos, Taco	X
Vertical In – Line	Aurora, Armstrong, Bell & Gossett, Grundfos, Leitch, Paco, Taco	X

ITEM	ACCEPTABLE PRODUCTS / SUPPLIERS / MANUFACTURERS	SHOP DWG.
RADIANT CEILING PANELS		
Water	Airtex, Frenger, Sterling	X
SILENCERS	I.A.C., Korfund, Vibro-Acoustics, Vibron, Wisp Air Acoustics, VAW Systems	X
TANKS		
Domestic Hot Water	Anthes, Clemmer, Enermax, Leitch, PVI, Westeel	X
Expansion (Diaphragm)	Amtrol, Extrol, Expanflex, Taco, Wheatley	X
TOILET SEATS	Beneke, Bemis, Olsonite, Moldex, Sperzel, Centoco	X
UNIT / CABINET UNIT HEATERS		
Liquid / Steam	Colmac, Engineered Air, McQuay, Rosemex, Trane, Sterling	X
VARIABLE SPEED MOTOR DRIVE CONTROLLER (VSD)	ABB, Allen-Bradley, Baldor, Hitachi, Graham, Siemens, Teco-Westinghouse, Toshiba	X
VIBRATION ISOLATORS	Mason	X
WATER HEATERS – DOMESTIC HOT WATER	John Wood, State, A.O. Smith, P.V.I., Rudd, Giant	X

NOTE:

.1 The design is based upon the equipment listed in the equipment schedules and/or underlined in the H.V.A.C. Equipment Supplier Schedules.

.2 **X** Denotes required submission.

END OF SECTION

BALANCING:	K.D. ENGINEERING CO.
	WESTERN MECHANICAL SERVICES
	MDT SYSTEMS LTD.
	ACCU-AIR BALANCE CO.(BC) Inc.
	INLAND TECHNICAL SERVICES LTD.
COMMISSIONING:	K.D. ENGINEERING CO.
	WESTERN MECHANICAL SERVICES
	MDT SYSTEMS LTD.
	INLAND TECHNICAL SERVICES LTD.
	AIRMEC SYSTEMS LTD.
OPERATING & MAINTENANCE MANUALS:	
	K.D. ENGINEERING
	WESTERN MECHANICAL SERVICES
	MDT SYSTEMS LTD.
	INLAND TECHNICAL SERVICES
CLEANING AGENCIES:	
- **DUCTWORK**	POWER SUCTION SERVICES LTD.
	ACE MOBILE POWER SERVICES LTD.
	CLEAN AIR SERVICES CANADA LTD.
- **WATER PIPING**	BIRD ARCHER
	GRACE DEARBORN
	IPAC CHEMICALS
	PACE CHEMICALS
	SAVOLITE
CONTROLS:	HONEYWELL LTD.
	JOHNSON CONTROLS
	SIEMENS BUILDING TECHNOLOGY LTD.
	ENERGRATED SYSTEMS

CHEMICAL TREATMENT:	BIRD ARCHER
	GRACE DEARBORN INC.
	ENERCON WATER TREATMENT
	IPAC CHEMICALS
	PACE CHEMICALS
	SAVOLITE

END OF SECTION

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 GENERAL

.1 Provide external thermal insulation for plenums and ductwork as called for. Note: items listed that do not require insulation.

.2 Provide internal acoustical insulation for plenums and ductwork, as called for. Note: do not externally insulate any ductwork that is specified to be internally insulated.

.3 Journeyman insulation applicators, skilled in this trade, shall perform the work.

.4 Be responsible for ensuring that sufficient space is always provided to allow proper installation of insulation materials.

.5 As applicable, use the latest edition of the "B.C. Insulation Contractors Association (BCICA) Standards Manual" as a reference standard if sufficient detail/information is not specified herein.

1.3 REGULATORY REQUIREMENTS

.1 Flame spread ratings and smoke developed classifications shall be as required by the 1998 B.C. Building Code and NFPA 90A. Generally the flame spread rating throughout the material shall not exceed 25 and the smoke developed classification shall not exceed 50.

.2 Insulation thickness and insulating values shall be in accordance with ASHRAE 90.1.

1.4 QUALIFICATIONS AND SAMPLES

.1 Submit, for approval, substantiating manufacturer's documentation (and samples when requested) for all materials, applications and finishing methods to establish that all will satisfy this specification and meet all applicable code requirements, before commencing work.

1.5 DEFINITIONS

.1 "CONCEALED" insulated mechanical services in furred spaces, shafts and hung ceilings considered to be concealed.

.2 "EXPOSED" will mean not concealed.

2 PRODUCTS

2.1 EXTERNAL FLEXIBLE INSULATION

.1 External flexible glass fibre insulation with integral vapour barrier.

.1 Minimum density - 12 kg/cu.m. [3/4 lbs/cu. ft.].

.2 Thermal Conductivity at 24 deg.C. - 0.042 W/m/deg.C.

.3 Acceptable Manufacturers:

.1 Certainteed STD Ductwrap #75 FSK, Manson Alley-Wrap FSK, Owens Corning all service faced duct wrap, Knauf FSK Ductwrap, Schuller Micro Lite FSK.

2.2 DUCT LINER

.1 Rigid Duct Liner

.1 Yellow or light coloured internal rigid glass fibre acoustical insulation with black sealer coating on one face.

.2 Minimum sound absorption (NRC) of 0.60 as tested per ASTM C423 using type "A" mounting.

.3 Thermal Conductivity at 24 deg.C. - 0.035 W/m/deg.C.

.4 Acceptable Manufacturers:

.1 Certainteed Toughgard 300#, Manson Akousti-Liner R, Knauf Rigid Coated Duct, Schuller Permacoat R300, Owens Corning Rigid Coated Duct Liner.

2.3 ACCESSORIES

.1 Insulation Adhesive

.1 Bakelite 230-39, Childers CP-82, CP-56W, Epolux Cadoprene 400, Foster 85-20, Polymer Glasstack #25, Robson Ticki-Tuff.

.2 Vapour Barrier Tape

.1 Finishing tape as commercially available to meet flame spread rating and smoke developed classification requirements of NBC 1985 and compatible with facing material.

.2 Scrim foil self-adhesive tape.

.3 Vapour Barrier Adhesive

.1 Bakelite 230-21, Childers CP-82, Epolux Cadoprene 400, Foster 85-20, 3M 4230.

.4 Insulation Coating

.1 Bakelite 120-09, Childers CP-50, Epolux Cadalag 336, Foster 30-36, Robson White Lag.

.5 Weather Coating - vapour barrier

.1 Bakelite 110-14, Childers CHIL-PRUF CP22/23/24, Foster 60-25, Insul-Mastic 15187.

.6 Reinforcing Membrane

.1 Glass reinforcing membrane as commercially available.

.7 Seal Coating

.1 Bakelite 120-09, Childers CP-50, Epolux Cadalag 336, Foster 30-36,Robson White Lag.

.8 Fabric Adhesive

.1 Bakelite 120-18, Childers CP-52, Epolux Cadalag 336, Foster 30-36.

.9 Fabric Coating

.1 Bakelite 120-09, Childers CP-50, Epolux Cadalag 336, Foster 30-36.

2.4 SCOPE OF INSULATION

.1 Scope 1: External Flexible Insulation with vapour barrier. (Exposed ducts within a room, which is being served by the exposed ducts, do not require external insulation)".

	Thickness	
Service	**mm**	**[ins]**
All cooling and heating supply ducts; - where the temperature difference between the space within which the duct is located and the design air temperature in the duct, is less than or equal to 22.2°C [40°F]	40	[1.5]
All cooling and heating supply ducts; - where the temperature difference between the space within which the duct is located and the design air temperature in the duct, is greater than 22.2°C [40°F].	50	[2]
Outdoor air ductwork and plenums (from intake to mixing plenum).	50	[2]
Combustion intake / relief air	50	[2]
Exhaust air discharge through roof (including sides and bottom of plenum).	50	[2]
All exhaust air ductwork from outside wall or roof to 1.5 m [5 ft.] inside building.	25	[1]

.2 Scope 2: Internal Flexible Duct Liner

	Thickness	
Service	**mm**	**[ins]**
All exposed supply ductwork in the mechanical room (from A.H.U. & H.R.U.)	50	[2]

.3 Scope 3: Internal Rigid Duct Liner

	Thickness	
Service	**mm**	**[ins]**
Built-up site fabricated air handling unit(s). Line sheet metal walls and tops from inlet dampers to discharge dampers. Do not line transverse walls containing coils, filters or fan discharge.	50	[2]
Built-up site fabricated heat recovery exhaust unit(s). Line sheet metal walls and tops.	50	[2]
Cold and hot supply air plenums. Line walls, tops and bottoms from discharge dampers to supply duct connections.	50	[2]
All outdoor air plenums. Line sheet metal walls and top.	50	[2]

3 EXECUTION

3.1 APPLICATION

.1 Apply external insulation to ductwork only after all tests have been made and systems accepted by the Departmental Representative as airtight.

.2 Apply insulation and insulation finish in a workmanlike manner so that the finished product is uniform, smooth in finish, pleasing to the eye and with longitudinal seams concealed from view. Apply ductwork insulation materials, accessories and finishes in accordance with manufacturer's recommendations.

.3 Insulation and vapour barrier shall be continuous through all non-rated separations.

3.2 INSULATION TERMINATION

.1 Terminate insulation short of all control, smoke and fire dampers so as not to interfere with their operation.

3.3 INSULATION FOR COOLING COIL HEADERS AND RETURN BENDS

.1 Pack flexible glass fibre insulation around headers and return bends on all cooling coils in built-up air handling units to control condensation.

3.4 EXTERNAL FLEXIBLE INSULATION WITH VAPOUR BARRIER

.1 Adhere insulation with insulation adhesive applied in 150 mm [6"] wide strips on 300 mm [12"] centres.

.2 On rectangular ductwork and plenums, over 610mm [24"] in width, spotweld pins 6mm [1/4"] longer than the insulation thickness, one per square foot of duct minimum. If pins are installed in the field, a capacitor gun shall be used. Impale the insulation over the pins, and hold in place using metal or nylon clips (washers). Alternatively, use an assembly consisting of a welded pin with integral head washer welded in place over the insulation. (Clinched pins not acceptable).

.3 Adhere foil faced vapour barrier tape over all butt joints, raw edges, holding washers and other points of penetration of the vapour barrier jacket on all exposed hot and cold ducts and concealed cold ducts.

3.5 INTERNAL RIGID DUCT LINER APPLICATION

.1 Adhere the internal rigid duct liner in the same manner as specified for internal flexible duct liner.

.2 Cover plenum wall insulation with solid galvanized sheet metal for a distance of 1200 mm [48"] downstream from cooling coils.

.3 Cover insulated walk-on plenum floors with solid galvanized sheet metal to protect insulation from damage. Provide supports under sheet metal to prevent insulation and pins from being crushed.

.4 All sheet metal and perforated sheet metal is under Section 23 31 00.

3.6 DUCTWORK INSULATION FINISHES

.1 "Concealed" ductwork insulation, in horizontal and vertical service spaces, will require no further finish.

.2 "Exposed" ductwork insulation, in unfinished floor spaces will have no further finish.

.3 "Exposed" ductwork insulation "inside" finished floor spaces, fan room and boiler room, shall be finished with two coats of white, foil-finishing, insulation coating.

.4 "Exposed" ductwork insulation "outside" the building shall have a weatherproof finish. Apply one coat of Childers Vi-cryl CP10, or other approved, asphaltic emulsion mastic, at the rate of 1 litre per square metre. Immediately embed #10 glass fabric into the wet coating. Smooth out all wrinkles, lapping ends and edges at least 50 mm [2"]. After the first coating has achieved initial set, but while still damp, apply a top finish coating of the asphalt emulsion mastic at 2 litres per square metre ensuring that the reinforcing glass fabric is completely coated. Smooth to a uniformly even finish.

END OF SECTION

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 GENERAL

.1 Provide thermal insulation for all heating and cooling equipment as called for and scheduled.

.2 Journeyman insulation applicators, skilled in this trade shall perform the work.

.3 Be responsible for ensuring that sufficient space is provided to allow proper installation of insulation materials.

.4 As applicable, use the latest edition of the "B.C. Insulation Contractors Association (BCICA) Standards Manual", as a reference standard, if sufficient detail/information is not specified herein.

1.3 REGULATORY REQUIREMENTS

.1 Flame spread ratings and smoke developed classifications shall be as required by the 1992 B.C. Building Code and NFPA 90A. Generally, the flame spread rating throughout the material shall not exceed 25 and the smoke developed classification shall not exceed 50. Materials shall not flame, smolder, glow, or smoke at the temperature to which they are exposed in service.

.2 Insulation thickness and insulating values shall be in accordance with ASHRAE90.1.

1.4 QUALIFICATIONS AND SAMPLES

.1 Submit, for approval, substantiating manufacturers documentation (and samples when requested) for all materials, applications and finishing methods to establish that all will satisfy this specification and meet all applicable code requirements, before commencing work.

1.5 DEFINITIONS

.1 "EXPOSED". All equipment shall be considered to be exposed in boiler room, chiller room, valve room and fan rooms.

2 PRODUCTS

2.1 PREFORMED BLOCK AND BOARD INSULATION

.1 Mineral Fibre (High Temperature) Rigid

.1 Thermal Conductivity at 93°C - 0.046 W/m/deg.C.

.2 Acceptable Manufacturers:

.1 Fibrex FBX1900, Owens-Corning Rocboard 1280, Rocblok PK-16, Roxul RHF.

2.2 FLEXIBLE SHEET INSULATION

.1 Flexible Closed Cell

.1 Thermal Conductivity at 24°C - 0.036 W/m/deg.C.

.2 Acceptable Manufacturer:

.1 Bonotex Polyethylene, Therma-Cel.

.2 Flexible Foamed Elastomeric

.1 Thermal Conductivity at 24°C - 0.039 W/m/deg.C.

.2 Acceptable Manufacturers:

.1 F/R Armaflex II, Rubatex R-180FS.

2.3 REMOVABLE INSULATION COVERS

.1 Flexible mineral fibre or fibre glass fully enclosed on all sides and edges within Alpha Maritex #8459-2-8S silicone fibre glass cloth suitable for temperatures involved with stainless steel wire mesh against hot surface.

.2 Insulation covers to be laced in place with brass/stainless steel hooks and copper/stainless steel wire and be easily removable.

2.4 ACCESSORIES

.1 Jacket Fastenings (Multi-Purpose)

.1 Staples (flare type). Stainless steel.

.2 Compatible jacket finishing tape.

.2 Corner Beads

.1 38 mm x 38 mm x 0.37 mm thick galvanized steel or aluminum as commercially available.

.3 Finish Jacket

.1 Thermocanvas Jacket

.1 Fattal's Thermocanvas, Robson Flamex FR Canvas, Tai-Can Canvas.

.4 Reinforcing Membrane

.1 Glass reinforcing membrane, as commercially available.

.5 Reinforcing Mesh

.1 25.4 mm square galvanized wire mesh, as commercial available .

.6 Insulating Cement

.1 Ryder Thermokote MW High Temp, Partek No. 1.

.7 Fabric Adhesive

.1 Bakelite 120-18, Childers CP-52, Epolux Cadalag 336, Foster 8142W, Robson White Lag.

.8 Fabric Coating

.1 Bakelite 120-09, Childers CP-50, Epolux Cadalag 336, Foster 30-36.

2.5 EQUIPMENT INSULATION SCOPE AND THICKNESS TABLE

Equipment	**Thickness - mm [ins]**	**Scope**
Boiler breeching	100 [4] (2 x 50 [2])	A
Domestic hot water storage tank(s)	50 [2]	A
Domestic cold water meter(s)	20 [3/4] 13 (1/2)	B, D
Expansion joints	50 [2]	C

SCOPE A: Preformed block insulation (high temperature)
SCOPE B: Flexible sheet insulation
SCOPE C: Removable insulation cover
SCOPE D: Preformed board insulation

3 EXECUTION

3.1 APPLICATION

.1 Apply insulation to equipment only after all connections to it are completed and all tests have been made and systems accepted as tight.

.2 Apply insulation and insulation finish, in a workmanlike manner carefully securing it permanently to all surfaces of the equipment. Finish the work so that the finished product is pleasing to the eye, uniform in application and smooth in finish with all edges protected and sealed.

.3 When more than one layer of insulating material is used to achieve the specified thickness, stagger the seams and joints to eliminate leakage paths.

.4 Weld insulation attachment fittings to surfaces, as required, to completely secure block insulation with mechanical, wire or strap fastenings.

3.2 NAMEPLATES

.1 Install insulation so that name and registration plates, cleanouts, manholes, inspection openings and gauge and controller tappings remain uncovered. Cut back insulation around the base of these items at 45 degrees and finish with finishing cement.

3.3 INSULATION - HOT APPLICATIONS

.1 Apply high temperature insulation block and/or preformed/molded pipe insulation and secure firmly to all surfaces with mechanical, wire or strap fastenings. Insulation shall be cut as required, shaped and fitted neatly to all contours, without voids.

.2 The insulation on equipment heads shall receive a 12 mm [1/2"] trowel coat, dry thickness of insulating hard coat finishing cement, to provide a smoothly contoured surface. The cement shall be reinforced with a layer of reinforcing mesh or a reinforcing membrane.

.3 Apply high temperature mineral fibre rigid insulation to the boiler breeching. Exterior application shall be sealed from moisture. Over the insulation, apply 0.53 mm [22 ga] thick aluminum. The longitudinal seams shall be located to shed water. Attach with holding strap at 150 mm [6"] on centres. Provide a complete aluminum jacket system using all of the parts, accessories and installation procedures of the manufacturer. Seal all outdoor jacketing watertight. Overlap all seams by a minimum of 75 mm [3”]. Expansion springs on bands may be required.

3.4 INSULATION - COLD APPLICATIONS

.1 Apply flexible sheet insulation on all cold surfaces. Secure material and longitudinal and butt joints with foam plastic adhesive. Insulation shall be cut as required and be shaped and fitted neatly to all contours, without voids.

3.5 BLOCK INSULATION FINISH

.1 Custom Finish

.1 No further finish required on hard finish cement.

END OF SECTION

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 GENERAL

.1 Provide thermal insulation on all piping, valves, fittings and radiant ceiling panels, as called for and as scheduled. Note items listed that do not require insulation.

.2 Journeyman insulation applicators, skilled in this trade, shall perform the work.

.3 Be responsible for ensuring that sufficient space is always provided to allow proper installation of insulation materials.

.4 As applicable, use the latest edition of the "B.C. Insulation Contractors Association (BCICA) Quality Standards Manual", as a reference standard if sufficient detail/information is not contained herein.

1.3 REGULATORY REQUIREMENTS

.1 Flame spread ratings and smoke developed classifications shall be as required by the 2006 National Building Code and NFPA 90A. Generally, the flame spread rating throughout the material shall not exceed 25 and the smoke developed classification shall not exceed 50.

.2 Insulation thickness and insulating values shall be in accordance with NRC Model National Energy Code of Canada for Buildings (MNECB).

1.4 QUALIFICATIONS AND SAMPLES

.1 Submit, for approval, substantiating manufacturer's documentation (and samples when requested) for all materials, applications and finishing methods to establish that all will satisfy this specification and meet all applicable code requirements, before commencing work.

.2 Submit, for approval, samples of each type of firestopping, smoke seal and accessory.

1.5 DEFINITIONS

.1 "CONCEALED" insulated mechanical services in trenches, chases, furred spaces, shafts and hung ceilings.

.2 "EXPOSED" will mean not concealed.

2 PRODUCTS

2.1 PREFORMED PIPE COVERING

.1 Mineral Fibre - Low and Medium Temperature:

- .1 With integral vapour barrier jacket and longitudinal lap.
- .2 Thermal conductivity at 24°C - 0.033 W/m/deg.C.
- .3 Acceptable Products:
  - .1 Manson Alley K, Owens Corning SSL-11, Knauf 850 ASJ/SSL, Johns Manville Micro-Lok AP-T Plus, Owens Corning 1200 ASJ/SSL.

.2 Mineral Fibre - High Temperature:

- .1 With integral vapour barrier jacket and longitudinal lap.
- .2 Thermal Conductivity at 93°C - 0.040 W/m/deg.C.

.3 Acceptable Products:

.1 Manson Alley Kapt, Johns Manville Micro-Lok AP-T Plus, Owens Corning 1200 ASJ/SSL, Roxul ASJ/SL.

2.2 FIRE STOPPING AND SMOKE SEAL MATERIALS

.1 References:

.1 CAN4-S115-M, Standard Method of Fire Tests of Firestop Systems.

.2 ASTM E814 Standard Method of Fire Tests and Through-Penetration Firestops.

.3 1997 Certifications Listings Intertek Testing Services N.A. Ltd. (Warnock Hersey).

.4 Underwriters Laboratories of Canada. Listing of Equipment and Materials Vol. 3 Fire Resistance Ratings -Revision 4/95.

.2 Work Included:

.1 Furnish all labour, material, equipment and services necessary to supply and install firestopping and smoke seals around mechanical service piping and duct penetrations through fire rated wall and floor assemblies, as indicated and as specified.

.3 Quality Assurance:

.1 The work of this section shall be carried out only by an approved specialist firm, employing skilled tradesmen experienced in firestopping and smoke seal application and approved, licensed and supervised by the manufacturer of fire stopping materials.

.2 All work to be of the highest quality according to best trade practice and in strict accordance with manufacturer's printed specifications.

.4 Submittals:

.1 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation.

.2 Submit manufacturers' product data for materials and prefabricated devices. Include assembly/location design system number references with copies of test information. Construction details should accurately reflect actual job conditions.

.3 For building assemblies which do not correspond to any previously tested and rated assemblies, submit proposals based on related designs using accepted fireproofing design criteria.

.5 Materials:

.1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of ULC CAN4-S115 and not to exceed opening sizes for which they are intended.

.2 Service penetration assemblies and design: Certified by ULC in accordance with CAN4-S115 and listed in ULC Guide No. 40 U19. 1997 Certification Listings Intertek Testing Services N.A. Ltd. (Warnock Hersey).

.3 Service penetration firestop components: Certified by ULC in accordance with CAN4-S115 and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15 under the Label Service of ULC or equivalent approved tests by Warnock Hersey.

.4 Fire resistance rating of installed fire stopping assembly shall be not less than the fire resistance rating of surrounding floor and wall assembly.

.5 Acceptable Products:

.1 DOW FS 2000/2001, Tremco Fyre-Sil, 3M 1000 silicone, 3M CP25WB, Firestop Systems 4800DW, Nuco Self Seal Fire Stops.

2.3 ACCESSORIES

.1 Insulation Fastenings:
- .1 1.6 mm [16 ga.] galvanized wire or 1.6 mm thick copper wire as commercially available.

.2 Jacket Fastenings:
- .1 Thermocanvas and All Service:
  - .1 Staples (flare type), compatible jacket finishing tape, contact adhesives recommended by the jacket manufacturer.
- .2 Metal Jackets:
  - .1 Sheet metal screws, pop rivets, bands.
- .3 PVC Jacket and Fitting Covers:
  - .1 PVC self-adhesive tape, plastic pop rivets, bonding cement.

.3 Adhesives:
- .1 Vapour barrier jacket adhesive:
  - .1 Bakelite 230-39, Childers CP-82, Epolux Cadoprene 400, Foster 85-20.
- .2 Fabric adhesive, to insulation pipe covering:
  - .1 Bakelite 120-18, Childers CP-52, Epolux Cadalag 336, Foster 30-36, Robson White Lag.

.4 Coatings:
- .1 Vapour barrier coating on reinforcing membrane or on insulating cement:
  - .1 Bakelite 120-09, Childers CP-50, Epolux Cadalag 336, Foster 30-36.
  - .2 Childers CP-30 (refrigeration suction lines only).
- .2 Flexible elastomeric and flexible closed cell insulation finish coating:
  - .1 Armstrong, Bakelite 120-13, Rubatex, Zipcoat.

.5 Finish Jackets:
- .1 Thermocanvas Jacket:
  - .1 Fattal's Thermocanvas, Robson Flamex FR Canvas or Tai-Can Canvas.
- .2 All Service Jacket (with 0.03 mm [0.0019”] minimum thick foil:
  - .1 Fattal's Fat-Lock ASJ, Fiberglass ASJ, Knauf ASJ, Kingspan ASJ, Manson APT, Johns Manville AP-T Plus, Owens Corning ASJ, Roxul ASJ.
- .3 PVC Finishing Jacket (minimum 0.50 mm [0.02”] thick:
  - .1 Proto PVC, Speedline PVC, Zeston PVC.
- .4 Aluminum Jacket:
  - .1 0.51 mm [22 ga.] thick corrugated or smooth aluminum jacketing with longitudinal slip joints and 50 mm [2"] end laps with factory applied protective liner on interior surface.
    - .1 Childers, Alco Thermoclad 1 or other as commercially available.

.6 Reinforcing Membrane:
- .1 Glass reinforcing membrane as commercially available.

.7 Insulating Cement:
- .1 Fibrex Superkote, Partek No. 1, Ryder Thermokote MW high temperature.

.8 Finishing Cement:
.1 Ryder Thermokote 1 FW.
.9 Flexible Insulation:
.1 Manson Alley-Wrap, Owens Corning AF 300 Series, Knauf Plain Wrap, Johns Manville Microlite, Roxul Wrap (RW).
.10 Preformed Fitting Covers:
.1 Aluminum Fitting Covers:
.1 0.51 mm [22 ga.] thick, die shaped components with factory applied protective liner on interior surface.
.1 Childers Ell-Jacs, Perma-Ells or Shield-Ells or other as commercially available.
.2 PVC Fitting Covers:
.1 0.50 mm [0.020"] thick premoulded one piece covers.
.1 Certainteed Snapform, Childers, Proto PVC, Speedline PVC, Zeston PVC, Fattal PVC.
.11 Preformed Insulation fittings:
.1 Shur-Fit, Moulded Acoustic Products or from insulation fabricators.

2.4 SCOPE OF INSULATION

.1 Heating Pipe, Fittings and Valves:
.1 Insulate the following systems, unless otherwise noted:
.1 Boiler feed water piping.
.2 Antifreeze heating supply and return piping.
.3 Hot gas piping.
.2 DO NOT insulate the following, unless otherwise noted:
.1 Piping located within perimeter heating enclosures.
.2 Relief piping.
.3 Drain lines.
.4 Condenser water piping inside building.
.3 Insulate the following valves and fittings if the pipe is insulated:
.1 Elbows, tees, reducers.
.2 Valve bodies on valves and check valves, over NPS 2-1/2".
.3 Flanges.
.4 Strainers.
.4 The following hot pipe fittings that operate at 60° C [140° F] shall be coated with Thermalite –SG as per manufacturer's specifications to prevent skin burns:
.1 Valves, NPS 2-1/2" and smaller.
.2 Valve bonnets.
.3 Unions.
.4 Drip legs.
.5 Flexible connections.
.6 Expansion joints.
.7 Check valve covers.

.2 Plumbing pipes, fire protection pipes, fittings, valves:

.1 Insulate the following systems, unless otherwise noted:

.1 Domestic cold water system including meter body and booster pump bodies and including traps on handicapped lavatories.

.2 Domestic hot water supply and recirculation piping.

.3 Domestic tempered water supply and return.

.4 Rainwater leaders and cast iron fittings for the first 6 metres.

.5 All drains, lines, stacks, fire standpipes and sprinkler mains in unheated areas (insulation shall cover heat tracing cables).

.6 Water valves, flanges, PRV's, strainers, check valves.

.7 Sprinkler / standpipe system from domestic water connection point to 5 metres [16 ft] downstream thereof or to the inlet of the alarm valve, whichever is less.

.8 Interior irrigation / hose bibb supply piping.

.2 DO NOT insulate the following, unless otherwise noted:

.1 Piping used exclusively for fire protection (unless in unheated spaces).

.2 Soil stacks, vents, etc.,

.3 All special service piping, e.g. gas, compressed air, etc.

.4 Unions.

.5 Flexible connections or expansion joints (unless noted on the drawings).

.6 Check valve covers.

.7 Strainer leg and basket covers.

.8 Flexible fixture connections.

.3 Pipe penetrations through walls and floors:

.1 All material for the stuffing, sealing and caulking of the pipe penetration shall be supplied and installed under this section.

2.5 PIPE INSULATION THICKNESS TABLE - MM [INS]

	NOMINAL PIPE SIZE (NPS)					
Service	**Design Operating Temperature**	**Runouts 2 and less (note 1)**	**1 and less**	**$1^1/_4$ to 2**	**$2^1/_2$ to 4**	**5 and larger**
Refrigerant Suction and Hot Gas	5°C [40°F] or lower	25 [1]	40 [1.5]	40 [1.5]	40 [1.5]	40 [1.5]
Hot Water / Glycol Heating	96-120°C [205-250°F]	25 [1]	40 [1.5]	40 [1.5]	50 [2]	50 [2]
Condensate (gravity)	100°C [212°F]	25 [1]	40 [1.5]	40 [1.5]	50 [2]	50 [2]
Continuous C.W. Drainage	5 °C [40 °F]	25 [1]	25 [1]	25 [1]	25 [1]	25 [1]
Drip Pan Drains – Unit Coolers	1°C [34°F] and above	None	none	None	None	none
Drip Pan Drains – Freezers	below 1°C [34°F]	25 [1]	25 [1]	25 [1]	25 [1]	25 [1]
Drip Pan Drains – Freezers	heat traced	25 [1]	25 [1]	25 [1]	25 [1]	25 [1]

	NOMINAL PIPE SIZE (NPS)					
Service	**Design Operating Temperature**	**Runouts 2 and less (note 1)**	**1 and less**	**$1^1/_4$ to 2**	**$2^1/_2$ to 4**	**5 and larger**
Evaporator Drip Pan Drains	11°C [51°] and above	None	none	none	None	None
Evaporator Drip Pan Drains	10°C [50°F] and lower	25 [1]	25 [1]	25 [1]	25 [1]	25 [1]
Domestic Cold Water	5°C [40°F]	25 [1]	25 [1]	25 [1]	25 [1]	25 [1]
Domestic Hot & Tempered Water Supply and Recirculation	40-70 °C [105-160°F]	25 [1]	25 [1]	25 [1]	40 [1.5]	40 [1.5]
Buried & Exterior Rainwater Storm Drainage	5°C [40°F]	none	none	None	none	none
Above Grade Interior Rainwater Storm Drainage	5°C [40°F]	25 [1]	25 [1]	25 [1]	25 [1]	25 [1]

Note 1: Runouts to individual terminal units not to exceed 3.7 m [12 ft] in length.
Note 2: All piping forming part of the HVAC system and located outside the building envelope shall be insulated for the level specified in the Table for steam piping at pressures 334 kPa [121 psig] and greater.

3 EXECUTION

3.1 APPLICATION

.1 Apply insulation to piping only after all tests have been made and systems accepted by Departmental Representative as tight.

.2 Apply insulation and insulation finish in a workmanlike manner so that the finished product is uniform in diameter, smooth in finish, pleasing to the eye and with the longitudinal seams positioned to be concealed from view. Apply piping insulation materials, accessories and finishes in accordance with manufacturer's recommendations.

.3 On piping NPS 2-1/2 and larger with insulation and vapour barrier, install high density insulation above hanger shield. Insert to be slightly longer than the length of shield. Maintain integrity of vapour barrier over full length of pipe without interruption at sleeves, fittings and supports.

.4 Insulation and vapour barrier shall be continuous through all non-rated separations.

3.2 INSULATION TERMINATION POINTS

.1 Terminate insulation 75 mm [3"] back from all uninsulated fittings to provide working clearance and terminate insulation at 90° and finish with reinforced scrim cloth and vapour barrier mastic system. Cover onto pipe and over the insulation vapour barrier. On concealed hot services terminate insulation 75mm [3"] back from all uninsulated fittings, cut off at 90° and apply reinforced scrim cloth and breather mastic system.

.2 Cut back insulation at 45° and finish with a silicone caulking sealant around the base of thermometer wells, pressure gauges, flow switches and pressure and control sensors.

3.3 VERTICAL RISERS

.1 On vertical pipe over 75 mm [3"] provide insulation supports welded or bolted to pipe, directly above lowest pipe fitting. Thereafter, locate on 4.5 m [15 ft.] centres.

3.4 HOT APPLICATION 26.7OC [80OF] AND OVER

.1 Piping:

.1 Install medium temperature pipe insulation with integral jacket to pipe and hold in place by stapling the flap, with spreading staples at 75 mm [3"] centres. Pipe insulation with integral self-sealing jacket will not require additional fastening.

.2 Install strips of vapour barrier jacket over butt joints and secure with spreading staples.

.2 Fittings:

.1 Insulate fittings, to thickness of adjacent pipe insulation, with sections of the pipe insulation mitred to fit tightly, or with preformed insulation fittings (Shur-Fit) or from insulation fabricator.

.3 Valves, Strainers:

.1 Insulate valve bodies and strainers with fitted pipe insulation, or mitred blocks all to thickness of adjacent pipe insulation or insulate with preformed insulation fittings (Shur-Fit) or from insulation fabricator. Drains, blowoff plugs and caps shall be left uncovered.

.4 Flanges and Victaulic Fittings:

.1 Insulate flanges with oversized pipe insulation or mitred blocks to the thickness of the adjacent pipe insulation. Insulation to overlap adjoining insulation at least 75 mm [3"].

3.5 COLD APPLICATION 10OC [50OF] AND LESS

.1 Piping:

.1 Install low/medium temperature pipe insulation with integral vapour barrier jacket to pipe and hold in place by securing the jacket flap. Seal all flaps with vapour barrier adhesive. Pipe insulation with integral self-sealing vapour barrier jackets will not require additional fastening.

.2 Install strips of vapour barrier jacket over butt joints with vapour barrier adhesive. Over wrap butt strips by 50 percent for insulation O.D. 300 mm [12”] and above apply strips on 250 mm [10”] centres for additional securement.

.2 Fittings:

.1 Insulate fittings to thickness of adjacent pipe insulation with sections of the pipe insulation mitred to fit tightly, or preformed insulation fittings (Shur-Fit), then apply reinforcing membrane embedded barrier coating and apply finish vapour barrier coating.

.2 Alternatively insulate fittings with tightly placed flexible insulation and apply premoulded 25/50 rated PVC fitting covers. Apply vapour-barrier adhesive and tape on all joints and overlaps.

.3 Valves, Strainers:

.1 Insulate valve bodies, bonnets and strainers with fitted pipe insulation, or mitred blocks all to thickness of adjacent pipe insulation, then apply reinforcing membrane embedded in barrier coating. Alternately, insulate with preformed insulation fittings (Shur-Fit) covered with reinforcing membrane, stapled in place and covered with a barrier coating. Drains, blow-off plugs and caps shall be left uncovered.

.4 Unions, Flange and Victaulic Fittings:

.1 Insulate cold unions and flanges with oversized pipe insulation or mitred blocks to the thickness of the adjacent pipe covering, then apply reinforcing membrane embedded in barrier coating and final coating of vapour barrier mastic.

3.6 ANTI-SWEAT COATING

.1 Coat with an anti-sweat coating - "No Sweat" by Robson Thermal Mfg. Ltd. or approved alternate the following uninsulated cold surfaces:

.1 Connecting surfaces of thermometers, pressure gauges, flow switches, controllers, etc.

.2 The coating thickness shall be as recommended by the coating manufacturer for the system operation conditions.

3.7 PIPE INSULATION FINISHES

.1 "Concealed" insulation in horizontal and vertical service spaces will require no further finish.

.2 "Exposed" flexible insulation shall be painted with a heavy brush coating of foam plastic white insulation coating.

.3 "Exposed" insulation inside the building shall be finished as follows:

.1 Economy Finish:

.1 Apply pipe insulation with an integral all-service type jacket. Cover longitudinal and circumferential joints with jacket finishing tape neatly applied. Alternately secure jacketing longitudinal joint using integral self-sealing lap. Cover circumferential joints with jacket finishing butt strips. Over wrap strips by 50 percent. For insulation O.D. 300 mm [12”] apply strips on 250 mm [10”] centres for additional securement. PVC, especially, .020” thick should not be used as a vapour barrier alone. Should have ‘ASJ’ or mastic system under it. Over insulation on short pipe runs and piping adjacent to fittings, valves, etc., jacket to be field applied.

.2 Over insulated fittings apply tack coat of vapour barrier mastic and embed reinforcing membrane and cover with same mastic. Over insulated valve bodies, valve bonnets, strainers and flanges, apply all-service jacketing using necessary fastenings and jacket finishing tape and with the reinforced mastic system on irregular surfaces.

3.8 REFRIGERATION SUCTION PIPING OUTSIDE BUILDING

.1 Install flexible foamed elastomeric or flexible closed cell preformed piping insulation. Secure longitudinal and butt joints with adhesive. Insulate all fittings and components. To obtain the specified thickness, apply in layers with staggered joints.

.2 Finish with flexible elastomeric or flexible closed cell insulation coating.

.3 Cover pipe insulation located outside building or exposed to outdoor with aluminum lading.

3.9 FIRE STOPPING AND SMOKE SEALS

.1 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.

.2 Maintain insulation around pipes penetrating fire separation only as permitted by Firestop Assembly Listing.

.3 Submit Certificate of Inspection (Form MF173) that all work is complete and in accordance with the specified requirements before Substantial Completion.

3.10 INSULATION PACKING OF PIPE SLEEVES

.1 Tightly pack the space between all pipe sleeves and pipe or between pipe sleeve and pipe insulation with mineral wool insulation - Thermal Ceramics "Cerafiber" or Carborundum "Fiberfax" to full depth of sleeve to prevent transmission of sound and/or passage of smoke.

3.11 INSULATION FOR RADIANT CEILING PANELS

.1 Provide and install 40 mm [1-1/2"] thick 12kg/cu.m. [3/4lbs/cu.ft.] flexible glass fibre insulation on top of all hot water ceiling radiant heating panels. Insulation shall be faced on both sides with a FSK (Foil, Scrim, Kraft) facing (similar to Manson C & I ceiling wrap) and all edges sealed with insulation coating / sealer.

.2 Application:

.1 Cut insulation to fit dimension of the back of each panel and lay insulation on top of each panel.

.2 Insulation shall extend from edge to edge.

.3 Insulation shall cover small piping located directly above the panel.

END OF SECTION

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 QUALITY ASSURANCE

.1 The commissioning shall be executed in accordance with the intent of ASHRAE Standard 1-1996 "Guideline for Commissioning of HVAC Systems".

.2 For list of acceptable Commissioning Agencies, refer to Section 23 06 04.

1.3 GENERAL

.1 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.

.2 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 various phases of the commissioning, testing, balancing and demonstration process.

.2 Commissioning is concluded when air and water systems have been balanced and the installation is in full working order and acceptable for use. The work will include the following:

- .1 Balancing of the air systems as specified in this section.
- .2 Balancing of the liquid systems as specified in this section.
- .3 Set up air diffusers, registers and grilles for optimum distribution/comfort.
- .4 Set up and test all implosion/explosion doors.
- .5 Set up constant volume and variable volume fans.
- .6 Adjust air valves as necessary.
- .7 Plug all air pressure and flow measuring holes.
- .8 Adjust vibration isolators and earthquake restraints for optimum performance.
- .9 Verification and certification of the sealing of all HVAC penetrations through fire separations (rated & non-rated) and sound separations.
- .10 Verification of water tightness of all roof and exterior wall penetrations.
- .11 Verification that all coil drain pans operate.
- .12 Set up all automatic control valves/dampers and automatic temperature control devices.
- .13 Testing and debugging of B.M.S. (Building Management System).
- .14 Set up and test all alarm and protective devices.
- .15 Power failure test with emergency generator start-up.

.3 At the conclusion of commissioning, demonstrate the operation of the systems to the Departmental Representative and then to the Departmental Representative's Operating Staff. For demonstration and instruction to Operating staff requirements, refer to this section of the specification and also to section 23 09 01(Controls Systems).

.4 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, fusible link fire dampers, smoke dampers, 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 Proper response of all mixing boxes and air valves to thermostats and volume adjustment controls.

.6 Operation of all smoke dampers

.7 Operability of randomly selected fire dampers.

.8 Noise level from typical air valves under extreme operating conditions.

.9 Operation of all equipment and systems under each mode of operating, and failure, including:

.1 B.M.S. (Building Management System) control features

.2 Automatic controls including air compressors

.3 Boilers and associated gas/oil fuel systems

.4 Refrigeration systems

.5 Air heat recovery system

.6 Heat exchangers/immersion heaters

.7 Pumps

.8 Cabinet unit heaters

.9 Unit heaters

.10 Fans

.11 Heating Coils

.12 Humidifiers

.13 Tanks - domestic hot water and expansion.

.5 At the completion of the commissioning, testing, balancing and demonstration submit the following to the Department of 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 B.C. Boiler Inspection Dept. approval of boiler, pressure vessels and pressure piping installations.

.5 B.C. Gas Inspection Dept. approval of boiler on gas firing.

.6 A list of all alarm and protective devices tested, with the final operating settings.

END OF SECTION

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 SCOPE OF WORK

.1 The new control system shall be a completely stand-alone and fully functional native BACnet DDC system.

1.3 GENERAL

.1 The control system is to be fully microprocessor based.

.2 The controls system is to be complete with all necessary control components and connections to achieve the specified functions and to permit the H.V.A.C. systems to perform properly in the manner described and as hereinafter specified.

.3 The controls contractor shall furnish all materials, including all central computer hardware and software, operator input/output peripherals, standalone DDC panels, automation sensors and controls, wiring and conduits. The controls contractor shall be responsible for the design, installation, supervision and labour services, calibration, all software programming, and checkout necessary for a complete and fully operational Building Automation System.

.4 The control system is to be set up and adjusted to achieve optimum operation of the H.V.A.C. system. This includes sequencing, timing and readjustment, as required. Modifications to the sequence of operation using points indicated will not be considered as extra to the Contract. These modifications to continue through the construction period, commissioning period and warranty period as required to achieve optimum operation of the mechanical system.

.5 This Section is a performance specification clarified in certain sections to establish minimum standard of equipment, installation or level of control. The specification describes the basic functions required but not all of the installation details or components. This Trade is expected to have sufficient experience to be able to design and estimate the cost of an appropriate control system. Materials and work necessary to achieve a satisfactory result will not be considered extra to the contract.

.6 The contractor shall review all contract documents and visit the site if possible, prior to the closing date of the tender and site confirm the requirements regarding the routing of interconnecting transmission network, etc..

.7 When preparing shop drawings, review the proposed sequences, suggest improvements and review these with the Departmental Representative.

.8 Work with the other parties involved in commissioning, assess how the programming can be modified to improve function, review this with the Departmental Representative and modify the programming as instructed by the Departmental Representative.

.9 The control system shall be a modular, flexible and fully commissioned Direct Digital Control (DDC) System except that controls not scheduled on the points list may be electric. Items identified in the sequence of operation as being under DDC control but which are not included in the points list shall be included in the DDC system.

1.4 SHOP DRAWINGS

.1 Shop drawings shall include:

- .1 Control centre layouts.
- .2 Manufacturer's descriptive technical literature for all equipment and devices.
- .3 Interconnection schematics.
- .4 Wiring and piping diagrams.
- .5 One-line diagram from sensor and control points to Field Interface device and/or standalone DDC panel including all components and cables.
- .6 Terminal cabinets, including termination listing.
- .7 Written description indicating sequence of operation. Shop drawings will be rejected if the written description is not included with the submission. Sequences should reference English descriptors and labels for each point described.
- .8 All input/output points which shall include the following information associated with each point.
  - .1 Sensing element type and location.
  - .2 Details of associated field wiring schematics and schedules.
  - .3 Pneumatic schematics and schedules. (Not required on "all electronic" projects).
  - .4 Software and programming details.
- .9 Detailed block diagrams of transmission trunk routing and configuration.
- .10 Valve and damper schedules indicating size, configuration, capacity and locations. If size varies greater than 10%, obtain approval of Departmental Representative.
- .11 Copies of all system graphics complete with system specific point labels.

1.5 OPERATING & MAINTENANCE MANUALS

.1 The maintenance manual data is intended to cover the operation and maintenance of all control systems and equipment installed. Forward 4 copies of the Controls and Instrumentation section of the operating and maintenance manuals to the Balancing Agency to ensure the binding and format of material are compatible. Ensure sufficient time has been given to the Balancing Agency for the compiling of the complete operating and maintenance manuals by the commissioning deadline. One complete manual shall be furnished prior to the time that system or equipment tests are performed.

.2 The manuals shall include the name, address and telephone number of the control subcontractor installing the systems and a list of emergency numbers for service personnel. The manuals shall have a table of contents and be assembled to conform to the table of contents with the tab sheets placed before instructions covering the subject.

.3 Manuals shall be furnished which provide full and complete coverage of the following subjects:

- .1 Operational Requirements: This document shall describe, in concise English terms, all the functional and operational requirements for the system and its functions that have been established. It shall not require knowledge of digital processor programming or electronic techniques or control system theory.
- .2 System Operation: Complete guidance and procedures for operation of the system, including required actions at each operator station; operation of computer peripherals; input and output formats and procedures; and emergency, alarm, and failure recovery procedures. Provide step-by-step instructions for system startup, back-up equipment operation, and execution of all system functions and operating modes.

.3 Functional Description: Detailed documentation, in language readily understandable to Departmental Representatives, of the theory of operation and specific functions of the system. Provide full details of data communications, including data types and formats, data processing and disposition data link components and interfaces and operator test or self-test of data link integrity for all system components and computer peripherals during each system function and operating mode. Hardware and software functions, interfaces, and requirements shall be explicitly detailed for all system components in all system functions and operating modes. Any operating procedures currently implemented or planned for implementation in an automatic mode shall be stated and described.

.4 Software: Documentation of the theory, design, interface requirements, and functions of all software modules and systems for all digital processors. Include test and verification procedures and detailed descriptions of program requirements and capabilities. Provide all data necessary to permit modification, relocation, or other reprogramming to respond to changing system functional requirements without disrupting normal control system operation. Include, as a minimum, for all software modules, fully annotated source code listings, error-free object code files ready for loading via a peripheral device, and complete program cross reference, plus any calling requirements, data exchange requirements, necessary subroutine lists, data file requirements, and other information necessary to ensure proper loading, integration, interfacing, and program execution. All DDC panel software shall be provided individually for each DDC panel while a single section shall reference all DDC panel common parameters and functions.

.5 Maintenance: Documentation of all maintenance on all system components including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective units. Include calibration, maintenance, and repair of all sensors and controls, plus diagnosis and repair or replacement of all system hardware.

.6 Test Procedures and Reports: The test implementation shall be recorded with a description of the test exercise script of events and documented as Test Procedures. A provision for the measurement or observation results, based on the previously published Test Specification, forms the Test Reports. The procedures record and the results of these exercises shall be conveniently bound and documented together.

.4 Refer to Section 23 05 00 for additional requirements.

.5 Provide electronic copy of the shop drawings in addition to hard copies.

1.6 WARRANTY

.1 Refer to General Conditions.

.2 The system including all hardware and software components shall be warranted for a period of one year following the date of final acceptance. Any manufacturing defects arising during this warranty period shall be corrected without cost to the Owner.

.3 All applicable software as detailed in this specification shall be updated by the Controls Contractor free of charge during the warranty period. This will ensure that all system software will be the most up-to-date software available from the Controls Contractor. All future patches to the software shall be made available to the Departmental Representative.

.4 Repairs required by a total system failure, or the malfunction of any priority portion of the system shall be considered an emergency repair, and shall be performed within eight (8) hours of the report of the failure.

.5 Repairs of a non-emergency nature shall be promptly repaired on the next normal business day.

.6 Provide written assurance that a local service centre will be maintained with a complete stock of replacement parts, and capable of servicing any and all troubles in the system.

.7 Use of installed equipment during construction shall not shorten or alter the warranty period as specified in the General Conditions.

.8 Take note of and provide any extended warranties specified.

1.7 ELECTRICAL COMPONENTS, WIRING AND CONDUIT

.1 By Control Contractor (Division 23):

.1 All control system components to make a complete and operable system, except those supplied as part of packaged equipment controls, but including all auto-sequencing devices and electrical interlocks required to accomplish the sequences specified hereafter. Refer to the electrical equipment schedule, the electrical drawings and the electrical specification, which describes the limits of the extent to the work in Division 26 serving mechanical systems. Materials, equipment, connections and power not provided by Division 26 but required for the Control System shall be provided under this section.

.2 All control circuit transformers (120/1/60 or 24/1/60 and as designated).

.3 All control wiring and metallic conduit for mechanical system controls.

.4 Supply, installation and connection of all electric control items including: damper motors, relays, outside sensors, sub-master control circuits, safety devices, electric thermostats, aquastats, flow switches, wiring to terminal strips, proportional controllers, controllers, etc..

.5 All wiring and conduit from power distribution system to any control devices needing power (including B.M.S components)

.6 Be responsible for coordinating with Division 26.

.7 Electrical work installed under Division 23 shall be to the standards specified under Division 26.

.2 By Division 26:

.1 All power wiring and conduit from power distribution system up to and including connection to all motors and starters.

.2 All disconnect switches required (unless specified in schedules as being integral with equipment).

.3 All motor protection switches, stop-start switches, magnetic starters, contactors and hand-off-automatic selector switches except those supplied as part of packaged equipment.

.4 Terminal strips within the motor control centres (MCC) for control connections.

.5 Fire alarm signals.

.3 Note:

.1 All magnetic starters for equipment shall have the following features supplied under Division 26:

.1 Hand-off-automatic selector or on-off selector, or start-stop buttons in cover with hand-automatic bridge if applicable.

.2 Pilot light.

.3 120 volt coils.

.4 120 volt control transformer.

.5 Four auxiliary dry contacts for interlocks; two normally open and two normally closed.

.2 The Controls Contractor is responsible for reading Division 26 plans and specifications to determine scope of responsibility and standards.

.4 Wiring:

.1 Carrier System – Open, exposed areas including mechanical, electrical and equipment rooms:

.1 All wiring shall be run in EMT conduit except the final 900mm of wiring to all operators and to all sensors subject to vibration, which shall be run in flexible metallic conduit.

.2 Provide steel fittings with nylon throats for all conduit connections.

.2 Carrier System – Concealed, accessible areas.

.1 Class II low voltage BMS open cable, neatly bundled, shall be routed parallel to building lines. Cable may follow ductwork routing and may be tied to the side or top of the ducting at duct supports, using suitable cable ties. If cabling does not follow ducting, it shall be fixed to the structure, supported at a minimum of every 5m. Open cable must be properly rated per electrical code.

.3 Wire:

.1 Line voltage power or switched power wiring - #12 gauge copper wire minimum.

.2 Line voltage control wiring - #14 gauge copper wire, length not to exceed 50 meters; #12 gauge copper wire, lengths exceeding 50 meters.

.3 Low voltage - minimum #22 gauge wire as directed by applicable electrical codes and requirements. 24 gauge wire for thermostat cables

.4 Cable:

.1 Data transmission cable shall be minimum #18 gauge twisted pairs (shielding as per manufacturers recommendations).

.5 Note:

.1 Run carrier system parallel to building lines.

.2 Support conduit carrier system every one meter independent of piping, ductwork and equipment.

.3 All wiring shall be concealed in finished spaces.

.4 Seal all penetrations through fire separations or walls as per code requirements.

.5 Identify all junction box covers with control company label.

.6 Identify with colour bands, all conduits at all junction and pullboxes, at both sides of wall and floors and at not more than 7.5 m [25 Ft] intervals along the length. Identification bands to be sprayed on and not less than 100mm [4"] wide. Bands to be pink in colour unless in conflict with Division 16 [26] colours.

.7 Use colour coded conductors.

.8 Adhere to all applicable electrical codes and regulations.

.9 Obtain electrical permit.

.10 For non-CSA equipment where required by electrical code, submit to Inspection Authorities and obtain approval prior to installation of equipment on site.

1.8 EQUIPMENT SUPPLIED FOR INSTALLATION UNDER OTHER SECTIONS

.1 The following equipment shall be supplied under this section but installed under the appropriate trade sections of Division 23:

.1 Automatic control valves.

.2 Temperature sensor wells.

.3 Automatic control dampers.

.4 Pressure tappings.

.5 Static pressure sensors.

.6 Flow switches.

.2 The Controls Subcontractor shall be responsible for arranging, coordinating and supervising the installation of the above devices in a suitable manner and readily accessible location.

1.9 FREEZE PROTECTION

.1 All air supply handling units containing coils shall have a non-recycling, manual reset, electric line voltage freeze protection controller that will stop the system upon sensing 4°C.

.2 The freeze protection controllers shall contain an additional set of dry contacts that will close on freeze detection for remote alarm indication at the B.M.S..

.3 The freeze protection contacts shall be connected on the common line after the H.O.A. selector switch.

1.10 ALARMS - GENERAL

.1 No alarm shall be triggered for a device until the device has been started and is in stable operation. Use software time delays to achieve this effect.

.2 Generate an alarm on the B.M.S. if any equipment is not in the intended operating condition or if any analog input is not within the intended operating range.

1.11 IDENTIFICATION

.1 Identify all controls with symbols relating directly to the control diagram. Use plasticized tags, engraved brass, aluminum, metalphoto or lamicoid labels and secure them to, or adjacent to, the control devices with key chains or cable ties.

.2 All manual switches supplied by this trade, unless they come with standard nameplates, shall be labelled with engraved lamicoid plastic nameplates to clearly indicate the service. Wording on nameplates shall be subject to approval by the Departmental Representative.

.3 Where "day" and "night" thermostats are adjacent to one another they shall be labelled with engraved lamicoid plastic nameplates.

.4 Motor control centre and motor starters should be provided with labels identifying that motors are under remote control.

.5 Mount an input/output layout sheet within each main DDC panel. This sheet shall include the name of the points connected to each controller channel.

.6 Identify all DDC panels and associated devices with symbols relating directly to the control diagram. Provide durable wire labels for each input and output point with the following information:

.1 Point descriptor.

.2 Point type and channel number.

.3 Corresponding DDC panel number.

1.12 SYSTEM COMMISSIONING AND CALIBRATION

.1 Program each standalone DDC panel immediately following installation.

.2 Set up and calibrate all control loops and sensors during the initial start-up of the systems and check, recalibrate and readjust as necessary during the Departmental Representative's Demonstration and Instruction period.

.3 Upon completion of the installation, perform all necessary testing and debugging operations satisfactorily.

.4 Perform all modifications and alterations as required to correct any deficiencies noted during these tests.

.5 Check sensor calibration and control system operation during the first heating season and prior to the first cooling season.

.6 Following each visit submit printed graphs of trend logs one week in duration with hourly samples for all analog inputs connected to each DDC panel.

1.13 VERIFICATION OF SYSTEM COMMISSIONING

.1 Preliminary Tests

.1 After installation of each part of the system and completion of mechanical and electrical hook-up, perform tests to confirm correct installation and functioning of equipment.

.2 Notify the Departmental Representative in writing at least seven days before testing is to take place stating the following:

.1 Location and part of system to be tested.

.2 Describe testing procedure and anticipated results.

.3 Provide all necessary testing equipment and personnel.

.4 Provide portable 2-way radios for communications during demonstrations. Provide three units on the same frequency and of sufficient power and quality as to be useful throughout the building.

.5 Perform tests in presence of the Departmental Representative.

.6 Demonstrate the proper operation of each component.

.7 Correct any deficiencies and re-test in the presence of the Departmental Representative, until designated part of the system performs satisfactorily.

.2 Final Operational Acceptance Test

.1 A final operational test of not less than thirty (30) consecutive days, twenty-four (24) hours per day, shall be conducted on the complete and total installed and operational Control System to demonstrate that it is functioning properly in accordance with all requirements of this specification. The correct operation of all monitored and controlled points shall be demonstrated as well as the operation and capabilities of all sequences, reports, specialized control algorithms, diagnostics, and all other software. If the equipment operates at an average effectiveness level (AEL) of at least 95% during the performance test period of thirty (30) consecutive calendar days, it will be deemed to have met the Acceptable Standard of Performance, and final acceptance of the system shall be made, provided the contractor has satisfied all other requirements of this specification. In the event the required AEL is not reached during the initial thirty (30) consecutive calendar day period, the final operational acceptance test period shall be extended on a day-to-day basis until the required AEL is reached for thirty (30) consecutive calendar days. The average effectiveness level (AEL) is defined as the ratio between the total thirty-day test period less any system downtime accumulated within that period, and the thirty-day test period. Downtime shall result whenever the control system is unable to fulfill all required functions detailed within this specification due to any malfunction of either BMS hardware or software. Any defect of hardware or software shall be corrected when it occurs before the test may be resumed. Downtime created by non-BMS equipment or activities will not be considered as downtime for the AEL calculation.

.3 Refer to Fire Fighters Pressurization Control (FFPC) system for commissioning and performance tests.

1.14 DEMONSTRATION AND INSTRUCTION TO DEPARTMENTAL REPRESENTATIVE

.1 The Controls Contractor shall provide the services of competent instructors who will give full instruction to designated personnel in the adjustment, operation and maintenance, including pertinent safety requirements, of the equipment and system specified. The training shall be oriented toward the system installed rather than being a general (canned) training course. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. The number of person-days (eight hours) of instruction furnished shall be as specified below as a minimum. A training manual shall be provided for each trainee which describes in detail the data included in each training program. All equipment and material required for classroom training shall be provided by the Contractor.

.2 Training Program: The training program shall be accomplished in two phases.

.1 First phase: this phase shall be for a period of at two days at a time mutually agreeable between the Contractor and Departmental Representative. Operating personnel will be trained in the functional operations of the system installed and the procedures that the operators will employ for system operation. First phase training shall include the following:

.1 General control system architecture.

.2 System communications.

.3 Operation of computer and peripherals.

.4 Elementary preventative maintenance.

.5 Report generation.

.6 Operator control functions.

.7 Colour graphics generation.

.2 Second phase: this phase of training shall be conducted four to eight weeks after system acceptance for a period of one days. The training shall include as a minimum, but not be limited to:

.1 A review of Phase 1 training.

.2 Equipment maintenance - this training shall include:

.1 General equipment layout.

.2 Trouble shooting of all control system components.

.3 Preventative maintenance of all control system components.

.4 Sensors and controls maintenance and calibration.

.3 Programming - this training shall include:

.1 System architecture.

.2 Application programs.

.3 DDC panel programming.

.4 Software access code review.

1.15 MAINTENANCE SERVICE DURING THE WARRANTY PERIOD

.1 The Contractor shall provide all services, materials and equipment necessary for the maintenance of the entire Control System, for a period concurrent with the warranty period. Any necessary material required for the maintenance work shall be provided by the Contractor.

.2 The Controls Contractor shall provide one minor inspection per quarter or as required by the manufacturer and two major inspections per year, and all service for the required maintenance.

.3 Major Inspections: these inspections shall include but not be limited to the following:

.1 Work as detailed hereinafter for minor inspections.

.2 Clean all peripheral equipment, CPU, interface panels, multiplexing panels and micro processor interior and exterior surfaces.

.3 Provide signal, voltage and system isolation checks of all CPU, interface panels, multiplexing panels and peripherals.

.4 Provide mechanical adjustments, new ribbons and necessary maintenance on printers.

.5 Check and/or calibrate each field input/output device.

.6 Run system software diagnostics as required.

.4 Minor Inspections: These inspections shall include but not be limited to the following:

.1 Provide visual and operational checks to all CPU, peripheral equipment, interface panels, multiplexing panels, and field devices.

.2 Change filter and check fan for all CPU's peripheral equipment as required.

.3 Provide complete back up of BMS system.

.4 Regular service calls: these calls shall be performed during regular working hours, 8:00 a.m. to 4:30 p.m. Monday through Friday excluding legal holidays.

.5 Emergency Service: the Departmental Representative will initiate service calls when there is indication that the control system is not functioning properly. The Contractor shall have qualified control personnel available during the warranty period to provide service to the "critical" control system components whenever required at no additional cost to the Departmental Representative. The Contractor shall furnish the Departmental Representative with a telephone number where the service mechanic can be reached at all times. The service mechanic shall be on the job ready to service the control system within the next eight (8) hours, after receiving a request for service and the work shall be performed continuously until the control system is back in reliable operating condition. Repairs of a non-emergency nature shall be promptly repaired on the next normal business day.

.6 Records and Logs: records and logs shall be kept of each maintenance task.

.7 System Modifications: recommendations for system modification shall be provided in writing to the Departmental Representative. No system modification, including operating parameters and control settings, shall be made without prior approval.

.8 Software: provide implementation of all software maintenance updates. These shall be accomplished as required and full coordination with control system supervisory personnel shall be maintained.

END OF SECTION

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 GENERAL REQUIREMENTS

.1 Provide all remote sensing points and instrumentation as required for the complete operational capability of the Control System. All sensors shall have the accuracies as stated hereinafter. Hysteresis, relaxation time, span, maximum / minimum limits, etc. shall also be accounted for in all application of sensors and controls.

.2 All instruments of a particular category shall be of the same type and manufacture.

.3 All external trim material shall be completely corrosion resistant with all internal parts assembled in watertight, shockproof, vibration proof, heat resistant assembly.

.4 Use standard conduit box termination with screwdriver connector block unless otherwise specifically stated.

.5 Operating conditions 0°C to 60°C with 10-90% RH (non-condensing) unless otherwise specifically stated.

2 PRODUCTS

2.1 AIR VALVE CONTROLLERS

.1 Microprocessor based terminal unit controllers (TUC's) and damper actuators for the air valves will be supplied by the Controls Contractor. The TUC's shall be provided in a pre-assembled control box for mounting on the air valve. The multi-point flow sensor shall be supplied and installed by the air valve manufacturer.

.2 The necessary interface requirements for the multi-point flow sensor shall be provided by the Controls Contractor (confirm exact requirements with the air valve manufacturer).

.3 Controller and actuator shall be factory mounted on the air valve by the air valve manufacturer.

.4 The Controls Contractor shall be responsible for ensuring that the controllers and damper actuators are suitable for the units and that the characteristics of the boxes listed herein are met.

.5 Controls arranged for pressure independent, variable volume and constant volume operation.

.6 Resettable to any air volume between zero and maximum rated volume.

.7 Refer to Section 23 09 24 for TUC specifications.

.8 Refer to Section 23 36 00 for air valve specifications.

2.2 ALARM PANELS

.1 Provide alarm panels in the following locations:

.1 General office area.

.2 Alarm panels shall include:

.1 Test button to verify lights and alarm horn function.

.2 Pilot trouble light(s) and alarm horn to indicate any alarm condition (1 light for each alarm).

.3 Non-disabling silencing button on panel shall silence horn but alarm light(s) shall continue to burn until alarm condition has been corrected and reset button has been reset. On all subsequent alarms received the horn shall sound.

.4 System on-off switch with key.

.5 Panel to be suitably labelled.

.6 Panel shall include for the following alarms:

.1 4 electrical alarm points.

.2 6 freeze protection alarm points.

.3 1 low control air pressure alarm point.

.4 2 plumbing alarm points.

.5 2 boiler failure alarm points.

.6 2 spare alarm points.

.7 1 heat pump system trouble alarm (wiring from auxiliary contacts in heat pump control panel).

.8 1 freeze high temperature alarm (wire from auxiliary contacts in freezer high temperature alarm package).

2.3 CURRENT SENSING (CR)

.1 Design: Best Coil D78009; Nelsen-Kuljian; Greystone, Veris.

.2 Range: 0-120 amps.

.3 Accuracy: +/-1%.

.4 Interface care:

.1 +/-1% accuracy.

.2 Integral zero and span adjustment.

.3 1-5 VDC or 4-20 mA output for full range input.

2.4 CONTROL DAMPERS

.1 Minimum Requirements:

.1 Provide control dampers configured as follows:

.1 Modulating; opposed blade dampers.

.2 Mixing; parallel blade dampers.

.3 Two position; parallel blade dampers.

.2 Assemblies - rigid and adequately braced with corner gussets.

.3 Galvanized steel or extruded aluminum frames.

.4 Maximum frame dimensions - 1220 mm [48"] wide and 1220 mm [48"] high, unless otherwise indicated. Multiple sections to have stiffening mullions.

.5 Maximum blade width - 200 mm [8"].

.2 Standard control dampers:

.1 Minimum performance, based on 610x610 [24"x24"] damper size as tested in an independent testing laboratory:

.1 Maximum 87 Pa [0.35"] static pressure drop at 15.2 M/s [3000 fpm] velocity (damper fully open).

.2 Maximum 55 L/s / sq m [10.75 cfm/sq.ft] leakage at 747 Pa [3" wg] (Damper fully closed).

.3 Maximum blade length of 1219mm [48"] suitable for minimum 622 Pa [2.5" wg] and 7.6 M/s [1500 fpm] velocity.

.2 Minimum 1.6mm [16 ga] single skin galvanized steel blades with longitudinal groove reinforcement.

.3 Synthetic sleeve type bearings (no metal to metal contact).

.4 Linkage concealed within the damper frame.

.5 Square or hexagonal axles locked into blades.

.6 Synthetic rubber or PVC coated fabric seals mechanically locked into the blade edge (adhesive or clip-on type seals not acceptable).

.7 Flexible metal compression type or extruded synthetic rubber jamb seals.

.8 Standard of Acceptance: Ruskin CD36.

.3 Low leakage control dampers:

.1 Minimum performance, based on 610x610 [24"x24"] damper size as tested in an independent testing laboratory:

.1 Maximum 62 Pa [0.25"] static pressure drop at 15.2 M/s [3000 fpm] (damper fully open).

.2 Maximum 55 L/s / sq m [10.75 cfm/sq.ft] leakage at 747 Pa [3" wg] (Damper fully closed).

.3 Maximum blade length of 1219mm [48"] suitable for minimum 100 Pa [4" wg] and 15.2 M/s [3000 fpm] velocity.

.2 Minimum 2.0 mm [14 ga] galvanized steel airfoil type or 2.1mm [12 ga] extruded aluminum airfoil type blades.

.3 Synthetic sleeve type bearings (no metal to metal contact).

.4 Linkage concealed within the damper frame.

.5 Square or hexagonal axles locked into blades.

.6 Synthetic rubber blade seals mechanically locked into the blade edge (adhesive or clip-on type seals not acceptable).

.7 Flexible metal compression type or extruded synthetic rubber jamb seals.

.8 Standard of Acceptance: T A Morrison 1000.

.4 Note:

.1 Control dampers integral to air handling and heat recovery units provided and factory installed by the unit supplier (actuators by this Division). All other control dampers by this Division.

.2 Instruct the Sheet Metal Trade on damper installation.

.3 Indicated size is outside frame dimension. Increase size of damper and oversize ductwork, to include for depth of the frame, for all dampers with a pressure drop greater than 12 Pa [0.05" w.g.]. Confirm with the Sheet Metal Sub-Contractor before fabrication.

.4 Check that dampers are installed square and true and that blades close tightly against seals and stops.

.5 Blades to be horizontal in vertical mounted dampers. Refer to drawings for orientation of dampers.

.6 Ensure that damper end-linkages are easily accessible (coordinate with the Sheet Metal Sub-Contractor).

.7 Provide an additional drive shaft bearing if the drive shaft is longer than 75 mm [3"].

.8 Do not install dampers within the thickness of any wall unless otherwise indicated (coordinate with the Sheet Metal Sub-Contractor).

.9 Dampers shall be adequate for the maximum system pressure. Refer to the appropriate Section of the specification.

2.5 CONTROL DAMPERS - ROUND

.1 Standard of Acceptance:

.1 Ruskin CDRS-25

.2 Minimum Requirements:

.1 1.19 mm thick [18 ga.] galvanized steel frame with rolled stiffener beads.

.2 Damper blade constructed from two layers of galvanized steel with neoprene edge seal sandwiched between layers.

.3 Stainless steel bearings.

.4 Air leakage shall not exceed 0.28 L/s per 100 mm of blade circumference at 1.0 kPa [.15 CFM per inch of blade circumference at 4" W.C.].

2.6 CONTROL VALVES

.1 All characteristics of control valves shall be suited to the required application. Three-way mixing valves shall be linear for each port giving constant flow, and two-way valves shall have modified linear flow characteristics.

.2 All valves shall be plug type with stainless steel stems and EPT ring pads or teflon packing.

.3 Valve pressure / temperature rating - minimum ANSI Class 125.

.4 Plugs shall be brass with molded composition discs.

.5 Discs (renewable) shall be bronze for media 110°C or less and stainless steel for media above 110°C operating temperature.

.6 Valve bodies for NPS ½ shall be screwed cast brass with integral seat.

.7 Valves NPS ¾ to NPS 2 shall have screened cast brass body and cast brass cage with integral seat.

.8 Valve bodies for NPS 2½ and up shall be cast iron flanged.

.9 All control valves supplied with positive positioning relay shall have a minimum of 27-76 kPa spring range.

.10 Note:

.1 Size control valves according to capacities and pressure drops as indicated in the schedules.

.2 Clearly identify the control valve coefficient (Cv) rating on valve bodies.

.3 All primary building heating valves shall fail open to heating (valves on terminal units may fail either open or to the last operating position). Cooling valves shall fail closed to cooling or to the last operating position. Domestic hot water heating valves shall fail closed to heating.

.4 Control valves to be supplied by this trade for installation by others.

.11 Design: NPS ½ to NPS 2 - Johnson Controls VG7000 series. NPS 2½ and larger - Johnson Controls cast iron flanged globe valves V5252, V5842.

.12 Acceptable Manufacturers: Honeywell V5011 and V5013 series (V5812 series for terminal units); Barber Colman 9213 and 9313 series; Landis & Gyr Powers 656, 658, 591, 592, 593 series.

2.7 CONTROL VALVE ACTUATORS

.1 General:

.1 Valve operators shall allow smooth operation of the valve throughout its entire range and assure tight shut-off against system pressure.

.2 Valve actuator shall be easily removed from the valve body for replacement.

.2 Electric Two Position Valve Actuators (VTE):

.1 Two Position Control Valve Actuators (only to be used where specifically specified):

.3 Incremental Control Valve Actuators (only to be used where specifically specified) (VMI):

.1 The valve actuator shall modulate the control valve between the fully open and closed position based upon a 3-wire control signal (24 VAC). The actuator shall remain in position until the signal is applied.

.2 The valve shall maintain its shutoff force even if power is lost.

.3 The TUC shall calculate valve position based on the motor speed and duration of control signal. The valve shall be driven to a full position and the calculation reset once every 24 hours.

.4 Proportional Control Valve Actuators (VME):

.1 The valve actuator shall modulate the control valve between the fully open and closed position based upon a 0-10 VDC or 4-20 mA control signal. The actuator shall remain in its position until the applied signal changes. In the event of a control signal loss, the actuator shall move to the zero voltage input position.

.2 The valve shall maintain its shutoff force even if power is lost.

2.8 CONTROL PANELS

.1 General:

.1 Fabricate from prime and enamel coated steel suitable for [flush mounting], complete with mounting legs.

.2 Panel doors shall be hinged and complete with locks.

.3 Construct so that instruments and gauges are flush mounted.

.4 Provide sub-panel, inside control panel, for mounting control components.

.5 Adhere lamicoid nameplates on the control panels to clearly identify the service of each device.

.6 Submit shop drawings of control panel for review.

.2 Panel mounted devices:

.1 Temperature gauges and manual reset (where applicable) for:

.1 Outdoor air.

.2 Return air.

.3 Mixed air.

.4 Discharge air (each zone).

.5 Hot water supply.

.6 Hot water return (each coil).

2.9 DIFFERENTIAL PRESSURE TRANSMITTERS (DPT)

.1 Provide differential pressure transmitters having the following minimum specifications:

.1 Internal materials to be suitable for continuous contact with the process material measured including compressed air, water, glycol or steam as applicable.

.2 Output signal of 4 - 20 mA into a maximum of 500 ohm load.

.3 Output variations of less than 0.2% full scale for supply voltage variations of +/- 10%.

.4 Combined non-linearity, repeatability and hysteresis effects not to exceed +/- 1% of full scale output over entire range.

.5 Integral zero and span adjustment.

.6 Temperature effect of +/- 1.5% full scale/50°C or less.

.7 Output short circuit and open circuit protection.

.8 Over-pressure input protection to a minimum of twice rated input.

2.10 DAMPER ACTUATORS

.1 General:

.1 Provide 120 or 24 volt electric or damper actuators where indicated or required.

.2 Damper actuators for all fan variable volume devices, all control dampers shall be supplied by this trade. Refer to Section 23 06 00 or the drawings for schedule of control and dampers.

.3 Damper actuators for VAV boxes and air valves shall be supplied by this trade for factory installation by unit manufacturer. Damper actuators shall meet the requirements of the unit manufacturer in all cases.

.4 Spring return for "fail-safe" in Normally Open or Normally Closed position where required.

.5 Size actuators to control dampers against maximum pressure or dynamic closing pressure whichever is greater.

.6 Size damper actuators so that they will provide smooth and full travel of the dampers while stroking in both directions.

.7 Where individual dampers are installed, install a separate damper actuator for each damper.

.8 Where multi-section dampers are installed, install a separate damper actuator for each section.

.9 Locate damper actuator so that they are easily accessible for testing and servicing.

.10 Where damper actuator operates outdoor and exhaust air dampers, pretension the damper drive linkage to ensure tight closure.

.11 Where a damper actuator is installed on an insulated surface of a duct or plenum, mount it on a stand-off bracket, so as not to interfere with the continuity of the insulation.

.2 Electronic Damper Actuators (DME & DTE):

.1 Actuators shall be direct coupled enabling it to be mounted directly to the damper shaft without the need for connecting linkage.

.2 The actuators shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.

.3 Proportional actuators shall accept a 2 to 10 VAC or 4 to 20 mA signal.

.3 Incremental Control Damper Actuator (DMI):

.1 For VAV box damper control only.

.2 The damper actuator shall modulate the damper between fully open and fully closed based on a 3-wire control signal (24 VAC). The actuator shall remain in position until the signal is applied.

.3 The TUC shall calculate damper position based on the motor speed and duration of control signal. The damper should be driven to a full position and the calculation reset once every 24 hours.

2.11 ELECTRIC RELAYS (ER)

.1 Provide DPDT relays for control and status indication of alarms and/or electrical starters and equipment.

.2 Relay coils shall be rated for 120V or 24V. Where other voltages occur provide transformer.

.3 Contacts rated at 5 amps at 120V AC.

.4 Relays to be plug in type with termination base.

2.12 ELECTRONIC AIR FLOW MEASURING STATIONS (FMS)

.1 Air flow measuring stations for the VAV supply, return and HRV fans shall be supplied and installed by this trade.

.2 The electronic air flow measuring stations shall be as manufactured by Air Monitor Corporation. The station shall consist of all necessary components to provide the required VAV control and interface with the BAS.

.3 As a minimum the electronic air flow measuring stations shall consist of FI probes located in the bellmouth of the fans to be controlled and a Vectron DPT 2500 transmitter with digital readout.

2.13 ELECTRONIC WATER FLOW MEASURING STATIONS (WFS)

.1 Water flow measuring stations are to be provided by the Mechanical Contractor(s) c/w electronic transducer for connection by the Controls subtrade.

.2 Specified equipment is: Annubar GCR-15-CF-MG2 c/w L.V. electric / electronic sensor for connection to B.A.S..

2.14 FLOW SWITCHES (FSW)

.1 Acceptable Manufacturers:

.1 McDonnell Miller, Johnson Controls.

.2 Minimum Requirements:

.1 Single pole double throw action (vapour proof on chilled water).

.2 Adjustable sensitivity.

.3 Extended trimmable paddles.

.4 Selected for minimum flow condition.

.3 Notes:

.1 Install in upright position in horizontal run of pipe.

.2 Install a minimum of 5 pipe diameters downstream of any valves, elbows, orifices or any other obstructions.

.3 Adhere to manufacturer's installation recommendations.

2.15 FREEZE PROTECTION

.1 Freeze protection thermostats shall be manual reset type with 6 m averaging element. Provide multiple thermostats for large duct cross sectional areas.

.2 For liquids, elements shall be rigid bulb type mounted in separable wells.

.3 Freeze protection elements shall be hard wired to the fan starter and also wired to the B.M.S. or alarm system.

2.16 HUMIDITY SENSORS (HS)

.1 Provide humidity sensors as directed with the following minimum specifications:

.1 Range room type 30-80% RH.

.2 Range duct type 20-90% RH.

.3 Operating temperature range of 0°C to 60°C.

.4 Absolute accuracy of +/- 3% RH.

.5 Stainless steel sheath construction complete with integral shroud to enable specified operation in air streams of up to 10 m/sec.

.6 Sensor able to be cleansed of oil vapour, dust or other anticipated air borne contaminants by a simple field method such as solvent or mild detergent solution washing.

.7 Room humidity sensors shall be located at the inlet to an RA grille.

.8 Duct mounted sensors shall be located such that the sensing element is located in the air stream and the transmitter electronics are out of the air stream.

2.17 MIXING BOX CONTROLLERS

.1 Microprocessor based terminal unit controllers (TUC's) and damper actuators for the mixing boxes to be supplied by the Controls Contractor. The TUC's shall be provided in a pre-assembled control box for field mounting on the mixing boxes. The multi-point flow sensors shall be supplied and installed by the mixing box manufacturer

.2 The necessary interface requirements for the multi-point flow sensor shall be provided by the Controls Contractor (confirm exact requirements with the mixing box manufacturer).

.3 The Controls Contractor shall be responsible for ensuring that the controllers and damper actuators are suitable for the units and that the characteristics of the boxes listed herein are met.

.4 Controls arranged for pressure independent, variable volume and constant volume operation.

.5 Resettable to any air volume between 50% and 120% of the nominal schedule volume or to zero.

.6 External taps for balancing gauge.

.7 Refer to Section 23 36 00 for mixing box specifications.

2.18 PROGRAMMABLE CONTROLLER

.1 Acceptable Manufacturer:

.1 MaxiRex D4, Davis Controls Ltd.

.2 Minimum Requirements:

.1 Seven day programmable load controller with a minimum of four independent load circuits.

.2 Liquid crystal display to indicate time, day and function.

.3 Built-in battery to maintain program memory and clock accuracy for 72 hrs.

.4 Self-contained enclosure with clear plastic cover.

.5 Manual on/off/auto switches for each of the four circuits to allow manual override.

2.19 PRESSURE SWITCHES (PSW)

.1 Provide pressure or differential pressure switches for ranges as indicated.

.2 Pressure sensing elements shall be Bourbon tube, bellows or diaphragm type.

.3 Adjustable setpoint and differential.

.4 Pressure switches shall be snap action type rated at 120 volts, 15 amps AC or 24 volts DC.

.5 Sensor assembly shall operate automatically and reset automatically when condition returns to normal.

.6 Sensor Ratings: sensors shall have the following pressure and accuracy ratings:

.1 Pressure switches for pump operation shall have a range of 20 kPa to 350 kPa and adjustable differential from 1 kPa to 35 kPa.

.2 Pressure switches for fan operation shall have a range of 0 to 1500 Pa and adjustable differential from 10 to 50 Pa.

.3 All sensors shall have an isolation valve and snubber installed between the sensor and pressure source.

2.20 ROOM HUMIDISTATS & THERMOSTATS

.1 Minimum Requirements

.1 Adjustable sensitivity and set point.

.2 Electric.

.1 Low or line voltage as specified.

.3 Pneumatic.

.1 Two-pipe relay type.

.4 Standard metal or Lexan covers.

.1 Visible thermometer (thermostats only) graduated in deg.C.

.2 Concealed set-point adjustment (or removable key adjustment).

.3 Lock key covers.

.5 Room thermostats sensors for all applications shall be equipped with an "occupied" switch or button to enable room occupants to override the "unoccupied" schedule for "after hours" operation.

.2 Note:

.1 Provide a key for each instrument requiring a removable key up to a maximum of six. Obtain two signed receipts from the Departmental Representative certifying that the keys have been received. Hand one over to the Departmental Representative.

2.21 STATIC PRESSURE TRANSMITTERS (SPT)

.1 Output of 4 - 20 mA linear into maximum of 500 ohm load.

.2 Calibrated span: not greater than twice the static pressure at maximum flow.

.3 Accuracy: +/- 1% of span.

.4 Repeatability: within 0.5% of output.

.5 Linearity: 1.5% of span.

.6 Deadband or Hysteresis: 0.1% of span.

2.22 TEMPERATURE SENSORS

.1 General: Temperature sensors shall be thermistor, resistance or thermocouple type, however, thermocouples shall be restricted to temperature range +200°C and above.

.2 The following shall apply to thermistor, resistance or thermocouple temperature sensors as applicable.

.1 RTDs shall be 100 ohm or 1,000 ohm at 0øC (+/- .2 ohm) nickel or platinum element with strain minimizing construction and 3 integral anchored leadwires coefficient of resistivity of 0.000385 ohms/ohm/ deg.C. Thermistors shall be 3,000 or 10,000 ohms.

.2 Sensing element to be hermetically sealed.

.3 Stem and tip construction to be copper or 304 stainless steel as noted.

.4 Sensors to have a time constant response of less than 3 seconds to a temperature change of 10°C.

.5 Sensors shall operate over the following ranges with the accuracies over the noted range of the sensor.

.1 -50°C to +50°C, plus or minus 0.5°C.

.2 0°C to +50°C, plus or minus 0.25°C.

.3 0°C to 25°C, plus or minus 0.1°C.

.4 0°C to 100°C, plus or minus 1°C.

.6 Immersion wells shall be of stainless steel materials for steam and domestic hot water and brass for other applications. Heat transfer compound to be compatible with sensor.

.3 Temperature sensors shall be of the following types:

.1 Room type (RTS) - suitable for wall mounting, with or without protective guard. Element length of 10-50 mm with ceramic tube or equivalent mode of mechanical protection.

.2 General purpose duct type (DTS) - suitable for insertion into air ducts at any angle, insertion length shall be suitable for application. Copper sheathed construction.

.3 Spring-loaded thermowell type (ITS) - spring loaded construction with compression fitting for 20 mm NPT well mounting. Lengths shall be suitable for application. Stainless steel sheathed construction.

.4 Averaging duct type (ATS) - continuous filament with immersion length of 6000 mm minimum. Probe to be bent, at field installation time, to a minimum radius of 100 mm at any point along the probe length without degradation in performance. Copper sheathed construction.

.5 Outside air type (OTS) - complete with non-corroding shield designed to minimize solar and wind effects, threaded fitting for mating to 12 mm conduit, probe length of 100 - 150 mm.

2.23 TEMPERATURE SWITCHES (TSW)

.1 Provide high/low temperature switches for ranges as indicated on point schedule.

.2 Temperature sensing element shall be liquid, vapour or bimetallic type.

.3 Adjustable setpoint and differential.

.4 Snap action type rated at 120 volts, or 24 V DC as required.

.5 Sensors shall operate automatically and reset automatically. Sensors used for freeze detection or fire detection shall be manually reset type.

.6 Temperature accuracy shall be +/-1°C.

.7 Temperature switches shall be of the following types:

.1 Room type - suitable for wall mounting on standard electrical box with or without protective guard.

.2 General Purpose Duct type - suitable for insertion into air ducts, insertion length of 457 mm.

.3 Thermowell type - with compression fitting for 20 mm NPT well mounting, length of 100 mm. Immersion wells shall be brass (stainless steel for domestic water and steam).

.4 Freeze detection type - continuous element with insertion length of 6000 mm minimum, suitable for duct mounting to detect the coldest temperature in any 30 mm section of its length.

.5 Strap-on type - with helical screw stainless steel clamps.

2.24 TIMECLOCKS

.1 Acceptable Manufacturers:

.1 Intermatic, Paragon, Tork.

.2 Minimum Requirements:

.1 150 mm (6") dia. dial, 7-day calendar type.

.2 Spring reserve (minimum of 10 hours) and manual reset.

.3 Accessories:

.1 Accessible manual-automatic bypass switch (one for each switching circuit).

.2 Adjustable spring wound timer (0-12 hours) without "hold" (Intermatic F12H).

2.25 VELOCITY PRESSURE TRANSMITTERS (VPT)

.1 Output of 4 - 20 mA linear into maximum of 500 ohm load.

.2 Calibrated span: not greater than twice the static pressure at maximum flow.

.3 Calibrated accuracy: +/- 1.0% of span.

.4 Repeatability: within 0.1% of output.

.5 Linearity: 0.5% of span.

.6 Deadband or Hysteresis: 0.1% of span.

2.26 VARIABLE SPEED DRIVE CONTROLLER

.1 Minimum Requirements:

.1 Unit to operate with an input, line side power factor of 0.94 or better at all speeds and loads.

.2 All units supplied to the project must be of the same manufacturer and model type.

.3 Factory C.S.A. certified.

.4 Unit to operate in ambient temperatures ranging from 0^{o} C to $+40^{o}$ C.

.5 Unit to operate at full load with a variation of -15% and +10% of rated building voltage.

.6 Unit to operate at full load with a variation of +5% of rated frequency.

.7 Printed circuit board design using the latest "state of the art" components including microprocessor control of protective circuits.

.8 Suitable for use with the standard or high efficiency EEMAC Design B motors used on this project.

.9 VSD module and all additional peripheral components as specified herein, to be integrated and mounted in one common EEMAC 1 (use EEMAC 3R for outdoor units) wall or floor mounted enclosure.

.10 Transformers shall not be used on either the input or output of unit.

.11 The VSD shall have an adjustable PWM carrier/switching frequency from nominal 1 through 12 kHz. Units unable to adjust to a minimum upper level of 12 kHz are not acceptable. Maximum switching frequency of 16 kHz.

.12 The VSD shall include reactors or LRC filters as necessary to protect the motor from PWM - IGBT voltage spikes and limit the voltage rise times and maximum peak voltages throughout the specified building voltage range and for all operating conditions at the related motor connections as follows:

.1 Maximum peak voltage 1000 volts.

.2 Maximum voltage rate of rise: 500 volts/microsecond.

.13 Unit shall be provided with protection against:

.1 Stalls caused by overcurrent.

.2 Stalls caused by regenerative overvoltage.

.3 Overcurrent protection.,

.4 Regenerative overvoltage protection.

.5 Overload protection (thermal type).

.6 Ground fault protection.

.7 Instantaneous power failure protection.

.8 Alarm against overload.

.9 Overtemperature of heat sink.

.10 Input power under voltage, over voltage and phase loss.

.11 DC bus over voltage.

.14 The unit shall have the following features:

.1 Adjustable acceleration and deceleration. Across the line starting shall not be possible. A ramp up time from 0 RPM to 1800 RPM of 30 seconds shall be the minimum possible ramp up time.

.2 Dynamic breaking for acceleration and stopping.

.3 Critical speed avoidance will allow for the selection of two skip speeds and a rejection band of 0 – 10Hz around each speed.

.4 Voltage/frequency ratio and adjustment.

.5 Power failure restart to be selectable and programmable for number of attempt's & time interval between attempt's. Unit also to have circuits to permit a start into a rotating motor, in either direction without trip or failure.

.6 Frequency range (output) 2 - 60 Hz minimum.

.7 Frequency resolution of 0.5 Hz or better.

.8 Frequency accuracy of +/-0.5% at 25°C.

.9 Able to accept a 4-20 milliamp, 0 to 5 vdc or 0 to 10 vdc external control signal for speed control.

.10 Able to accept a remote start / stop control.

.11 Minimum of 3 programmable preset speeds to facilitate operation of the unit from interlocks, at fixed speeds.

.15 Provide EMI filters to reduce EMI to FCC acceptance levels.

.16 The units shall have the following components:

.1 Run and Stop pushbuttons or switch.

.2 Hand-Off-Auto selector switch.

.3 Manual speed adjusting potentiometer.

.4 Fused disconnect switch rated for the full connected load and complete with lockable, through door operator, defeatable with screw driver. Fuses to be suitable semi-conductor rated.

.5 Trip relay with light.

.6 Run relay with light.

.7 Analogue speed indicator, 0 - 110%, 50mm [2"] bezel minimum.

.8 110 volt control transformer, fused in the primary and secondary.

.9 Auto reset thermal overload - relay interlocked in run circuit.

.10 Terminal strip to accept N.C. safety contacts such as freeze stats and smoke alarms to safety shut down VSD when in Hand or Auto position.

.11 N2 Interface card for interface with BMS to provide full control, status and alarm interface.

.12 Form C contacts to indicate run mode.

.13 Form C contacts to indicate fault or alarm mode.

.14 0 to 10 vdc output signal directly proportional to controller's speed.

.15 Provide integral factory wired and mounted bypass provisions, where scheduled, such that the controlled motors can be manually put into operation bypassing the VSD. Bypass to consist of a motor contactor and overload relay rated for the connected load. The bypass must have its own isolating device to allow corrective work on the VSD whilst operating in the bypass mode. Bypass contactor and VSD must be fully interlocked to prevent both outputs being enabled simultaneously. Control of the bypass will be by means of an enclosure door mounted VSD Bypass selector and Start Stop pushbuttons. Two door mounted lamps shall be provided to indicate operating mode (VSD or Bypass).

.17 Units shall be equipped with a 5% line reactor and a harmonic filter on the power input side to prevent the backfeeding of harmonics into the power system. Filters should control the THD within the values specified by IEEE 519.

.18 Refer to Schedule - VARIABLE SPEED DRIVES.

.19 VSD's shall be installed by the Controls Contractor. All power wiring connections shall be by Division 16 and all control wiring by the Controls Contractor.

.20 The manufacture's representative shall be present at start-up and shall supervise the start-up and test the voltage at the motor connection with the Commissioning Agency present with a digital oscilloscope with storage capacity and with a sufficiently fast sample time to accurately measure voltage rate of rise to confirm that the voltage spikes and rate of rise are within the specified level. Submit the results to the Departmental Representative including the input voltage on all three phases to the VSD at the time of measurement.

.21 The manufacture's representative shall be present for a minimum of 1/2 day to instruct the building maintenance personnel in the correct use and operation of the VSD units following the commissioning of the systems.

.22 Provide a parts and labour warranty for three years subsequent to Substantial Completion for the Variable Speed Drives.

.23 Provide a three year parts and labour warranty against VSD related failure for each motor connected to a VSD power output.

.24 Shop drawings shall include:

.1 Dimensional drawings.

.2 All connection points.

.3 Power circuit diagrams.

.4 Installation and maintenance manuals.

.5 Warranty description.

.6 Certification of agency approvals.

.7 Conformance to each specified requirement.

.8 Placement of input and output reactors / filters, EMI filters, semi-conductor rated fuses (where required).

.9 Harmonic analysis indicating the level of harmonic distortion that the drives will cause.

.25 Variable speed drives shall be configured with hand-off-auto override capability. For applicable fans, the hand position shall override the normal EMCS control output but not the freeze protection interlock. When the VSD is bypassed for maintenance or due to failure the controlled motor shall operate as if in hand position such that the freeze protection interlock (if applicable) are not overridden.

2.27 VARIABLE SPEED DRIVE CONTROLLER

.1 Variable speed motor drive controllers have been specified to be provided as part of air handling units and pumps packages, to be supplied by the mechanical contractor, wired and connected by Division 16 (Power Wiring) and control wiring by the controls subtrade (under this contract). Refer to individual building contract document for specified product information, etc.

3 EXECUTION

3.1 GENERAL

.1 All equipment shall be installed according to manufacturers' published instructions.

.2 Temperature, Humidity Sensors, Thermostats and Humidistats:

.1 All sensors shall be stabilized to such a level as to permit on-the-job installations that will require minimum field adjustments or calibration.

.2 Sensor assemblies shall be readily accessible and adaptable to each type of application in such a manner as to allow for quick, easy replacement and servicing without special tools or skills.

.3 Outdoor installation shall be weatherproof construction in NEMA 4 enclosures. Install space instruments at a height of 1.5 m above the finished floor, unless otherwise indicated.

.4 Install corridor instruments at a height of 2.1 m above the finished floor.

.5 Locate instruments in the same vertical centreline as light switches.

.6 Where instruments are indicated on an outside wall install on a stand-off wall bracket which provides an air space between the instrument and the wall; or on an insulating base (e.g. a cork pad).

.7 Install protective metal guards on instruments in areas where they may be subject to damage (loading areas, cell areas and wing public corridors and storage areas). Bolt guards, independent of instruments to separate baseplates. Provide backing in wall for securing mounting bases.

.8 Sensors in ducts shall be mounted in locations to sense the correct temperature of the air only, and shall not be located in dead air spaces. The location shall be within the vibration and velocity limits of the sensor. Where an extended surface element is required to properly sense the average temperature it shall be securely mounted within the duct to measure the best average temperatures. Elements shall be thermally isolated from brackets and supports to respond to air temperature only. Sensor element to be supported separately and not connected to coils or filter racks.

.9 Wells shall be installed in the piping at elbows where piping is smaller than the length of the well to effect proper flow across the entire area of the well. Well shall not restrict flow area to less than 70 percent of line-size-pipe normal flow area.

.3 Temperature Transmitters, Humidity Transmitters, Controllers and relays to be installed in NEMA I enclosures.

.1 Panels to be either free standing or wall mounted ANSI 61 polyester powder coated steel cabinets with hinged and key locked front door. Arrange for conduit and tubing entry from top, bottom or either side.

.2 Panels shall be modular multiple panels being used if required for capacity in any particular location.

.3 All panels shall be lockable with same key.

.4 All wiring and tubing within panels to be located in trays or individually clipped to back of panel, and clearly identified.

.4 All field devices to be properly identified.

.5 Mount electrical instruments on standard electrical rough-in boxes fastened to structure.

.6 Testing:

.1 All field devices shall be properly calibrated and tested for performance and accuracy. A report detailing test performed and results to be submitted to the Departmental Representative for approval. The Departmental Representative will verify results at random. Provide all testing equipment necessary. Provide manpower necessary to assist Departmental Representative's verification.

.2 Provide security type tamper proof temperature sensors in cell rooms.

END OF SECTION

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 GENERAL REQUIREMENTS

.1 Performance requirements of the Building Automation System (B.A.S.) and associated hardware and software are specified in this section and defines the minimum hardware and performance requirements.

.2 The B.A.S. system shall be a realtime, online, multitasking, multi-user, micro processor based system.

.3 All of the specified programming features must be written by the controls contractor and available for use by the Departmental Representative. These features will all be tested and verified during commissioning. It shall not be satisfactory to merely provide software that is capable of these features if programmed by the Departmental Representative.

.4 Environmental Conditions: The BAS and its immediate associated devices shall be able to operate properly under environmental conditions of 0 °C. to 44 °C. and a relative humidity of 10 to 95 percent noncondensing.

1.3 RADIO FREQUENCY INTERFERENCE (R.F.I.)

.1 Ensure that all equipment installed under this division is capable of operating properly when subjected to the ambient radio frequency signals existing at the site and in accordance with the Radio Interference Regulations (RIR).

.2 Take into consideration all A.M., F.M., T.V., U.H.F. and V.H.F. signals generated by private and commercial transmitters as well as spurious signals generated by hospital equipment such as X-ray and linear accelerator treatment equipment, etc.

.3 Provide traps as required to reduce all radio frequency and electromagnetic interference signals to acceptable levels.

1.4 SOFTWARE UPDATE

.1 Patches to the software package shall be provided at no cost for the lifetime of the system. These shall include all patches and fixes to the original software package supplied, but shall not necessarily include new software products subsequently released by the manufacturer after substantial completion.

1.5 SPARE PARTS

.1 Provide written assurance that in the event of a catastrophic failure of the system or portion thereof, the manufacturer or the system sub-contractor is able to obtain components for replacement with a maximum turn-around of 24 hours.

2 PRODUCTS

2.1 GENERAL PRODUCT DESCRIPTION

.1 The Building Management System (BMS) shall be capable of integrating multiple building functions including equipment supervision and control, alarm management, energy management, and historical data collection and archiving.

.2 The Building Management System shall consist of the following:

.1 Standalone Panels (SAPs).

.2 Terminal Unit Controllers (TUCs).

.3 Portable Operator's Terminals (POTs).

.4 Personal Computer Operator Work Station(s) (OWSs).

.3 The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, SAPs, applicable TUCs and operator devices.

.4 System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each SAP shall operate independently by performing its own specified control, alarm management, operator I/O, and historical data collection. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

.5 SAPs shall be able to access any data from, or send control commands and alarm reports directly to any other DDC panel or combination of panels on the network without dependence upon a central processing device. SAPs shall also be able to send alarm reports to multiple operator work stations without dependence upon a central processing device.

.6 The Building Management System shall be capable of accepting Autocad drawing files. The Autocad drawings shall be interfacial with the control system graphics software via stripped down DWG files, which are converted into Windows Metafiles for use as graphics for BMS.

2.2 NETWORKING/COMMUNICATIONS

.1 Networking/Communications capabilities shall consist of:

.1 Peer to Peer Communications between SAPs.

.2 Operator Work Station Interconnection.

.3 Terminal Unit Controller (TUC) communications.

.4 Off-site modem communications.

.2 Peer to Peer Interpanel Communications:

.1 SAPs shall communicate with one another over a high speed peer to peer protocol communications bus. All devices on the bus shall be peers and no specific device shall be designated as the master for communications purposes. The failure of any one device on the peer bus shall not result in a loss of communications between any of the other devices on the bus.

.2 Communication protocol shall employ token passing or collision detection to manage access to the bus in a peer to peer fashion. Minimum baud rate shall be 38.4K and system throughout capability shall be sufficient to satisfy the requirements in Section 2.3.2.

.3 The system shall have the ability to establish priority levels in terms of accessing the peer bus. The peer protocol shall be able to distinguish between alarms, automatic data transfer, manual commands and database transfers and the relative priorities between these events shall determine their access to the bus and consequently the relative speeds of these transactions.

.3 Operator Work Station Interconnection:

.1 Operator work stations shall access the peer bus by either directly connection to a SAP via an RS232 port or directly to the peer bus. If directly connected, it shall be via a device that resides on the bus as a true peer with only one OWS per such device.

.2 The systems shall support multiple OWSs connected to the peer bus either through multiple SAPs or multiple peer devices or a combination of both. When changes are made to datafiles at one OWS (including but not limited to graphics files, graphics link files, point datafiles, point labels and panel datafiles), they shall be automatically updated at all other OWSs (except those that are off-site). This shall be accomplished directly over the peer bus or via a parallel Local Area Network (LAN).

.4 Terminal Unit Controller (TUC) Communications:

.1 TUCs shall communicate with one another and a higher order device on the peer bus via a communications bus with a minimum 9600 baud rate. The TUC communications bus shall access the main peer bus via an SAP or a node device that acts as a full peer on the main bus.

.2 The TUC communication protocol shall be either poll / response (with the peer device acting as the master) or peer to peer.

.5 Off-Site Modem Communications:

.1 Each SAP shall support a dial in / dial out modem for connection of an offsite OWS.

.2 SAP shall be able to automatically dial out to a user definable number upon the occurrence of any programmable event or alarm occurrence.

.3 The system shall support dialing in from an off-site OWS which will have all of the capabilities specified for a directly connected OWS except for the automatic updating of datafile changes. The hardware and software for an off-site OWS need only be provided if specified herein.

.4 The system for this project shall be provided complete with one autodial modem connected to one of the SAPs.

2.3 PROCESSING SPEED

.1 Effective Panel Processing Speed (All Panels):

.1 The maximum permissible execution time is TWO (2) seconds and is defined as follows:

.1 Execution Time:

.1 The time required for the CPU in the stand-alone panel to execute all application software in the panel, from the same point in the software back to the same point, assuming full memory usage as defined in 1.3, while simultaneously responding to operator or terminal display requests and carrying on normal inter-panel communications averaged over a ONE (1) minute period.

.2 The execution time will be verified by setting up a counter in each panel and monitoring the counting rate.

.3 Provide with the proposal the estimated execution time for each panel in the system as configured to this job.

.2 Effective System Processing Speed:

.1 The effective system processing speed applies to multi-panel systems only. The system processing speed is intended to address inter-panel communications and will be monitored by evaluating the delays in inter-panel data transfer.

.2 The effective system processing speed will be verified by initiating a cyclical flag in one panel every minute. This flag will initiate a counter and at the same time command a flag in a remote panel. The remote flag will be used to terminate the counter in the original panel. The value of the counter will be compared to a continuous counter over a one hour period to determine the average delay in inter-panel data transfer. The test will be carried out with the system fully commissioned and all memory requirements specified herein invoked.

.3 The maximum allowable delay for data transfer between SAPs shall be 5 seconds for normal data and 1 second for alarms (not including panel cycle times).

.4 If critical alarm generating points are connected to TUCs then the maximum delays for getting the information to the applicable SAP shall be as per 2.3.2.3 above.

.5 The maximum delay between an alarm event in a SAP or TUC and having that alarm annunciated to the OWS(s) shall be four (4) seconds including panel cycle time. This will be verified with the system fully loaded and commissioned.

2.4 STANDALONE PANELS (SAPS)

.1 General: SAPs shall be microprocessor based, multi-tasking, multi-user, real-time digital control processors. Each SAP shall consist of all required hardware including but not limited to processors, communication controllers, power supplies, and input/output modules. A sufficient number of controllers shall be supplied to fully meet the requirements of this specification and the attached point list.

.2 Memory: Each DDC panel shall have sufficient memory to support its own operating system and databases including:

.1 Control processes

.2 Energy Management Applications

.3 Alarm Management

.4 Historical/Trend Data for all points

.5 Maintenance Support Applications

.6 Custom Processes

.7 Operator I/O

.8 Dial-Up Communications

.9 In addition to the memory required to accommodate all of the points and sequences specified, each SAP shall have memory capacity to accommodate trending of all inputs and outputs with 100 samples per point. This shall include all points connected to subordinate TUCs if they do not have their own on-board trending capabilities.

.3 Point Types: Each DDC panel shall support the following types of point inputs and outputs if applicable:

.1 Analog inputs:

.1 4 - 20 Milliamps
.2 0 - 10 Volts DC
.3 120 Volts AC
.4 10,000 ohm thermistor
.5 100,000 ohm thermistor
.6 100 or 1000 ohm Pt
.7 1000 ohm Ni
.8 20.7 - 103.4 kPa [3 - 15 psi] (via external transducer)

.2 Digital inputs:

.1 Dry contact closure
.2 Pulse accumulator (i.e. electrical consumption)

.3 Actuators/Output Signals:

.1 Digital outputs (contact closure):

.1 Motor starters, sizes 1 to 4 (via external relays)

.2 Analog outputs:

.1 4 - 20 Milliamps
.2 0 - 10 Volts DC
.3 Triac 24 Volts AC
.4 20.7 - 103.4 kPa [3 - 15 psi] (via external transducer).

.4 The DDC panel electronics shall be housed in a metal cabinet with keylock utilizing a master key.

.5 Spare Points: The system shall have spare points capacity for future use. Housed in one specific DDC panel in mechanical room the spares shall be comprised of not less than six analog and ten digital inputs as well as six analog and ten digital outputs. These shall not require any vendor specific hardware or software to utilize.

.6 Expandability: The system architecture shall support a future system capacity of 100 control points including points connected to SAPs and TUCs.

.7 Serial Communication Ports: SAPs shall provide at least two (2) serial data communication ports in addition to the network communication port, for simultaneous operation of multiple operator I/O devices such as industry standard printers, OWSs and Portable Operator's Terminals. SAPs shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers, or network terminals.

.8 Hardware Override Switches: The operator shall have the ability to manually override automatic or centrally executed commands at the SAP via local, point discrete, onboard hand/off/auto operator override switches for binary control points and analog control type points.

.9 Integrated On-Line Diagnostics: Each DDC panel shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all subsidiary equipment. The DDC panel shall provide both local and remote annunciation of any detected component failures, or repeated failure to establish communication.

.10 Surge and Transient Protection: Isolation shall be provided at all network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standard 587-1980. Isolation levels shall be sufficiently high as to allow all signal wiring to be run in the same conduit as line voltage wiring where acceptable by electrical code.

.11 Powerfail Restart:

.1 In the event of the loss of normal power, there shall be an orderly shutdown of all SAPs to prevent the loss of database or operating system software. Non-Volatile memory (EPROM, EEPROM or FLASH RAM) shall be incorporated for all critical controller configuration data, and battery back-up shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.

.2 Provide automatic power failure routine to accomplish orderly shutdown of the automation system when loss of power is detected. Do not place any equipment in an unacceptable or dangerous condition as a result of power failure or restart procedures.

.3 Restart the system automatically and in an orderly fashion upon power restoral.

.4 Restart equipment based on priority to minimize in-rush currents as large loads are reintroduced.

.5 Restart only those systems or loads which were operating at the time of shutdown.

.6 Alarm any equipment which fails to restart when requested.

.7 Provide automatic restart lockout capability and UPS back up power.

.12 Upon restoration of normal power, the DDC panel shall automatically resume full operation without manual intervention.

.13 Should SAP memory be lost for any reason, the system shall generate an alarm. The user shall have the capability of reloading the SAP via an OWS which is either on-site or via modem.

2.5 SYSTEM SOFTWARE FEATURES

.1 General:

.1 All necessary software to form a complete operating system as described in this specification shall be provided. The software shall become the property of the Building Departmental Representative, who shall have full control over its use (within the confines of the Project). Provide the user with all necessary access codes to all levels of software programming and control system access including custom DDC programming. The quoted cost shall include for all necessary licensing, fees, cost, agreement requirements etc. so that the Departmental Representative has unrestricted use of the software.

.2 The software programs specified in this section shall be provided as an integral part of the DDC panel and shall not be dependent upon any higher level computer for execution.

.2 Control Software Description:

.1 Pre-Tested Control Algorithms: The DDC panels shall have the ability to perform the following pre-tested control algorithms:

.1 Two Position Control.

.2 Proportional, Integral, plus Derivative Control.

.3 Floating three position control (where specified).

.2 Equipment Cycling Protection: Control software shall include a provision for limiting the number of times each piece of equipment may be cycled within any one-hour period.

.3 Heavy Equipment Delays: The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.

.4 Powerfail Motor Restart: Upon the resumption of normal power, the DDC panel shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling, and turn equipment on or off as necessary to resume normal operation.

.3 Energy Management Applications: SAPs shall have the ability to perform any or all of the following energy management routines:

.1 Time of Day Scheduling
.2 Calendar Based Scheduling
.3 Holiday Scheduling
.4 Temporary Schedule Overrides
.5 Optimal Start
.6 Optimal Stop
.7 Night Setback Control
.8 Enthalpy Switchover (Economizer)
.9 Peak Demand Limiting
.10 Temperature Compensated Load Rolling
.11 Fan Speed/CFM Control
.12 Heating/Cooling Interlock
.13 Supply Air Reset
.14 Hot Water Reset
.15 DX condensing unit.
.16 Cooling Sequencing
.17 All programs shall be executed automatically without the need for operator intervention, and shall be flexible enough to allow user customization. Programs shall be applied to building equipment as described in the Execution portion of this specification.

.4 Custom Process Programming Capability: SAPs shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.

.1 Process Inputs and Variables: It shall be possible to use any of the following in a custom process:

.1 Any system-measured point data or status
.2 Any calculated data
.3 Any results from other processes
.4 User-Defined Constants
.5 Arithmetic functions (+,-,*,/, square root, exp, etc.)
.6 Boolean logic operators (and, or, exclusive or, etc.)
.7 On-delay/Off-delay/One-shot timers

.2 Process Triggers: Custom processes may be triggered based on any combination of the following:

.1 Time interval

.2 Time of day

.3 Date

.4 Other processes

.5 Time programming

.6 Events (e.g., point alarms)

.3 Dynamic Data Access: A single process shall be able to incorporate measured or calculated data from any and all other panels on the system including SAPs and TUCs

.1 In addition, a single process shall be able to issue commands to points in any and all other panels on the system including SAPs and TUCs.

.4 Advisory/Message Generation: Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device, buffer the information in a follow-up file, or cause the execution of a dial-up connection to a remote device such as a printer or pager.

.5 All SAPs must be fully user custom programmable. Application specific controllers will not be accepted except for TUC applications as noted in the points list.

.5 Alarm Management: Alarm management shall be provided to monitor, buffer, and direct alarm reports to operator devices and memory files. SAP shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic, and prevent alarms from being lost. At no time shall the DDC panel's ability to report alarms be affected by either operator activity at a PC Work station or local I/O device, or communications with other panels on the network.

.1 Point Change Report Description: All alarm or point change reports shall include the point's English language description, and the time and date of occurrence.

.2 Priortization: The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of three priority levels shall be provided. Each DDC panel shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point. The user shall also be able to define under which conditions point changes need to be acknowledged by an operator, and/or sent to follow-up files for retrieval and analysis at a later date.

.3 Report Routing: Alarm reports, messages, and files will be directed to a user-defined list of operator devices, or PCs used for archiving alarm information. Alarms shall also be automatically directed to a default device in the event a primary device is found to be off-line.

.4 Alarm Messages: In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 50-character alarm message to more fully describe the alarm condition or direct operator response. Each SAP shall be capable of storing a library of at least 250 Alarm Messages.

.5 Auto-Dial Alarm Management: In Dial-up applications, only critical alarms shall initiate a call to a remote operator device. In all other cases, call activity shall be minimized by time-stamping and saving reports until an operator scheduled time, a manual request, or until the buffer space is full. The alarm buffer must store a minimum of 50 alarms.

.6 Historical Data and Trend Analysis: Trend analysis shall be time event and/or deviation based and must be capable of graphing at least 8 separate trends simultaneously. A variety of Historical data collection utilities shall be provided to automatically sample, store, and display system data in all of the following ways.

.1 Continuous Point Histories: SAPs shall store Point History Files for all analog and binary inputs and outputs (minimum of 100 samples per point).

.2 Dynamic Control Loop Performance Trends: SAPs shall also provide high resolution sampling capability with an operator-adjustable resolution of 10-300 seconds for verification of control loop performance.

.3 Extended Sample Period Trends: Measured and calculated analog and binary data shall also be assignable to user-defineable trends for the purpose of collecting operator-specified performance data over extended periods of time. Sample intervals of 1 minute to 2 hours shall be provided. Each SAP shall have a dedicated buffer or capability of down loading to an on-line data storage and retrieval computer for trend data, and shall be capable of storing a minimum of 5000 data samples.

.4 Data Storage and Archiving: Trend data shall be stored at the SAPs, and uploaded to hard disk storage when archival is desired. Uploads shall occur based upon either user-defined interval, manual command, or when the trend buffers become full. All trend data shall be available in disk file form for use in 3rd Party personal computer applications.

.7 Runtime Totalization: SAPs shall have the ability to accumulate and store runtime hours for binary input and output points as specified in the Execution portion of this specification.

.1 The Totalization routine shall have a sampling resolution of one minute or less.

.2 The user shall have the ability to define a warning limit for Runtime Totalization. Unique, user-specified messages shall be generated when the limit is reached.

.8 Analog/Pulse Totalization: SAPs shall automatically sample, calculate and store consumption totals on a daily, weekly, or monthly basis for user-selected analog and binary pulse input-type points.

.1 Totalization shall provide calculation and storage of accumulations of up to 99,999.9 units (e.g. KWH, litres, KBTU, tons. etc.).

.2 The Totalization routine shall have a sampling resolution of one minute or less.

.3 The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.

.9 Event Totalization: SAPs shall have the ability to count events such as the number of times a pump or fan system is cycled on and off. Event totalization shall be performed on a daily, weekly, or monthly basis.

.1 The Event Totalization feature shall be able to store the records associated with a minimum of 9,999,999 events before reset.

.2 The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.

2.6 TERMINAL UNIT CONTROLLERS (TUCS)

.1 Terminal Unit Controllers (TUCs) shall be used to control terminal equipment and other miscellaneous points as noted on the points list.

.2 Each TUC shall operate as a standalone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each TUC shall be a microprocessor-based, multi-tasking, real-time digital control processor.

.3 Each TUC shall have sufficient memory to support its own operating system and data bases including:

.1 Control Processes

.2 Energy Management Applications

.3 Portable Operators Terminal (POT)

.4 The operator interface to any TUC point data or programs shall be through any OWS or any POT connected to any SAP or TUC in the network.

.5 TUCs shall directly support the temporary use of a POT. The capabilities of the portable operators terminal shall include, at minimum, the following:

.1 Display temperatures

.2 Display status

.3 Display setpoints

.4 Display control parameters

.5 Override binary output control

.6 Override analog setpoints

.7 Modification of gain and offset constants

.8 Program parameter adjustments

.9 Trend log displays edit/create trend logs

.10 Display/Command any point connected to any TUC or SAP in the system.

.6 Powerfail Protection: All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the controller. TUCs shall employ EEPROM or FLASH RAM for this functionality.

.7 Application Descriptions:

.1 VAV Reheat Coils, CV Reheat Coils, Perimeter Radiation controls only. Terminal Unit Controllers shall support, but not be limited to, the control of the terminal units to address current requirements as described in the Execution portion and points list of this specification.

.2 It is anticipated that TUCs will be application specific and thus not custom user programmable. The application software provided with the TUCs shall meet the requirements of the sequences of operation as specified herein and the programming and potential subsequent reprogramming of the TUCs shall be subject to clause 1.2.4 in Section 23 09 01.

.3 For TUCs used in VAV applications, they shall have a built-in solid state flow transmitter for sensing air flow. Heated wire flow sensors will not be acceptable. It shall be the responsibility of this contractor to ensure that the flow transmitter is compatible with the velocity pressure probe supplied with the VAV box.

2.7 OPERATOR INTERFACE

.1 Basic Interface Description

.1 Command Entry/Menu Selection Process: Operator Work station interface software shall minimize operator training through the use of English language prompting, English language point identification, and industry standard PC application software. The operator interface shall minimize the use of a typewriter style keyboard through the use of a mouse or similar pointing device, and "point and click" approach to menu selection. Users shall be able to start and stop equipment or change setpoints from graphical displays through the use of a mouse or similar pointing device.

.2 Graphical and Text-Based Displays: At the option of the user, Operator Work stations shall provide consistent graphical or text-based displays of all system point and application data described in this specification. Point identification, engineering units, status indication, and application naming conventions shall be the same at all work stations.

.3 Multiple, Concurrent Displays: The Operator Interface shall provide the ability to simultaneously view several different types of system displays in overlapping windows to speed building analysis. For example, the interface shall provide the ability to simultaneously display a graphic depicting an air handling unit, while displaying the trend graph of several associated space temperatures to allow the user to analyze system performance. If the interface is unable to display several different types of displays at the same time, the controls contractor shall provide at least two operator stations.

.4 Password Protection: Multiple-level password access protection shall be provided to allow the user/manager to limit work station control, display and data base manipulation capabilities as he deems appropriate for each user, based upon an assigned password.

.1 Passwords shall be exactly the same for all operator devices, including portable or panel-mounted network terminals. Any additions or changes made to password definition shall automatically cause passwords at all DDC panels on a network to be updated and downloaded to minimize the task of maintaining system security. Users shall not be required to update passwords for DDC panels individually.

.2 A minimum of four levels of access shall be supported.

.3 A minimum of 50 passwords shall be supported at each DDC panel.

.4 Operators will be able to perform only those commands available for their respective passwords. Menu selections displayed at any operator device, including portable or panel mounted devices, shall be limited to only those items defined for the access level of the password used to log-on.

.5 User-defineable, automatic log-off timers of from 1 to 60 minutes shall be provided to prevent operators from inadvertently leaving devices on-line.

.6 It shall be possible to limit which points in the system that a particular operator has access to.

.5 Operator Commands: The operator interface shall allow the operator to perform all commands required to operate or program the entire system.

.6 Logs and Summaries: Reports shall be generated automatically or manually, and directed to either CRT displays, printers, or disk files. As a minimum, the system shall allow the user to easily obtain the following types of reports:

.1 A general listing of all points in the network.

.2 Individual lists of all points currently in alarm, off-line, in override status, disabled, or locked out.

.3 List all Weekly Schedules.

.4 List all Holiday Programming.

.5 List of Limits and Deadbands.

.6 Summaries shall be provided for specific points, for a logical point group, for a user-selected group of groups, or for the entire facility without restriction due to the hardware configuration of the facility management system. Under no conditions shall the operator need to specify the address of hardware controller to obtain system information.

.7 Dynamic Color Graphic Displays: Color graphic floor plan displays, and system schematics for each piece of mechanical equipment, including air handling units, chilled water systems, and boiler systems, shall be provided as specified herein to optimize system performance analysis and speed alarm recognition.

.1 System Selection/Penetration: The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection, or text-based commands.

.2 Dynamic Data Displays: Dynamic temperature values, humidity values, flow values, and status indication shall be shown in their actual respective locations, and shall automatically update to represent current conditions without operator intervention.

.3 Graphics Definition Package: Graphic generation software shall be provided to allow the user to add, modify, or delete system graphic displays.

.1 Libraries of pre-engineered screens and symbols depicting standard air handling unit components (e.g. fans, cooling coils, filters, dampers, etc.), complete mechanical systems (e.g. constant volume-terminal reheat, VAV, etc.) and electrical symbols shall be provided.

.2 The graphic development package shall use a mouse or similar pointing device in conjunction with a drawing program to allow the user to perform the following:

- Define symbols
- Position and size symbols
- Define background screens
- Define connecting lines and curves
- Locate, orient and size descriptive text
- Define and display colors for all elements
- Establish correlation between symbols or text and associated system points or other displays.

.3 Graphical displays can be created to represent any logical grouping of system points or calculated data based upon building function, mechanical system, building layout, or any other logical grouping of points which aids the operator in the analysis of the facility. To accomplish this, the user shall be able to build graphic displays that include point data from multiple DDC panels, including Terminal Unit Controllers used for DDC unitary or VAV terminal unit control.

.4 Pre-Constructed Graphics

.1 Provide a complete set of pre-constructed graphics for use with the system at time of hand-over.

.2 Provide, at minimum the following dynamic graphics.

- All supply air systems.
- All return air systems.
- All exhaust air systems.
- All air handling ventilation units.
- Glycol/hot water heating system.
- Domestic hot water heating systems.
- DX cooling systems.
- Heat recovery systems.
- Fire alarm zones for each floor. Refer to description of FFPC system.

.8 System Configuration and Definition: All temperature and equipment control strategies and energy management routines shall be definable by the operator. System definition and modification procedures shall not interfere with normal system operation and control.

.1 The system shall be provided complete with all equipment and documentation necessary to allow an operator to independently perform the following functions:

.1 Add/Delete/Modify SAPs, Modify Operator Work stations, TUCs.

.2 Add/Delete/Modify points of any type, and all associated control loops, point parameters, and tuning constants.

.3 Add/Delete/Modify Totalization, Historical Data Trending for every point.

.4 Add/Delete/Modify custom control processes and all graphic displays, symbols, and cross-references to point data.

.5 Add/Delete/Modify dial-up telecommunication definition, operator passwords and Alarm Messages.

.2 System Definition/Control Sequence Documentation: All portions of system definition shall be self-documenting to provide hard copy printouts of all configuration and application data.

.3 Database Save/Restore/Back-Up: Back-up copies of all standalone panel databases shall be stored in at least one personal computer operator work station. Continuous supervision of the integrity of all SAP data bases shall be provided. In the event that any SAP on the peer bus experiences a loss of its data base for any reason, the system shall automatically download a new copy of the respective data base to restore proper operation. Data base back-up / download shall occur over the peer bus without operator intervention. Users shall also have the ability to manually execute downloads of any or all portions of a SAP data base.

.9 Personal Computer Operator Work station Description:

.1 Primary Personal Computer Operator Work Station shall be provided for command entry, information management, network alarm management, and database management functions. All real-time control functions shall be resident in the SAPs to facilitate greater fault tolerance and reliability.

.1 Work station shall be general purpose, commercially available, personal computer with sufficient memory and processor capacity to perform all functions described in this specification. At minimum, provide IBM or compatible pentium based duo core processor, 2.6 GHZ clock speed P.C. Minimum ram memory shall be 2.0GB with a super V.G.A. video card to take advantage of windowed operating environment with 3rd party software such as Autocad, Windows, D.base, etc. Unit shall have a 16x DVD drive.

.2 Sufficient proprietary bulk storage shall be provided to accommodate all fully configured point data bases, all application databases, all graphics data bases, all user-defined reports, and all historical data archival as described in this specification. Provide at minimum 200 GB hard drive.

.3 The display provided for system operation shall have a diagonal screen measurement of no less than 19" LCD, and a minimum display resolution of no less than 1400 x 900 pixels. The screen shall be non-reflective.

.4 Standard ASCII keyboard with a 10-key numeric keypad and dedicated function keys.

.5 Provide a printer appropriate for printing alarms, using current technology available at time.

.6 56 Kbps modem to allow the system to dial out on alarm and to provide the capability for remote access to the system.

.7 Provide a CD/DVD RW drive and 3 USB ports.

.2 The primary Operator Work Station shall be located in the location directed by the departmental representative. (Confirm exact location with the Departmental Representative prior to construction). Provide control over the complete communication system and monitor all connected SAPs throughout the system for change-of-state, change-of-value, or no response conditions. Centrally resident software shall be provided for the operator interface, temporary scheduling, control of holiday programming, definition process programming, automatic initialization routines, real-time logs, historical storage, reporting, trend logging and full on-line dynamic graphics.

END OF SECTION

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 DEFINITIONS & ABBREVIATIONS

.1 The following are abbreviations used throughout the section defining computerized control systems specified herein or defined on plans:

.1	BAS	Building Automation System
.2	SAP	Stand Alone Panel - generic term that applies to BC, AAC, ASC
.3	DI	Digital Input
.4	DO	Digital Output
.5	AI	Analog Input
.6	AO	Analog Output
.7	HVAC	Heating, Ventilation, Air Conditioning
.8	MCC	Motor Control Center
.9	DDC	Direct Digital Control
.10	LAN	Local Area Network
.11	OS	Operating System
.12	OT	Operator Terminal
.13	PC	Personal Computer
.14	OWS	BACnet Operator Work Station – same as B-OWS
.15	Native	Native BACnet
.16	BC	BACnet Building Controller – same as B-BC
.17	AAC	BACnet Custom Application Controller - same as B-AAC
.18	ASC	BACnet Application Specific Controller - same as B-ASC
.19	SS	BACnet Smart Sensor – same as B-SSEthernet – BACnet TCP/IP Ethernet
.20	MS/TP	BACnet Master-Slave/Token Passing
.21	PTP	BACnet Point–to-Point Protocol
.22	Gateway	BACnet Gateway
.23	Micropanel	Generic term that applies to AAC and ASC

1.3 REFERENCES

.1 Canadian Standards Association - CSA C22.2no.205- M1983, Signal Equipment.

.2 Institute of Electrical and Electronic Engineers - IEEE 472, IEEE 587.

.3 National Institute of Standards and Technology - NISTIR 6392 GSA Guide to Specifying Interoperable Building Automation and Control Systems Using ANSI/ASHRAE Standard 135-1995, BACnet.

.4 Native BACnet - Native BACnet means that no translation software will be used internal to the OWS, BC, AAC, and ASC to convert from a proprietary protocol to BACnet Standard Object Types, Standard Application Services and devices. Gateways are not native BACnet.

.5 BACnet Gateways

.1 Any use of a proprietary protocol (non-BACnet) internal to a SAP, OWS, or communication bridge shall deem the SAP or OWS as a gateway not native BACnet.

.2 BACnet gateways shall be used only where identified in the specifications and nowhere else.

1.4 SCOPE OF WORK:

.1 Supply, installation and mounting of all hardware (unless specifically stated otherwise).

.2 Supply and mounting of sensor elements and associated hardware, wiring or piping connecting sensors to SAP's.

.3 Wiring connecting SAP's to transducers, fire alarm and smoke control.

.4 Supply and wiring connection of solid state relays and relays to terminal connections at MCCs and to SAP's.

.5 Supply and installation of SAP's comprising of BC's, AAC's, and ASC's;

.6 The controls sub-contractor will do the complete installation of all sensors, associated control panels, relays, transducers, actuators, flow switches, gauges, air receivers, SAP computer board, associated power supplies, conduit, wiring, tubing, and all other control devices including isolation room panels, and all terminations.

.7 The controls sub-contractor will participate and provide coordination required between the Client, the Departmental Representative, other sub-contractors where controls are involved and the commissioning agent.

.8 The controls sub-contractor will provide verification and commissioning as follows:

.1 End to end continuity checks will be performed on all wiring and control tubing.

.2 All sensors, transducers, relays, actuators, control valves and dampers will be calibrated and operationally checked by this Sub-Contractor.

.3 Provide a point checkout sheet for verification of system. This Sub-Contractor to initial each point as it is verified.

.9 The controls sub-contractor will test the SAP computer hardware and operator consoles.

2 PRODUCTS

2.1 SYSTEM DESCRIPTION

.1 A complete, fully tested, commissioned and operational Native BACnet Building Automation System (BAS) utilizing fully electronic Direct Digital Control (DDC) to meet the requirements described herein and in complete accordance with applicable codes and ordinances.

.2 The system software and control devices shall be fully compatible with the latest BACnet versions.

.3 Unless specified otherwise, provide proportional plus integral electronic components.

.4 The design, installation, supervision and labor services, calibration, software programming and de-bugging, checkout and commissioning required for the BAS.

.5 Supply and installation of electronic packaged zone controllers for terminal unit control.

.6 Devices, components, wiring and materials as required for a fully operating control system.

.7 Include full graphics operating package with modification of on site graphics and navigation sequences via customized software programming.

.8 Instruction to the Facility's maintenance and operating personnel.

.9 Complete system documentation including:

.1 As-built site diagrams showing location of wiring and panels and system architecture.

.2 Operating and Maintenance manuals.

2.2 CABLE

.1 Primary Data transmission cable shall be CAT 5 Ethernet cable

2.3 ELECTRONIC TERMINAL EQUIPMENT (AAC) CONTROLLERS

.1 Each zone controller will be microprocessor-based, multi-tasking, real-time digital control processor. The zone controllers will monitor space temperature sensors and control operation of terminal air valves, air valve reheat coils, fan coil units, and perimeter radiant panels in the corresponding zone.

.2 Each zone controller will have sufficient memory to support its own operating system and data base including:

.1 Control functions

.2 Energy management applications

.3 Interface with operator portable personal computer

.3 Zone controller panels will have the following features:

.1 Setpoint adjustments

.2 Modify gain and offset constants

.3 Program parameter adjustments

.4 Trend log display edit/create trend logs through DDC system main panels

.4 Zone controllers shall NOT be mounted in ceiling spaces.

2.4 ELECTRONIC AIR VALVE CONTROLS, SENSORS & ACTUATORS

.1 Control sub-contractor shall include for the supply and installation of pressure sensors, operators and stand-alone controllers for the air valves.

.2 Control components shall be pre-assembled for testing and performance verification prior to arrival on site.

.3 Multipoint crossflow sensors shall be supplied by air valve manufacturer.

.4 Flow transducer shall be a full differential pressure unit not hot wire or thermister type.

.5 Electronic operators shall be provided for air valve dampers with piston or gear driven type damper operators.

.6 Air valve damper motors shall be Belimo LM24-T floating control or approved equal.

.7 Damper operators shall operate with floating point signal for full modulation.

.8 Damper operators shall be rigidly attached to the support structure and linkage shall have no "slop".

.9 These control components shall be field tested with air valve for testing and performance verification.

.10 Submit written test data for the terminal unit controllers for each size of air valve and fan coil unit.

.11 Supply air temperature measurement shall be provided on each air valve with reheat coils.

2.5 DDC SYSTEM FUNCTIONS

.1 The DDC system shall utilize "BACnet open architecture" and have a proven Operator Control Language (OCL), which shall be capable of reading the value, and/or status of all control devices from any user defined combination of calculations and logical expressions.

.2 All SAP's and BACnet Gateways shall conform to the BACnet Protocol Implementation Conformance Specification.

.3 Other mandatory monitoring and control features of the DDC system are:

.1 Provide two level security system access with passwords.

.1 Level 1: to allow assignment of Level 1 and Level 2 passwords. Creation of new system operators, ability to create, delete and modify system components, modify selected system components, and alarm levels, and generally full system access.

.2 Level 2: to allow command and override of system components, alarm acknowledgment, monitor system, display information including alarm messages, graphics, points log, help menus.

.2 Operator defined digital and analog alarms and automatic alarm condition reporting.

.3 Auto lockout of alarms when alarmed system is shut down.

.4 Direct keyboard override of all digital and analog outputs, with an indication of the display of any point that is operating under keyboard override.

.5 Addition, deletion, definition and modification of points and point types from operator keyboard.

.6 Trend log graphing of user selected points and times.

.7 Run time totalization.

.4 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. To accomplish this, an off-line disk storage device shall be utilized to provide software backup and reload.

.5 On-site backup and verification of the entire system, with full applications software, shall be less than TEN (10) seconds per SAP.

.6 The DDC system shall be provided with automatic protection from any power failure of up to seventy two (72) hours duration.

.7 This protection shall at a minimum include continuous real-time clock operation and automatic system restart upon power return. System will be tested to confirm rated hours.

.8 Panel replacement shall be possible without any hardware modification. Describe replacement procedure in technical data submitted.

.9 Any panel malfunction shall not affect the operation of the multi-panel system.

.10 Indicate how points located on one panel can be accessed and utilized by another panel. Explain any limitations of the above.

.11 Each BC and AAC standard panel proposed shall have enough random access memory for all of the following:

.1 Trend Logs - two for each input and output point connected to the panel with 100 samples each.

.2 Controllers - two for each analog output point connected to the panel.

.3 Variables - three for each output point connected to the panel. Variables are "virtual points" (as opposed to physical points) but which have all the attributes of real or physical points.

.4 Operator Control Language (OCCL) - twenty syntactically correct lines each with at least 4 operators, for each output point connected to the panel, or TEN (10) syntactically correct lines, each with at least four operators, for each output point connected to the panel, if the OCL has the ability to call common routines or use wild card commands.

.5 Descriptor - one for each user definable point, real or virtual, in the panel. In addition, on multi-panel systems, every descriptor in the system must be accessible from a single I/O port.

.6 Time Schedules - one for every 3 output points connected to the panel.

.7 Totalizers - one for each digital point in the panel.

.12 Processing Speed

.1 Effective Panel Processing Speed - Maximum permissible execution time is half a second. Execution time is defined as the time it takes the stand alone panel CPU to execute all application software in the panel, from some point in the software back to the same point, assuming full memory usage, while simultaneously responding to operator or terminal display requests and carrying out normal inter-panel communications averaged over a one - minute period. This will be done by setting up a counter in each panel and monitoring the counting rate.

.2 Effective System Processing Speed - This applies to multi-panel systems only. System processing speed is intended to address inter-panel communication and will be checked by evaluating system display response. This will be done by setting up a display of all panel counters and checking how frequently each counter updated on the refreshed display.

.3 Displays shall load real time current values, not stored values, within ten seconds. Every counter shall show an updated value on the display within sixty seconds at the previous update appearing. Provide confirmation that required system processing speed will be achieved.

.13 DDC System Inter-Panel Communication.

.1 Means shall be provided to ensure communication integrity. Provide detail of the system.

.2 To prevent damage to the system, each data highway line shall be provided with a means of isolation, either optically or by some other means. Provide detail of protection system in proposal.

.14 Sensors and Associated Equipment.

.1 BAS shall be supplied with all sensors, relays and associated equipment to fully connect the listed DDC points. Field point installation shall be performed in a neat and orderly fashion with all components marked or labeled to correspond with the making or labeling in the as built drawings.

.2 All sensors and controllers shall be of commercial grade and shall be installed according to the manufacturer's recommendations. Provide full details of all sensors and controllers proposed, including their range and accuracy.

2.6 SYSTEM STRUCTURE

.1 The Building Automation System (BAS) architecture shall consist of the following installed in communication and main mechanical rooms:

.1 Stand-alone DDC system main panels

.2 Stand-alone DDC system terminal equipment (zone) controllers

.3 Provide plug-in access for remote or lap-top computer at each panel using the same software as resides on the central workstation.

2.7 DDC SYSTEM PANELS

.1 References:

.1 National Institute of Standards and Technology - NISTIR 6392 GSA Guide to Specifying Interoperable Building Automation and Control Systems Using ANSI/ASHRAE Standard 135-1995, BACnet.

.2 DDC Panel Types:

.1 BC minimum capabilities equivalent to the BACnet Building Controller (B-BC).

.2 AAC Local Control Unit minimum capabilities equivalent to the BACnet Custom Application Specific Controller (B-AAC).

.3 ASC Terminal Control Unit minimum capabilities equivalent to the BACnet Application Specific (B-ASC).

.4 AAC Room Control Unit minimum capabilities equivalent to the BACnet Custom Application Specific Controller (B-AAC).

.5 SS Smart Sensor minimum capabilities equivalent to the BACnet Smart Sensor (B-SS).

.3 DDC Panel Applications – This section describes the mechanical systems that shall be connected to the different DDC panel types.

.1 BC main function is to provide direct control of all main central mechanical systems such as chillers, cooling towers, heat exchangers, domestic hot water, fan systems etc. The BC's shall directly reside on the primary Ethernet LAN.

.2 AAC function is to provide control for miscellaneous HVAC components in remote mechanical rooms such as rooftop units, fan coils, unit ventilators, VAV, etc. AAC's shall reside on the secondary RS485 MS/TP network.

.3 ASC level controllers are not acceptable unless specifically specified for a unique application.

.4 All DDC panels shall meet the minimum requirements set out in this section.

2.8 BC BACNET OVERVIEW

.1 A BC (B-BC) is a native BACnet, general purpose, field programmable controller capable of carrying out a variety of building automation and control tasks. It enables the specification of the following:

.1 Data Sharing:

.1 Ability to provide the values of any of its BACnet objects.

.2 Ability to retrieve the values of BACnet objects from other devices.

.3 Ability to allow modification of all of its BACnet objects by another device.

.2 Alarm and Event Management:

.1 Generation of alarm / event notifications and the ability to direct them to recipients.

.2 Maintain a list of unacknowledged alarms / events.

.3 Notification of other recipients that the acknowledgment has been received.

.4 Adjustment of alarm / event parameters.

.3 Scheduling:

.1 Ability to schedule output actions, both in the local device and in other devices, both binary and analog, based on date and time.

.4 Trending:

.1 Collection and delivery of (time, value) pairs.

.5 Device and Network Management:

.1 Ability to respond to information about its status.

.2 Ability to respond to requests for information about any of its objects.

.3 Ability to respond to communication control messages.

.4 Ability to synchronize its internal clock upon request.

.5 Ability to perform re-initialization upon request.

.6 Ability to upload its configuration and allow it to be subsequently restored.

.7 Ability to command half-routers to establish and terminate connections.

.2 Provide sufficient number of BC's to fully meet all requirements of this specification plus specified spare point capacity. An Ethernet gateway connecting the WAN to the building BC is NOT acceptable.

.3 BC to be stand-alone intelligent controller. BC panel to:

.1 Be microprocessor based, multi-tasking, multi-user, real-time digital control processors capable of supervising other lower level programmable controllers through secondary networks.

.2 Consist of modular hardware with plug-in processors, communication controllers, power supplies, I/O modules.

.3 Provide MS/TP BACnet LAN port for local AAC/ASC network.

.4 Provide on board LAN interface for ethernet BACnet peer-to-peer communication between BC’s and at least 1 RS-232C serial data communication ports to support simultaneous operation of multiple operator I/O devices such as industry standard printers, lap-top work-stations, PC work-stations and BC-mounted or portable OT’s. One RS-232C data port will support point-to-point PTP BACnet protocol.

.5 Allow temporary use of portable devices without interrupting normal operation of permanently connected modems, printers, OT’s.

.6 Interface field sensors via local I/O terminations located on BC located in processor cabinet.

.7 In standalone mode execute programmable logic control (direct digital or closed loop process control) of associated HVAC equipment without interacting with other processors or OWS’s.

.4 Dial-up Communications:

.1 Auto-dial/auto-answer communications to allow BC's to communicate with remote OW's on non-continuous basis via telephone lines.

.2 To analyze and set priorities for all alarms to minimize of calls. Non-critical alarms to be buffered in memory and reported as group or until operator manually requests upload of alarms.

.5 Spare Capacity:

.1 Provide 20% spare point capacity on panels with greater than 32 I/O and 10% spare capacity on panels with less than 32 I/O.

.6 Programming and Energy management routines:

.1 BC to provide for the following energy management routines:

.1 Time of day scheduling.

.2 Calendar based scheduling.

.3 Holiday scheduling.

.4 Temporary schedule overrides.

.5 Optimal start.

.6 Optimal stop.

.7 Supply air reset

.8 Duty cycling

.9 Night setback

.10 DX cooling reset

.11 Heating water reset

.7 All programs to be executed automatically without need for operator intervention.

.8 Programming languages:

.1 Shall meet requirements specified in Custom Programming Capability section of specification.

.9 Priority Level:

.1 BC shall provide for 16 levels of priority from all outputs. The priority levels shall conform to the BACnet object specifications.

.10 Trend Logging:

.1 All trend log information shall be stored at BC and not at OWS.

2.9 AAC BACNET OVERVIEW

.1 An AAC (B-AAC) is a general purpose, field programmable controller capable of carrying out a variety of building automation and control tasks. It enables the specification of the following:

.1 Data Sharing:

.1 Ability to provide the values of any of its BACnet objects.

.2 Ability to retrieve the values of BACnet objects from other devices.

.3 Ability to allow modification of all of its BACnet objects by another device.

.2 Alarm and Event Management:
  .1 Generation of alarm / event notifications and the ability to direct them to recipients.
  .2 Maintain a list of unacknowledged alarms / events.
  .3 Notifying other recipients that the acknowledgment has been received.
  .4 Adjustment of alarm / event parameters.
.3 Scheduling:
  .1 Ability to schedule output actions, both in the local device and in other devices, both binary and analog, based on date and time.
.4 Trending:
  .1 Collection and delivery of (time, value) pairs.

.5 Device and Network Management:
  .1 Ability to respond to information about its status.
  .2 Ability to respond to requests for information about any of its objects.
  .3 Ability to respond to communication control messages.
  .4 Ability to synchronize its internal clock upon request.
  .5 Ability to perform re-initialization upon request.
  .6 Ability to upload its configuration and allow it to be subsequently restored.
  .7 Ability to command half-routers to establish and terminate connections.

.2 Provide sufficient number of AAC's to fully meet all requirements of this specification plus specified spare point capacity.

.3 AAC to be stand-alone intelligent controller. AAC panel to:
  .1 Be microprocessor based, multi-tasking, multi-user, real-time digital control processors capable of supervising other lower level programmable controllers through secondary networks.
  .2 Consist of modular hardware with plug-in processors, communication controllers, power supplies, I/O modules.

.4 Provide MS/TP BACnet LAN port for local ASC network.

.5 Provide on board LAN interface for MS/TP BACnet peer-to-peer communication between AAC’s and at least 1 RS-232C serial data communication port to support operation of operator I/O devices such as industry standard printers, lap-top work-stations, PC work-stations and AAC-mounted or portable OT’s. RS-232C data port, will support point to point PTP BACnet protocol.

.6 Allow temporary use of portable devices without interrupting normal operation of permanently connected modems, printers, OT’s.

.7 Interface field sensors directly to I/O terminations located on AAC in processor cabinet.

.8 In standalone mode execute programmable logic control (direct digital or closed loop process control) of associated HVAC equipment without interacting with other processors or OWS’s.

.9 Spare Capacity:
  .1 Provide 10% spare point capacity for each AAC without additional cards, terminals or a minimum of one spare input and one spare output.
  .2 If AAC is used for unitary equipment then no spare capacity is required unless identified on points list.

.10 Programming and Energy management routines:

.1 AAC to provide for the following energy management routines:

.1 Time of day scheduling.

.2 Calendar based scheduling.

.3 Holiday scheduling.

.4 Temporary schedule overrides.

.5 Optimal start.

.6 Optimal stop.

.7 Supply air reset.

.8 Duty cycling.

.9 Night setback.

.11 All programs to be executed automatically without need for operator intervention.

.12 Programming languages:

.1 Shall meet requirements specified in Custom Programming Capability section of specification.

.13 Priority Level:

.1 AAC shall provide for 16 levels of priority from all outputs. The priority levels shall conform to the BACnet object specifications.

.14 Trend Logging:

.1 All trend log information shall be stored at AAC and not at BC or OWS.

2.10 ASC BACNET OVERVIEW

.1 ASC BACnet overview: An ASC (B-ASC) is a controller with limited resources relative to an AAC. It is intended for use in a specific application and supports limited programmability. It enables specification of the following:

.1 Data Sharing:

.1 Ability to provide the values of any of its BACnet objects

.2 Ability to allow modification of some or all of its BACnet objects by another device

.2 Alarm and Event Management:

.1 None

.3 Scheduling

.1 None

.4 Trending

.1 None

.5 Device and Network Management

.1 Ability to respond to information about its status.

.2 ASC to be stand-alone intelligent controller. ASC panel to:

.1 Be microprocessor based, real-time digital control processors.

.2 Consist of modular hardware with communication controllers, power supplies, I/O modules.

.3 Provide on board LAN interface for MS/TP BACnet peer-to-peer communication between ASC's and at least [1] RS-232C serial data communication port to support operation of operator I/O devices such as industry standard printers, lap-top work-stations, PC work-stations and ASC-mounted or portable OTs.

.4 Allow temporary use of portable devices without interrupting normal operation of permanently connected modems, printers, OTs.

.5 Interface field sensors directly to I/O terminations located on ASC in processor cabinet.

.3 In standalone mode execute programmable logic control (direct digital or closed loop process control) of associated terminal equipment without interacting with other processors or OWS's.

.4 Spare Capacity:

.1 Provide 10% spare point capacity for each ASC without additional cards, terminals.

.2 If ASC is used for terminal equipment then no spare capacity is required unless identified on points list.

.5 Programming and Energy management routines:

.1 ASC to provide for the following energy management routines:

.1 Temporary schedule overrides.

.2 Supply air reset

.3 Night setback

.2 All programs to be executed automatically without need for operator intervention.

.3 Programming languages:

.1 Firmware based application specific program utilizing full BACnet objects and functionality.

.6 Priority Level:

.1 ASC shall provide for 1 levels of priority from all outputs.

.7 Trend Logging

.1 All trend log information shall be stored at AAC or BC not ASC.

2.11 CUSTOM PROGRAMMING CAPABILITY

.1 Programming languages:

.1 All GCL General Control Language software to be programmed in general control type or high-level control language supporting full BACnet objects and functionality.

END OF SECTION

1 GENERAL - REFER TO SECTION 23 09 01

2 PRODUCTS – REFER TO SECTION 23 09 13

3 CONTROL SEQUENCES

3.1 HEATING WATER CONTROL:

.1 Provide differential pressure switches in each pump discharge to provide on-off indication.

.2 Outdoor sensor shall reset a discharge water sensor and controller to step fire boilers.

.3 Provide differential pressure switch in pump circuit (close control valve on no flow conditions and) indicate alarm. Provide alarm bypass switch.

.4 Provide on local control panel:

- System graphic
- System supply temperature
- System supply control point adjustment
- System return temperature
- Outdoor air temperature
- Pump on-off switch
- Pump on-off indication
- Boilers lead-lag switch

3.2 COMBUSTION AIR UNIT HEATERS

.1 Thermostat shall modulate 2-way heating control valve. Aquastat on return heating water line shall stop unit on low temperature.

3.3 CABINET AND UNIT HEATERS

.1 Electric thermostats shall cycle unit motor. (Aquastat on return heating water line from flow mounted cabinet heaters shall stop unit on low temperature).

3.4 REHEAT COIL

.1 The room thermostat shall modulate 2-way heating control valve.

3.5 FORCE FLOW UNITS

.1 The space thermostat shall modulate 2-way heating control valve.

3.6 ENERGY RECOVERY UNIT

.1 Fully open pre-heat coil valve when discharge air temp. lower than 12 °C. Modulate 2-way valve to maintain the discharge air temp. at 12 °C.

.2 During free cooling season, the energy wheel shall stop and be positioned properly, the out door air shall by-pass the energy wheel.

3.7 AIR HANDLING UNITS

.1 Fully open preheat coil valve, if outside air temperature is below 5°C

.2 Supply air to controls when supply fan is started (and open outside air damper).

.3 Freeze-stat (hard-wired) located downstream of the heating coil shuts down fan and activates DDC alarm.

.4 Provide aquastat freeze protection in preheat coil return line to stop supply fan and close outside air dampers

.5 Provide damper end switch to prevent supply fan starting until damper is open.

.6 Return air humidistat reset form outdoors shall modulate normally closed humidifier valve, Interlock spray pumps with supply fans and sump low level control. Set outdoor reset to 50% R.H. at 21°C. and 15% R.H. at -37°C.

.7 Thermostat in supply air duct shall modulate mixed air dampers, preheat coil valve, and cooling coil valve in sequence.

.8 Outside air thermostat above 18 °C shall close outside air damper, leaving minimum outside air damper open.

.9 Interlock return fan to start with supply fan.

.10 Pressure sensor shall modulate supply fan inlet vane dampers in sequence to maintain constant supply static pressure. Locate sensor minimum 15 m downstream of fan in supply air duct.

.11 Pressure sensor shall modulate supply fan inlet vane dampers to maintain constant supply static pressure. Modulate return air fan inlet vane dampers to maintain constant building pressurization.

.12 Provide time clock for day-night control with manual bypass switch marked "Day-Auto-Night". (on night cycle close outside air dampers

.13 Provide on local control panel:

- System graphic
- System on-off auto switch
- System on-off indication
- System day-night-auto switch
- Supply fan on-off (auto) switch
- Supply fan on-off indication
- Return fan on-off (auto) switch
- Return fan on-off indication
- Preheat coil pump on-off switch
- Preheat coil pump on-off indication
- Outside air temperature indication
- Mixed air temperature indication
- Fan discharge air temperature indication
- Reheat zone air temperature indication
- Return humidity indication
- Fan discharge temperature control point adjustment
- Return humidity control point adjustment
- Supply static pressure indication
- Supply static pressure control point adjustment

3.8 EXCESS PRESSURE CONTROL

.1 (Open modulating bypass valve) (Cycle pumps in sequence) (Vary pump speed through variable drive control) from controller sensing pressure differential between supply and return lines.

3.9 HUMIDIFIER CONTROL

.1 Line voltage thermostat open 2-position, 2-way hot water valve.

3.10 DOMESTIC HOT WATER TANK & RECIRCULATING PUMP

.1 Tank temperature will be controlled by manufacturer supplied, pre-wired controls.

.2 Domestic water supply temperature to be indicated at DDC panel.

.3 Recirculating pump will be cycled through DDC panel to maintain recirculating temperature and according to DDC time schedule.

3.11 BAY AREA VENTILATION SYSTEM

.1 Scope: EF-1, 2, and 3.

.2 Components:

.1 General exhaust outlet gravity backdraft dampers.

.2 Exhaust fans.

.3 O/A motorized dampers

.3 Normal Operation:

.1 Fan stopped.

.1 Exhaust fan stopped by the relay from the CO controller.

.2 Start-up (start switches activated by CO controller or by a wall mounted switch or according to DDC time program).

.1 Exhaust fan starts at minimum delivery.

3.12 CARBON MONOXIDE (CO) CONTROLLER

.1 Stand alone single channel CO controller shall control the EF-1, 2 and EF-3 exhaust fans on and off for the garage bay, IDENT bay, and secure bay.

3.13 VARIABLE FLOW CONTROL SYSTEM

.1 Scope

.1 Provide infinitely variable speed fan drive package for main supply and return fan.

.2 Provide variable speed motor drive package for pumps P-3, P-4.

.3 Submit shop drawings and technical information.

.2 Air Flow Control System:

.1 Provide airflow control system for the variable air volume fan systems as specified.

.2 Each flow control system shall consist of the following.

.1 A capacity control device for both the supply and return fans.

.2 A motor control panel.

.3 A static pressure control system for the supply fan.

.4 An air flow monitoring and control system for the return fan.

.5 Signals for tie-in to Building Management System.

.6 On site commissioning.

.3 Water Flow Control Systems:

.1 Provide water flow control system for secondary heating water pump system as specified.

.2 The heating water flow control system shall consist of the following.

.1 A capacity control device for the heating water pump

.2 A motor control panel

.3 Signals for tie-in to control building monitoring and control system

.4 On site commissioning

.4 Variable Speed Drive:

.1 Variable fan speed operation shall be by means of Variable Speed Drive (VSD) units controlling squirrel cage induction motors. The inverter duty squirrel cage induction motor shall be supplied by the fan manufacturer. It is the responsibility of this supplier to ensure drive/motor compatibility and to provide interval drive protection to prevent failure of drive fan voltage spikes, over/under voltage etc. and protect the motor being serviced from premature failure.

.2 Variable Speed Drive

.1 CSA approval.

.2 Constant voltage DC bus type.

.3 Voltage to match the building electrical supply without the use of transformers.

.4 Minimum end-to-end efficiency of 0.95 over entire motor speed range.

.5 Input voltage tolerances of +10% and -20%.

.6 Pulse width modulated control (phase angle control not permitted).

.7 Power ride through feature of up to 4 cycles.

.8 Current limiting feature.

.9 Short circuit protection.

.10 Soft start feature.

.11 Output current sine wave with minimum distortion so that the motor power including service factor is not reduced by more than 5%.

.12 Speed adjustment from zero to maximum without bogging, torque, or other fluctuations or instabilities.

.13 Status indication by means of LEDs for the following:

1 DC power supply on.

2 peak current shutdown.

3 remote shutdown.

4 over temperature.

5 overload.

6 ground fault shutdown.

7 control logic circuit malfunction.

8 bus over voltage.

9 bus under voltage.

10 system control adjustment as follows:

11 acceleration rate.

12 deceleration rate.

13 slip compensation.

14 IR compensation.

15 maximum frequency adjustment.
16 frequency range adjustment.
17 output voltage adjustment.
18 internal/external control for each function above.
19 controls to provide a response to match the fan speed to the system load.
20 ambient temperature operation of 32°F to 104°F
21 humidity range of operation 20% to 90% RH, non-condensing.
22 Input and output line reactors.
23 Load bypass switch to allow motor to continue operating in event of drive failure or repair.

.5 Motor Control Panels (MCP):

.1 Provide integrated motor control panels for the air flow control system as specified herein. Each MCP shall be provided with the following:

.1 CSA approval, CEMA 1 type enclosure, vented, if required, with key operated door lock.

.2 Disconnect switch interlocked with the panel door and sized for the connected load.

.3 Motor starter c/w overload and short circuit protection sized for each motor, as well as soft start control for each motor.

.4 Identified terminal strips to which all external wiring can be connected, including:

.5 Power wiring in and out

.6 Freeze stat

.7 Fire stat

.8 Fire alarm tie in

.9 BMS tie ins

.10 Power factor correction equipment to ensure a minimum power factor of 0.95.

.11 The MCP shall be provided with the following:

1 H-O-A switch for each motor controlled.
2 Manual/auto switch for each fan being controlled.
3 Manual capacity adjustment selector for each fan controlled.
4 Static pressure indication.
5 Static pressure set point indication.
6 Supply fan air flow indication L/S [CFM]
7 Return fan air flow indication L/S [CFM]
8 Pilot light indication of motor operation (status) for each motor.
9 Pilot light indication of system shut down on freeze alarm.
10 Pilot light indication of system shut down on fire alarm trip.

.6 Static Pressure:

.1 Provide an industrial grade electronic static pressure controller for supply fan to be controlled. This controller shall be mounted in the MCP and shall continuously indicate the measured static pressure. It shall be provided with:

.1 Set point indication.

.2 Set point adjustment at the instrument: Note: the adjustment shall be located either inside the panel or if on the panel, by means of a tamper proof mechanism.

.3 Static pressure indication, accurate to +/- 2% of scale.

.4 Range 0 to 1245 Pa [0 to 5”]

.5 Controller accuracy = +/- 25 Pa [0.1”]

.6 Stability - no cycling after two minutes from start up.

.7 Install the static pressure probe in the supply air duct according to the manufacturer's recommendations, at a location directed by the Departmental Representative, typically two-thirds of the way along the main duct from the fan. Ensure the throttling range of the controlled device is compatible with the pressure controller supplied to ensure performance within ± 25 Pa [0.1”] of the set point.

.8 The static pressure controller and associated controls shall ensure that the supply fan is in an unloaded condition prior to starting the supply fan motor.

.7 Air Flow Monitoring & Control System:

.1 Provide a Supply Fan/Return air tracking control package, to control the capacity of the return fan and the base building reference pressure, in response to changing loads within the building, as well as changes in outside atmospheric conditions. Mount the tracking control package in the MCP or in a control panel in the mechanical area, adjacent to the MCP.

.2 The capacity of the supply fan shall be controlled by the static pressure controller. Include with the supply fan capacity control package, a control stability system to ensure that the capacity control device does not hunt or cycle. The system must be capable of dampening out pulsations and minor pressure fluctuations within the supply air system to read a true average static pressure, and at the same time, control the supply static within 25 Pa [± 0.1”], with no cycling or hunting.

.3 Include with the control system an airflow measuring system to indicate the volume of air being delivered by both the supply and return fans. Provide duct mounted airflow measuring stations in both the supply and the return duct systems, with full instrumentation, including velocity pressure transmitters.

.4 The return fan flow shall be controlled by a return fan capacity controller (RFCC). The linearized signal from the supply fan airflow measurement shall be used as the floating setpoint adjustment to RFCC. The RFCC shall be provided with control stability instrumentation to control the return fan capacity with no cycling or hunting. The linearized signal from the return fan airflow measurement shall be used as the control loop feedback signal to the RFCC to close the control loop.

.5 The RFCC shall ensure that the return fan is in an unloaded condition prior to starting the motor.

.6 Provide a manual building Reference Pressure Balance Control to allow for the adjustment of the building reference pressure to compensate for variations, drafts and other space pressure imbalances. Provide zero and range adjustments.

.8 Tie-In to the Building Management System (B.M.S.):

.1 Provide connection points within the control panel to allow for direct tie-in to the B.M.S. Connection shall be either by means by an RS232 port so that the B.M.S. can address and modify the control system directly, or by means of identified terminals for each input or output signal. Analog signals shall be either 0-10 VDC or 4-20 ma. Binary signals shall be by means of a single dry contact.

.2 The following point shall be provided:

.1 Static pressure indication for each static pressure sensing point.

.2 Static pressure setpoint indication.

.3 Static pressure setpoint adjustment.

.4 Building reference pressure override adjustment.

.5 Supply fan capacity L/S [CFM]

.6 Return fan capacity L/S [CFM]

.7 Supply fan start/stop

.8 Supply fan start/stop

.9 Supply fan status

.10 Return fan status

.11 Low temperature alarm

.12 High temperature alarm

.13 Fire alarm shutdown alarm.

.9 On-Site Commissioning:

.1 Include for the services of a qualified technician to assist the contractor in setting up the flow control system on the job site. The technician shall have at least five years experience in heating, ventilating, and air conditioning systems and their controls. Include for a minimum of one man-day per system.

.2 Provide a start-up and commissioning report, which documents the procedures used and confirms the correct operation of the equipment at various system capacities. Report the voltage and amperage draw of each motor being controlled at three intermediate points and compare with expected values at those capacities.

.3 Provide complete check out to ensure all protective equipment to ensure reliable operation of drive and motor has been installed and wired correctly.

.4 Provide secondary visits to the site to fine tune/adjust drive resulting from nuisance trips/failures.

.5 Provide written confirmation that drive has been fully installed and commissioned in accordance with drive and motor supplier recommendations for reliable operation.

.10 Installation

.1 Secure panels to steel support framework or seismically braced building structure. Do not mount to plenum walls.

.2 Provide seismic bracing for panels and mount on resilient brackets.

End of Section

1 GENERAL

1.1 GENERAL

.1 The following points list indicates the input and output points that shall be connected to the B.A.S. Any additional points that are noted in Section 23 09 93 to be under DDC control shall also be included as if they were on the points list. All points associated with one mechanical system shall be connected to the same Stand Alone Panel (SAP). All points shall be connected to SAPs unless they are specifically noted in the points list as TUC points or if the TUC meets the same specifications for user custom programmability as the SAP in Section 23 09 24.

.2 Program alarms as specified in the points list and sequences with user adjustable alarm thresholds. Provide descriptors for all programmed alarms which can be accessed via the graphics at the OWS(s).

.3

1.2 DEVICE LEGEND

.1 Refer to Section 23 09 13 for specification of devices.

.2 RTS = Room Temperature Sensor

.3 DTS = Duct Temperature Sensor

.4 ITS = Immersion temperature Sensor

.5 ATS = Averaging Duct Temperature Sensor

.6 OTS = Outdoor Temperature Sensor

.7 HS = Humidity Sensor

.8 DPT = Differential Pressure Transmitters

.9 SPT = Static Pressure Transmitter

.10 VPT = Velocity Pressure Transmitter

.11 PSW = Pressure Switch

.12 TSW = Temperature Switch

.13 IPT = Current / Pneumatic Transducer

.14 CR = Current Relay

.15 FSW = Flow Switch

.16 ESW = End Switch

.17 ER = Electric Relay

.18 DME = Damper Actuator Modulating Electronic

.19 DTE = Damper Actuator Two Position Electronic

.20 DMI = Damper Actuator Modulating Incremental Control

.21 VME = Valve Actuator Modulating Electronic

.22 VTE = Valve Actuator Two Position Electronic

.23 VTP = Valve Actuator Two Position Electronic

.24 VMI = Valve Actuator Modulating Incremental Control

.25 MFT = VAV Box Flow Transmitter

.26 FMS = Electronic Flow Measuring Station

.27 WFS = Water Flow Measuring Station

1.3 TABLE LEGEND

.1 DI = DIGITAL INPUT; DO = DIGITAL OUTPUT; AI = ANALOG INPUT; AO = ANALOG OUTPUT; X = TUC POINT; H = HIGH ALARM; L = LOW ALARM; S = STATUS ALARM

2 INPUT/OUTPUT POINTS LIST

2.1 SYSTEM: HYDRAULIC HEATING SYSTEM

		INPUT		OUTPUT				
Unit No.	**Point Description**	**DI**	**AI**	**DO**	**AO**	**TUC**	**Alarm**	**Notes**
B-1								
	On/Off							
	2-stage gas valve							
	Status							
B-2								
	On/Off							
	2-Stage Gas Control							
	Status							
P-1								
	On/Off							
	Status							
P-2								
	On/Off							
	Status							
P-3								
	On/Off VFD							
	Status							
	Return Water Temp.							
	Supply Water Temp.							
P-4	(Stand by)							
	On/Off VFD							
	Status							
HC-AHU	Refer to AHU-1							
HC-HRV	Refer to HRV-1							
UH-1~5	(Typ. of 5)							
	2-Way control valves							
	Room T-stat							
	Status							
	Supply Air Temp. Sensor							
HC-1~5	(Typ. of 5)							
	2-Way control valves							
	Room T-stat							
	Supply Air Temp. Sensor							
RP1~11	(Typ. of 11)							
	2-Way control valve							

		INPUT		OUTPUT				
Unit No.	**Point Description**	**DI**	**AI**	**DO**	**AO**	**TUC**	**Alarm**	**Notes**
VAV - 1~16	(Typ. of 16)							
	2-Way control valves							
	Supply Air Temp. sensor							
	VAV Control/Actuator							
	Room T-stat							
FF-1,2,3	(Typ. of 3)							
	2-Way Control Valve							
	Room T-stat							

2.2 SYSTEM: AIR HEATING / COOLING SYSTEM

		INPUT		OUTPUT				
Unit No.	**Point Description**	**DI**	**AI**	**DO**	**AO**	**TU C**	**Alarm**	**Notes**
AHU-1								
	Supply Fan							
	On/Off VFD				1			
	Status		1					
	Static Pressure Sensor		1					
	Heating Coil							
	2-Way Control Valve				1			
	Heating Coil Supply Temp.		1					
	Coil Return Temp.		1					
	Dx coil & Condensing Unit							
	On/Off				1			
	Status		1					
	O/A Damper / Actuator				1			
	Min. O/A Damper / Actuator (from ERU-1)				1			
	E/A Damper / Actuator				1			
	O/A Temp.		1					
HRV-1								
	Supply Fan							
	On/Off			1				
	Status	1						
	Exhaust Fan							
	On/Off			1				
	Status	1						
	Wheel Motor (two speed)							
	On/Off				1			
	Status		1					
	Pre-heat Glycol Heating Coil							
	2-way Control Valve				1			
	Supply Air Temp.		1					

2.3 SYSTEM: DOMESTIC HOT WATER SYSTEM

		INPUT		OUTPUT				
Unit No.	**Point Description**	**DI**	**AI**	**DO**	**AO**	**TUC**	**Alarm**	**Notes**
DHWT-1								
	Supply Water Temp.							
	Return Water Temp.							
P-5								
	On/Off							
	Status							

2.4 SYSTEM: MISCELLANEOUS

		INPUT		OUTPUT				
Unit No.	**Point Description**	**DI**	**AI**	**DO**	**AO**	**TUC**	**Alarm**	**Notes**
LAN Room								
	Split A/C unit							
	On/Off							
	Status							
	Room Temp. Sensor							
DNA Room								
	EF-4							
	On/Off							
	Status							
PTSS Room	EF-5							
	On/Off							
	Status							
	Room Temp. sensor							
Indent bay								
	EF-1							
	On/Off							
	Status							
	MD-1–out door air intake							
	On/Off							
	Status							
Garage Bay								
	EF-2							
	On/Off							
	Status							
	MD-2–out door air intake							
	On/Off							
	Status							
Security Bay								
	EF-3							
	On/Off							
	Status							
	MD-3 –out door air intake							

		INPUT		OUTPUT				
Unit No.	**Point Description**	**DI**	**AI**	**DO**	**AO**	**TUC**	**Alarm**	**Notes**
	On/Off							
	Status							
Sprinkler Room								
	Sprinkler Trouble							
	Room Temp. sensor							
	BB-1							

END OF SECTION

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 Refer to Section 23 05 49 for required seismic restraint of piping.

1.2 REFERENCE STANDARDS

.1 Do all piping system work in accordance with ASME/ANSI B31.9 code and CSA B51.

1.3 REGULATORY REQUIREMENTS

.1 All components, products and fabrication techniques shall be provided in compliance with the Regulations and Requirements of the Province of British Columbia "Power Engineers Boiler and Pressure Vessel Safety Act and Regulations".

.2 Installation of, and repair or alterations to, pressure piping systems shall be performed only by licensed Contractors and licensed Welders, certified for the work being done in accordance with the Regulations and Requirements of the Province of British Columbia "Power Engineers Boiler and Pressure Vessel Safety Act and Regulations".

.3 All field welding to be in accordance with the procedures of CSA-W117.2 and the current edition of ASME/ANSI B31.1 or B31.9 Code.

1.4 SYSTEM PRESSURE RATINGS

.1 Pipe Fittings:

.1 Piping systems 860 kPa [125 psig] or less operating pressure - 860 kPa [125 psig] rating.

.2 Valves:

.1 Suitable for maximum system operating temperature and pressure.

1.5 SHOP DRAWINGS

.1 Submit detailed shop drawings of valves in accordance with Section 23 05 00. Shop drawings shall clearly indicate valve make, model, location, type, size and pressure rating and Provincial CRN number.

2 PRODUCTS

2.1 GENERAL

.1 All products shall be registered with the regulatory authority in accordance with CSA B51.

2.2 PIPE

.1 Steel Pipe:

.1 to NPS 10, Schedule 40 to ASTM A53 Grade B or NPS 3/4 to NPS 2 to ASTM A795, Schedule 5, suitable for Pressfit.

.2 for the following systems:

.1 Hot water heating

.2 Glycol heating

.3 Chemical feed

.4 Relief valve vents

.2 Galvanized Steel Pipe: to ASTM A53, Grade B, galvanized with average coating of 0.55 kg/sq.m. as follows:

.1 Schedule 40

.3 Copper Pipe: to ASTM B88M-86, Type K, or L hard drawn copper tubing.

.1 Type L, hard drawn:

.1 Domestic hot water preheat.

.2 Type L hard drawn may be used as an alternative to steel piping for the following systems:

.1 Hot water heating.

.3 Type K, hard drawn:

.1 Air vent overflow where exposed.

.4 Type K, soft drawn:

.1 Air vent overflow where concealed.

2.3 PIPE JOINTS - STEEL PIPING

.1 NPS 2 and under: screwed fittings, except where otherwise noted, with teflon tape and rectroseal teflon paste or pipe dope, Pressfit in applicable applications.

.2 NPS 2-1/2 and over: welding fittings and flanges to CSA W47.1.

.3 Flanges: raised face, steel weld neck, lap or back-welded slip on type. Use flat face for attachment to cast iron valves.

.4 Victaulic Pressfit fittings with grade "E" EPDM O-rings may be used on hot water heating up to 110°C [230°F] working temperature, glycol heating systems.

.5 Bolts and Nuts, carbon steel: to ANSI B18.2.1 and ANSI B18.2.2.

.6 Flange gaskets:

.1 Up to 860 kPa [125 psig] system pressure - non-asbestos gaskets for mating surfaces.

.2 Over 860 kPa [125 psig] system pressure - stainless steel spiral wound non-asbestos gaskets.

2.4 PIPE FITTINGS - STEEL PIPE

.1 Pipe fittings, screwed, flanged or welded:

.1 Cast iron pipe flanges: Class 125 to ANSI B16.1.

.2 Cast iron screwed fittings: Class 125 to ANSI B16.3.

.3 Steel pipe flanges and flanged fittings: to ANSI B16.5.

.4 Steel butt-welding fittings: to ANSI B16.9a.

.5 Unions, malleable iron ground joint type: Class 150 to ANSI B16.3.

.2 Fittings for roll grooved piping: malleable iron to ASTM A47M or ductile iron to ASTM 536.

2.5 PIPE JOINTS - COPPER PIPE

.1 All sizes, soldered or brazed as specified in EXECUTION.

.2 NPS 2 to NPS 8 - Victaulic Style 606 rigid copper couplings with flush seal gasket grade "EPDM" gasket for temperature range -34øC [-30øF] to 110øC [230øF] may be used on domestic water system.

2.6 PIPE FITTINGS - COPPER PIPE

.1 Cast bronze: to ANSI B16.18.

.2 Wrought copper and bronze: to ANSI B16.22.

.3 Roll grooved (non-flared) fittings by Victaulic.

2.7 FLANGES - COPPER PIPE

.1 Brass or bronze: to ANSI B16.15.

.2 Cast iron: to ANSI B16.4.

.3 Victaulic Style 641 Flange Adapter.

2.8 VALVES GENERAL

.1 Wherever possible all valves shall be of one manufacturer.

.2 Provide valves with manufacturer's name and pressure rating clearly marked on outside of body. All valves must be suitable in all respects for service used.

.3 All valves shall have a Provincial CRN number which is current.

.4 Include lock shield handles where shown or noted.

.5 Provide valves located more than 2100 mm [7 ft] from floor in equipment room areas with chain operated sheaves. Extend chains to 1800 mm [6 ft] above floor and hook to clips arranged to clear walking aisles.

.6 Use non-rising stem valves where there is insufficient clearance for stem to rise.

.7 Where butterfly valves are installed to permit removal of equipment, they shall be of the threaded full lug type or grooved if grooved system is used. They may however, be of the wafer type if an additional pair of flanges (not those installed to contain the valve) are installed.

2.9 GATE VALVES

.1 NPS 2 and under, screwed:

.1 Bronze body, rising stem, solid wedge disc, union or screwed bonnet.

.2 Acceptable Products:

.1 Class 125 [860 kPa] - Crane 1700, Grinnell 3010, Kitz 24, Newman Hattersley 607, Nibco T-134, Toyo 293.

.2 NPS 2 and under, soldered:

.1 Bronze body, rising stem, solid wedge disc, screwed bonnet.

.2 Acceptable Products:

.1 Class 200 W.O.G. [1380 kPa] - Crane 1700S, Grinnell 3080SJ, Kitz 44, Newman Hattersley 607C, Nibco S-134, Toyo 299.

.3 NPS 2-1/2 and over, flanged:

.1 Cast iron body, rising stem, O.S. & Y, solid wedge disc, bronze trim, bolted bonnet.

.2 Acceptable Products:

.1 Class 125 [860 kPa] - Crane 465-1/2, Grinnell 6020A, Kitz 72, Newman Hattersley 504, Nibco F-617-0, Toyo 421A.

2.10 GLOBE VALVES

.1 NPS 2 and under, screwed:

.1 Bronze body, rising stem, renewable composition or bronze disc, union bonnet.

.2 Acceptable Products:

.1 Class 125 [860 kPa] - Crane 1703, Grinnell 3240, Kitz 03, Newman Hattersley 14, Nibco T-235-Y, Toyo 220.

.2 NPS 2 and under, soldered:

.1 Bronze body, rising stem, renewable composition or bronze disc, screwed bonnet.

.2 Acceptable Products:

.1 Class 200 W.O.G. [1380 kPa] - Crane 1703S, Grinnell 3240SJ, Kitz 10, Newman Hattersley 51, Nibco S-211-YW, Toyo 212.

2.11 BUTTERFLY VALVES

.1 NPS 2-1/2 and over:

.1 Cast iron or ductile iron body with ductile iron plated or bronze disc, stainless steel stem and extended neck to clear minimum of 50 mm [2"] thick insulation.

.2 Threaded full lug type or wafer type (with or without integral flanges).

.3 Resilient EPT or EPDM seat.

.4 Operators (unless otherwise specified in the Controls Section):

.1 NPS 8 and under - lever handle with minimum 10 position ratchet and disc position indicator.

.2 NPS 10 and over - worm gear operator.

.5 Acceptable Products:

.1 Class 150 [1030 kPa] W.O.G. - Crane, Centreline, Demco, Dezurik, Grinnell, Keystone, Kitz, Kurimoto, Newman Hattersley, Nibco WD-2100 or LD-2100, Norriseal, Apollo 141 or 143

.2 NPS 2-1/2 and over - roll grooved piping:

.1 Ductile iron body with ductile iron disc encapsulated with Grade 'E' – EPDM.

.2 Dual seal disc with two molded in rings.

.3 Grooved ends.

.4 Operators (unless otherwise specified in the Controls Section):

.1 NPS 8 and under - lever handle with minimum 10 position ratchet and disc position indicator.

.2 NPS 10 and over - worm gear operator.

.5 Acceptable Products:

.1 Class 300 [2065 kPa] W.O.G. - Grinnell G8292, Mech-Line MBFV, Victaulic VIC-300.

2.12 BALL VALVES

.1 NPS 2 and under, screwed:

.1 Forged brass body, threaded cap, chrome plated ball, PTFE seats, blow out proof stem.

.2 Ball valves for isolation service shall have a large/full port.

.3 Ball valves for balancing service shall have a reduced port and valve handle shall have a memory stop.

.4 Acceptable Products:

.1 Class 600 W.O.G. [4140 kPa] - Crane F9202, Grinnell 3700, Kitz 58, Newman Hattersley 1969, Nibco T-585-70, Toyo 5044A, Victaulic 722.

.2 NPS 2 and under, soldered:

.1 Forged brass body, threaded cap, chrome plated ball, PTFE seats.

.2 Ball valves for isolation service shall have a large/full port.

.3 Ball valves for balancing service shall have a reduced port and valve handle shall have a memory stop.

.4 Acceptable Products:

.1 Class 500 W.O.G. [3450 kPa] - Crane F9222, Grinnell 3700SJ, Kitz 59, Newman Hattersley 1979, Nibco S-585-70, Toyo 5049A.

2.13 BALANCE FITTINGS AND VALVES

.1 NPS 1-1/4 and under:

.1 Bronze body and bronze trim, rising stem, renewable composition disc, globe type with memory stop, Lockshield, male union connection, angle and straight type.

.2 Acceptable Products:

.1 Class 100 [690 kPa] - Dahl 13000-M series, Toyo 250 or 251.

.2 NPS 1-1/2 and over:

.1 Screwed connections up to NPS 2.

.2 Flanged connections NPS 2-1/2 and over.

.3 Cast iron body, non-lubricated eccentric plug with resilient coating EPT or RS 55, suitable for 121°C [250°F] operating temperature, stainless steel bearings, adjustable memory stop, plug type suitable for wrench adjustment.

.4 Acceptable Products:

.1 Class 175 W.O.G. [1210 kPa] - DeZurik 400, Keystone Ballcentric.

.3 NPS 3 and over:

.1 Victaulic Vic-Plug Valve Series 377.

2.14 AUTOMATIC FLOW CONTROL VALVES

.1 General: Devices shall automatically control the required flow quantity between differential pressure ranges of 14 to 310 kPa [2 to 45 psig].

.2 NPS 2 and smaller:

.1 Body shall be forged brass ASTM B283 600 W0G, 163°C [325°F].

.2 Return from coil: (downstream side of Temperature Control Valve); Combination assembly including:

.1 Body fitted with ball shut off valve, hard chrome plated, Teflon Ball Seals and Viton O-Rings.

.2 Flow Cartridge shall be accessible non-clogging piston type with + 5% accuracy.

.3 Two P/T Plugs, union for accepting temperature control valve (by controls contractor).

.3 Return from coil: (upstream side of Temperature Control Valve); Combination assembly including:

.1 Full port union with manual air vent and P/T test plug.

.4 Supply to coil; Combination assembly including:

.1 Ball valve, strainer P/T test plug and blow down drain valve.

.3 NPS 2½ and larger:

.1 Body shall be epoxy coated ductile iron ASTM A536 2758 kPa [400 psig] 177°C [350°F].

.2 Flow cartridges 304 SS moving parts in brass housing, 14 to 310 kPa (2 to 45 psig) 1.9 to 144 l/s (25 to 2280 gpm)

.3 P/T Plugs, thermometer well and drain.

.4 Provide a dual hose temperature/pressure meter kit with flow conversion chart and carrying case.

.5 Acceptable Product: Nexus, Griswold

2.15 CIRCUIT BALANCING VALVES

.1 NPS 2 and under: copper alloy body, screwed, 'Y' pattern globe.

.2 NPS 2-1/2 and over: cast iron body, flanged or grooved, 'Y' pattern globe.

.3 Maximum pressure 1715 kPa [250 psig] and maximum temperature 121°C [250°F].

.4 Calibrated balancing valve with memory, positive shut-off, inlet and outlet pressure measuring connections with integral shut-offs and drains.

.5 Calibration charts and adjustment tools to be included.

.6 Provide one (1) differential pressure meter kit suitable for direct readout c/w connection hoses suitable for the system pressure.

.7 Acceptable Products:

.1 Bell and Gossett - Circuit Setter

.2 ESBE - Circuit Setter

.3 Tour & Anderssen - STAD

.4 Armstrong - CBV

.5 Wheatley – GS

.6 Nexus

2.16 SWING CHECK VALVES

.1 NPS 2 and under, screwed:

.1 Bronze body, bronze swing disc, screw in cap, regrindable seat.

.2 Acceptable Products:

.1 Class 125 [860 kPa] - Crane 1707, Grinnell 3300, Kitz 22, Newman Hattersley 60, Nibco T-413-B, Toyo 236.

.2 NPS 2 and under, soldered:

.1 Bronze body, bronze swing disc, screw in cap, regrindable.

.2 Acceptable Products:

.1 Class 200 W.O.G. [1380 kPa] - Crane 1707S, Grinnell 3300SJ, Kitz 23, Newman Hattersley 61, Nibco S-413-B, Toyo 237.

.3 NPS 2-1/2 and over, flanged:

.1 Cast iron body, renewable or regrindable seat, bronze swing disc, bolted cap.

.2 Acceptable Products:

.1 Class 125 [860 kPa] - Crane 373, Grinnell 6300A, Kitz 78, Newman Hattersley 731, Nibco F-918, Toyo 435A.

2.17 COMBINATION BALANCE/CHECK VALVES

.1 Integrated shut off, non-slam check valve and balance valve.

.2 Suitable for 1029 kPa [150 psig] and 122°C [250°C].

.3 Cast iron body, stainless steel trim, bronze seat and disc.

.4 Connections:

.1 NPS 2 and under; screwed.

.2 NPS 2-1/2 and over; flanged, or grooved Victaulic.

.5 Select for system flow rate, and allowable pressure drop at a velocity not exceeding 1.8 m/s (6 fps).

.6 Acceptable Products:

.1 Armstrong Flo Trex, Bell & Gossett Triple Duty, Taco Multi-purpose, Victaulic triple service valves.

2.18 NEEDLE VALVES

.1 Bronze body, screwed, globe type with cadmium plated steel stem.

.2 Acceptable Products:

.1 Class 400 [2760 kPa] - Crane 88/89, RP&C 60-100.

.3 Application: Install needle valves where petcocks or manual vents are indicated.

2.19 RADIATOR VALVES

.1 Screwed bronze body with bronze trim, wheel handle, rising stem, renewable composition disc, male union connections, angle and straight type.

.2 Acceptable Products:

.1 Class 100 [690 kPa] - Dahl 11041 or 11042, Dunham Bush 200B or 246B, Kitz 100 series, Sarco type R or RP, Toyo 252 or 253.

2.20 THERMOSTATIC RADIATOR VALVES

.1 Screwed nickel plated brass body, stainless steel spindle, EPDM rubber valve disc, straight and angle type.

.2 Valves complete with sensors, operators and capillary tubing.

.3 Remote sensors/operators to have 8 m [26 ft] capillary tube.

.4 Capillary tubing to be run concealed in walls and ceilings, sheathed in 20 mm [3/4"] dia. plastic tubing.

.5 Acceptable Products: Danfoss

.6 Notes:

.1 Valves on radiant ceiling panels in office to have remote wall mounted sensors/operators.

.2 Valves in public areas to have valve mounted operators with remote wall mounted sensors.

.3 Valves on convector units to have valve mounted operators and sensors.

2.21 DRAIN VALVES

.1 Globe type, bronze body with bronze trim and composition disc.

.2 Acceptable Products:

.1 Crane 1703, Dahl 2343, Kitz 03, Newman Hattersley 13, Nibco T-235-Y, Toyo 220.

2.22 HOSE BIBBS

.1 Brass ball valve with forged brass cap and chain, NPS 3/4 male threaded hose end, lockshield in public areas. Working pressure 1724 kPa [250 psi] to 121°C [250°F].

.2 Acceptable Products:

.1 Crane F9202CC, DAHL #50-430 [50.430LS], Kitz 58CC, Red-White / Toyo 5046.

3 EXECUTION

3.1 PIPING

.1 Ream pipe ends. Clean scale and dirt, inside and outside before and after assembly. Remove welding slag or other foreign material from piping.

.2 During construction, protect all openings in piping and equipment, by capping or plugging to prevent entry of dirt.

.3 Screw or weld (unless otherwise specified) all piping systems up to NPS 2.

.4 Weld (unless otherwise specified) all piping systems NPS 2-1/2 and over.

.5 Install piping to conserve headroom and space. Run exposed piping parallel to walls. Group piping wherever practical.

.6 Avoid piping in exterior walls unless otherwise directed. If required, install this piping protected from the outside by the building insulation and vapour barrier.

.7 Maintain a minimum of 25 mm [1"] space between adjacent flanges or pipe insulation, whichever has the larger diameter.

.8 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.

.9 Saddle type branch fittings may be used on mains, if branch line is half size or smaller than main. Hole saw or drill and ream main to maintain full inside diameter of branch line prior to welding saddle.

.10 Use long radius elbows.

.11 Install all thermometer wells and immersion sensor wells specified under the Controls Section. Where wells will restrict flow in small diameter pipes (NPS 1-1/2 and smaller) install a section of oversized pipe at least NPS 2.

.12 Remake leaking joints using new materials, do not caulk or cement leaking threaded joints.

.13 Use eccentric reducers at pipe size changes, flush on top side, to permit positive venting and drainage.

.14 Do not use thread protection couplings, close nipples, running nipples or street elbows.

.15 Install dielectric type unions or flanges or Victaulic Style 47 Clearflow Dielectric Waterways on "OPEN" type systems, where copper piping connects to steel. eg. domestic hot water tanks.

.16 Avoid locating water and drain piping over electrical equipment. Where this is unavoidable, provide galvanized drip pans under such pipe and weld piping and fittings. Provide drain and piping from drip pans to satisfactory floor drain.

.17 Bull head tees shall not be used for converging flows.

3.2 PIPE GRADING

.1 Grade all piping to provide positive drainage and venting. Slope as follows:

.1 Supply mains and branches - up in the direction of flow, minimum 1:480 [1" in 40 ft].

.2 Return mains and branches - down in the direction of flow, minimum 1:480 [1" in 40 ft].

.3 Reverse return supply and return mains - up in the direction of flow, minimum 1:480 [1" in 40 ft.].

.4 Grade horizontal drainage and vent piping down in direction of flow, 2% minimum.

.5 On closed system, equip low points with 20 mm [¾"] drain valves. Provide, at high points on lines and on equipment connections, collecting chambers and high capacity float operated air vents.

3.3 SOLDERING AND BRAZING

.1 Pressure fluid systems - <u>with</u> chemical treatment (heating water) BRAZE with silver base brazing alloy, 538°C [1000°F] melting point.

.2 Pressure fluid systems - <u>without</u> chemical treatment, (domestic water) SOLDER with 95/5 tin-antimony.

.3 Non-pressure systems, (drains) SOLDER with 50/50 tin lead.

.4 Piping connections to radiant ceiling panels, SOLDER with 95/5 tin-antimony.

3.4 DRAIN CONNECTIONS

.1 Pipe the discharge from all liquid relief valves, liquid safety valves, high capacity air vents, steam drip pan elbows, equipment blowdowns, water columns, overflows and piping system drains to the nearest building drain. Install a brass, bronze or copper receiving funnel on the drain where shown.

.2 Drains from drain pans shall be DWV copper ASTM B306 32 mm [1-1/4"] minimum size.

.3 Drain and vent piping shall be of the same material as the piping system to which it is connected, except where otherwise specified.

.4 Where item being drained is under pressure, provide a deep seal trap.

3.5 EXPANSION OF PIPING

.1 Install all piping systems with due regard and provision for expansion avoiding strain or damage to equipment and building. Pay particular attention to piping running horizontal across building expansion joints and provide adequate expansion and contraction for all such piping.

.2 Only major expansion configuration and fittings have been shown on the drawings. Provide all required additional compensators, loops and swing connections.

.3 Provide anchors, where shown. Anchors shall be fabricated from mild steel plate and structural steel angle and channel sections, in accordance with ANSI B.31.

.4 Expansion loops shall be of all welded construction with long radius elbows.

.5 Install expansion loops, cold sprung 50% of the calculated expansion.

.6 Install at least three [3] elbows in all branch connections. Where space does not permit 3 elbows, install braided flexible pipe connectors in accordance with manufacturers recommendations. Three [3] elbow branch connections shall have sufficient developed length to ensure that excessive stresses are not generated in the piping and in no case less than 900 mm [36"].

3.6 VALVES

.1 Install valves with stems upright or angled 45^{o} above horizontal unless approved otherwise.

.2 Install control valves with their stems upright unless approved otherwise and with adequate clearance for removal of actuators.

.3 Use gate valves or (ball valves NPS 2 and under) to shut off branch takeoffs and to isolate equipment.

.4 Butterfly valves may be used as an alternative to gate valves on chilled water, condenser water, heat pump and glycol heat recovery systems.

.5 Use globe valves to control flow in circuits; except, where balancing cocks are specifically specified.

.6 Use plug type globe valves in control valve bypass connections.

.7 Use plug cocks for balance valves in water return branch mains and branch connections to return mains and for shut off and balancing on glycol circuits.

.8 Install balance fittings or valves in the return piping connections to each terminal heating and cooling unit - eg. radiators, unit heaters, fan coil units, heating and cooling coils.

.9 Install radiator valves in the supply connections to each convection heating element.

.10 Provide isolation valves in all systems such that floor by floor for horizontal systems, all risers in a vertical system and zone areas on a large horizontal system can be isolated.

.11 Provide valves upstream of all meters, gauges, automatic air vents, etc. for isolation purposes.

.12 Use swing check valves, in horizontal and vertical upflow pipes and on the discharge of pumps. Spring loaded water check valves shall be located 8 pipe diameters downstream of pumps or elbows.

.13 Use silent check valves where specifically shown in vertical pipes with downward flow.

3.7 DRAIN VALVES AND HOSE BIBBS

.1 Install drain valves and hose bibbs at each low point in the piping system and at specific drain locations shown on the drawings.

.2 Install NPS 3/4 hose bibbs at all downfed terminal heating and/or cooling units.

.3 Install NPS 1-1/2 or NPS 3/4 on line sizes less than NPS 1-1/2 drain valves / hose bibbs at all low points in the piping systems to facilitate draining.

.4 Install drain valves in lieu of hose bibbs for systems operating at over 93°C [200°F].

.5 Install a hose end adaptor on the discharge side of each drain valve or pipe to drain, where indicated.

.6 Use a NPS 1-1/2 firehose and connect it to the discharge side of the drain valves, to flush the piping system during the pipe cleaning process.

.7 Install caps, with chains, on hose end adaptors, in public areas.

3.8 PIPING TESTS

.1 Notify the Departmental Representative and the Inspection Authority having jurisdiction, 48 hours in advance of intended test dates.

.2 Before testing piping, isolate all equipment, which cannot withstand the test pressure.

.3 Do not insulate, backfill or conceal until tests have been completed and approved by the inspection authorities.

.4 Examine all systems under test for leaks.

.5 Joints shall remain dry during the test. A general sweating around a weld shall be reason for rejection.

.6 Remake all leaking connections and joints.

.7 Tests shall be limited to new piping only.

.8 Do not backfill any underground piping until it has been surveyed and documented by the University.

.9 Initial Hydrostatic test:

.1 150% of working pressure, but not less than 860 kPa [125 psig] for 1 working day.

.10 Final Hydrostatic test:

.1 150% of working pressure, after piping connections to all equipment are complete, maintain until all parts of piping systems have been inspected.

3.9 FLUSHING AND CLEANING

.1 Flushing and cleaning shall commence only after all piping tests have been completed.

.2 Install temporary bypass connections around all heat pump units before commencing chemical cleaning.

.3 Chemically clean the following piping systems as recommended by an approved professional chemical cleaning and treatment agency who shall supervise the work:

.1 Glycol heating system(s).

.4 Flush out all traces of chemicals with clean water after chemical cleaning is complete.

.5 Install final connections to heat pump units after flushing is complete.

.6 Remove, clean and reinstall all strainer baskets.

.7 Submit a report signed by a principal of the Agency, which certifies that the cleaning has been satisfactorily completed.

3.10 CHEMICAL TREATMENT

.1 Chemically treat water systems in accordance with Section 23 25 00.

3.11 TESTING AND BALANCING

.1 Balance all piping systems in accordance with the requirements of Section 23 05 93.

END OF SECTION

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 REFERENCE STANDARDS

.1 The provision of all specialty components shall be in accordance with ANSI/ASME B31 Codes for Building Services Piping.

1.3 REGULATORY REQUIREMENTS

.1 All water specialty components shall be provided in compliance with the Regulations and Requirements of the Province of British Columbia "Power Engineers Boiler and Pressure Vessel Safety Act and Regulations".

.2 All water specialty components shall be provided in compliance with the Regulations and Requirements of the Pressure Vessel Ordinance of the Yukon Territory. Also, follow ASME Boiler and Pressure Vessel Code Sections VII and IX for Welding and Brazing.

1.4 SYSTEM PRESSURE RATINGS

.1 Piping systems 860 kPa [125 psig] or less operating pressure - 860 kPa [125 psig] rating.

2 PRODUCTS

2.1 AIR VENTS AUTOMATIC - HIGH CAPACITY TYPE

.1 Non-Serviceable Type

.1 Casing and internal parts suitable for system operating pressure and temperature.

.2 All metal construction with outlet threaded to accept vent tubing connection.

.3 Automatic float type.

.4 Shrader type venting valve.

.5 Acceptable Products:

.1 345 kPa [50 psig] maximum operating pressure -Armstrong 11-AV, Dole 75, Maid-O-Mist 7, Taco 423, Watson McDaniel AE1800.

.2 517 kPa [75 psig] maximum operating pressure -Armstrong 11-AV, Dole 75, Maid-O-Mist 7, Taco 426, Watson McDaniel AE1800.

.3 1035 kPa [150 psig] maximum operating pressure -Armstrong 11-AV, Maid-O-Mist 71, Taco 426, Watson McDaniel AE1800.

2.2 AIR SEPARATORS

.1 Provide centrifugal, type with 860 kPa [125 psi] WSP steel tank, galvanized steel 6 mm [¼"]perforated strainer, perforated stainless steel air collector tube and drain connection.

2.3 EXPANSION TANKS - AIR CUSHION TYPE

.1 Expansion tanks with a working pressure up to 207 kPa [30 psig] and less than 610 mm [24"] in diameter.

.1 Designed and constructed per ASME standards.

.2 Steel construction.

.3 Welding performed by certified, qualified welders.

.4 Factory tested hydraulically to 510 kPa [75 psig].

.5 Identification plate showing:

.1 Manufacturer's name.

.2 Expansion tank operating pressure, 207 kPa [30 psig].

.3 Hydraulic test pressure.

.4 Date of manufacture.

.2 Pipe Connections: (refer to drawings for sizes).

.1 System connection at bottom.

.2 Drain connection at bottom.

.3 Vent connection at top.

.4 Gauge glass connections.

.5 Two inspection tappings on centre line of sides, one near each end.

.3 Gauge Glass:

.1 Install a 12 mm [1/2"] dia. gauge glass with red line painted along length of glass, brass protection bars, brass ball check stop valves and drain cock (Penberthy 68A Redline, Lunkenheimer 589, Conbraco 20-250 series).

.2 Gauge glass shall be limited to 760 mm [30"] length and shall span at least 50% of tank diameter or shell length.

.3 Where shell lengths [vertical tanks] exceed 1500 mm [60"], use two gauge glasses, staggered, so that readings overlap.

2.4 FLEXIBLE HOSE ASSEMBLIES

.1 Scope: For connecting to air valve reheat coils, fan coil units etc.

.2 EPDM rubber inner core, stainless steel exterior braid, steel crimp ferrules and brass or bichromate steel threaded ends.

.3 End connections are male solid NPT one end and male swivel NPT on the other end.

.4 Suitable for hot water applications up to 110 ^{o} C [230^{o} F].

.5 Acceptable Products: Unisource Manufacturing Inc. H-P Flex.

2.5 PRESSURE REDUCING STATION - COLD WATER

.1 Screwed, bronze or cast iron body, suitable to 1380 kPa [200 psig], composition seat.

.2 Each reducing station to include:

.1 Gate valve, strainer, union, pressure reducing valve, union, gate valve.

.2 Bypass with globe valve.

.3 20 mm [3/4"] relief valve.

.3 Acceptable Products:

.1 Cashco, Watts.

2.6 PRESSURE RELIEF VALVES - WATER

.1 Screwed, bronze body or cast iron body with expanded outlet.

.2 ASME rated.

.3 Coordinate with Heat Exchangers Schedules.

.4 Acceptable Products:

.1 Bronze body: Watts 174A, NPS 3/4 to NPS 2.

.2 Iron body: Watts 740, NPS 3/4 x 1 to NPS 2 x 2-1/2.

2.7 STRAINERS

.1 NPS 2 and under: bronze body, screwed connections.

.2 NPS 2-1/2 and over: cast iron body, flanged connections.

.3 NPS 2 and over: Y or T type strainer with grooved ends with ductile iron body or malleable iron body.

.4 Suitable for maximum system operating pressure. Where system pressure exceeds 860 kPa [125 psig], use 1725 kPa [250 psig] strainer bodies.

.5 Basket Screen:

.1 Bronze, stainless steel or monel perforated screen.

.2 35 holes/cm2, 1.2 mm dia. perforations, 36% open area.

.6 Acceptable Products:

.1 Armstrong, Erwel, Kitz, Mech-Line, Muesco, Spirax/Sarco, Toyo, Victaulic.

2.8 SUCTION GUIDE

.1 Integrated long radius elbow, strainer and suction entrance guide vanes.

.2 Suitable for 1029 kPa [150 psig] and 122°C [250°F].

.3 Cast ductile iron body, stainless steel strainer, steel guide vanes

.4 Connections:

.1 NPS 2 and under, screwed.

.2 NPS 2-1/2 and over, flanged or grooved.

.5 Select for system flow rate and allowable pressure drop.

.6 Acceptable Products:

.1 Armstrong Suction Guide, Bell & Gossett Suction Diffusers, Mech-Line, Taco Suction Diffuser, Victaulic suction diffuser.

2.9 TANKS - DOMESTIC HOT WATER

.1 Steel construction with domed pressure heads and domestic hot water tank cement lining.

.2 Fabricated in accordance with ASME Section VIII for unfired Pressure Vessels; CSA B51-M1986, 860 kPa [125 psig] pressure rated.

.3 Tank lining shall be suitable for the local water conditions .

.4 The lining shall carry a 5 year unconditional guarantee (plus another 5 year prorated guarantee) and shall be checked on arrival at site.

.5 Oversized nozzle for the installation of immersion heater tube bundle(s). Nozzle oversized to permit the cement lining to be continuous up to the tube sheet or flange.

.6 The fabrication of the tank heater nozzle shall be coordinated with the immersion heater manufacturer.

.7 Internal tube bundle supports material shall be compatible with tube material.

.8 Everdur or stainless steel connections for all tank connections. Connections shall be extended the thickness of the lining on the inside and to allow for 50 mm [2"] thick tank insulation on the outside.

.9 Gasketted 380 mm x 280 mm (15" x 11") manhole with yoke type anchor in the shell.

.10 Vertical tanks shall be supplied with angle iron legs or pipe legs suitable for fixing to floor slab.

.11 Visible identification plate showing:

.1 Manufacturer's name.

.2 Design pressure.

.3 Code stamping and design registered according to ASME.

.4 ASME date report required.

.12 Tank shall be supplied with a combination temperature and pressure relief valve to relieve the full input of the immersion heater.

.13 For tank connections and sizes refer to the drawings. Unless otherwise shown, include connections for hot water supply, cold water, recirculating drain, relief valve, thermometers (2), pressure gauge and controller.

3 EXECUTION

3.1 AIR VENTS - AUTOMATIC - HIGH CAPACITY TYPE

.1 Install automatic high capacity air vents at each high point in the piping systems and where shown on the drawings.

.2 Install on tees and not on horizontal pipe runs or elbows.

.3 Install a 12 mm (1/2") minimum isolating gate valve ahead of each air vent, unless air vent has an integral shut-off valve.

.4 Fit all vents on top of an air-collecting chamber.

.5 Pipe all air vent discharge connections from the glycol circuit, separately back to the glycol mixing tank, using 6 mm (1/4") hard drawn copper tube.

3.2 AIR SEPARATOR

.1 Provide on suction side of the system circulation pump.

3.3 AIR SCOOP

.1 Provide on suction side of the system circulation pump.

3.4 COMBINATION BALANCE/CHECK VALVES

.1 Install combination stop/balance/check valves on the discharge of centrifugal pumps where shown on the drawings and/or where scheduled.

.2 Install in accordance with the manufacturer's recommendations.

.3 Minimum 5 pipe diameters from pump connections.

3.5 EXPANSION TANK - AIR CUSHION TYPE

.1 Install expansion/contraction tanks at each location shown on the drawings and as scheduled. Bolt floor mounted leg plates to the floor. Fit seismic restraint slack cables to suspended tanks.

.2 Install a NPS 3/4 globe valve in the tank vent connection and extend the vent down to hand level. Install a nipple and cap on the open end of the globe valve.

.3 Install a gate valve in the system connection.

.4 Install a globe valve in the tank drain connection.

3.6 FLOW CONTROL VALVES - AUTOMATIC

.1 Install automatic flow control valves where shown on the drawings in accordance with the manufacturer's instructions.

.2 Hand over temperature/pressure meter kit and calibration charts to the Departmental Representative's representative, at substantial performance and obtain receipt.

3.7 CIRCUIT BALANCING VALVES

.1 Install flow measuring balancing valves where shown on the drawings in accordance with the manufacturer's instructions.

.2 Hand over differential pressure meter kit and calibration charts to the Departmental Representative's representative, at substantial performance and obtain receipt.

3.8 PRESSURE REDUCING STATIONS - COLD WATER

.1 Install water make-up stations for each hot water and other closed water systems where shown on the drawings.

.2 Pipe relief valve to drain.

3.9 PRESSURE RELIEF VALVES - WATER

.1 Install pressure relief valve(s) on each heat exchanger to prevent over pressuring.

.2 Select relief valves to relieve full heat input of the heat supply side.

.3 Pipe relief valve to drain.

.4 Where one line vents several relief valves, cross sectional area shall equal sum of individual vent areas.

3.10 PRESSURE RELIEF VALVES - PUMP BYPASS

.1 Install pressure relief valves to relieve flow from the supply main to the return main where shown on the drawings.

3.11 STRAINERS

.1 Install pipe line strainers where shown on the drawings.

.2 Provide isolation valves on either side of the strainer to permit cleaning without draining the system.

.3 Blowdown connections:

.1 Strainers, NPS 2 and under - hot services: nipple and cap.

.2 Strainers, NPS 2-1/2 and over - hot services: nipple, globe valve and nipple.

.3 Strainers, all sizes - cold services: plug.

3.12 SUCTION GUIDE

.1 Install suction guides on the suction of centrifugal pumps, where shown on the drawing and where scheduled in accordance with manufacturer's recommendations.

.2 "Start up" strainer baskets must be removed prior to commissioning of systems.

3.13 TANKS - DOMESTIC HOT WATER

.1 Install the domestic hot water tank(s) in the location(s) shown on the drawings.

.2 Bolt legs or cradles to floor or support structure.

.3 Install a globe valve in the tank drain connection and pipe to drain.

.4 Pipe relief valve to drain.

.5 Fit thermometer, pressure gauge and controller in tapping connections provided.

.6 Refer to Section 23 07 16 for insulation requirements.

.7 Mount the immersion heater tube bundle taking care to rest it on the internal supports.

4 EQUIPMENT SCHEDULE

EXPANSION TANK

UNIT NO	**ET-1**
SERVICE	Heating system
LOCATION	Mech. Room
Max.operating temp.(°C)	116
(F)	240
WK.PRESS. (kPa)	862
(PSI)	125
CAPACITY (L)	99
(Imp Gals)	22
TANK DIMENSIONS:	
DIAMETER (mm)	413
(ins)	16
LENGTH (mm)	750
(ins)	30
ARRANGEMENT	VERTICAL
MANUFACTURER	AMTROL
MODEL NO	AX-40(V)

END OF SECTION

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 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 23 05 00.

.2 Submit shop drawings of pump curves with operating points indicated. Include NPSH curve when applicable.

.3 Submit manufacturer's 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.

.4 Submit motor efficiencies for all motors 1H.P. and over. Refer to Section 23 05 00 for minimum efficiencies.

1.3 QUALITY ASSURANCE

.1 Ensure pumps operate at specified system fluid temperatures without binding and cavitation, are non overloading in parallel or individual operation, operate within 25% of midpoint of published maximum efficiency curve.

.2 Where pumps are operated in conjunction with others such as parallel pumps, show all operating points on the pump curve.

1.4 GENERAL

.1 Motors powered by variable speed drive controllers shall be EEMAC Class B with Type F insulation, shall have a 1.15 service factor and shall be suitable to be driven by PWM variable speed drive controllers. The motor manufacturer shall submit in writing confirmation that the motors are designed to withstand voltage peaks of 1400 volts and a voltage rate of rise of 2000 volts / microsecond at a frequency of 20 kHz.

2 PRODUCTS

2.1 GENERAL

.1 Statically and dynamically balance rotating parts.

.2 Construction shall permit complete servicing without breaking piping or motor connections.

.3 Pumps shall operate at 1750 r/min. unless specified otherwise.

.4 Domestic water pumps shall be all bronze construction.

2.2 IN-LINE CIRCULATOR PUMPS

.1 Suitable for a maximum working pressure of 860 kPa [125 psig] and maximum temperature of 107°C [225°F].

.2 Casing: Cast iron radially split, with flanged connections. Supplied with matching companion flanges.

.3 Impellor: Corrosion resistant cadmium plated steel.

.4 Shaft: Alloy steel with bronze sleeve bearing, integral thrust collar.

.5 Seal Assembly: Mechanical.

.6 Coupling: Flexible self-aligning.

.7 Motor: Resilient mounted, drip proof, sleeve bearing.

2.3 VERTICAL IN-LINE CENTRIFUGAL PUMPS

.1 Suitable for a maximum working pressure of 1210 kPa [175 psig] and maximum temperature of 107°C [225°F].

.2 Casing: Cast iron radially split, single stage, flanged suction and discharge connections, separate tapped openings for venting, draining and gauge connections.

.3 Impellor: Bronze dynamically balanced, keyed drive with locking nut.

.4 Shaft: Stainless steel on split coupled pumps and carbon steel with bronze sleeve on close coupled pumps.

.5 Seal Assembly: Inside unbalanced mechanical seal with factory installed seal flushing line.

.6 Coupling: Close coupled on motors less than 7-1/2 HP and split couplers for all motors 7-1/2 HP and larger to permit removal of seal without disturbing the motor.

.7 Motor: EEMAC Class B, squirrel cage induction, continuous duty, drip proof, ball bearings.

.8 Accessories: Strainer/suction guide, combination check/balance valve where scheduled.

2.4 BOILER FEED PUMPS

.1 Pump casing and flanges suitable for maximum working pressure of 4000 kPa [580 psig].

.2 Combination self-priming multi-stage turbine with initial centrifugal stage.

.3 Low NPSH.

.4 Cast iron casing, bronze impellors, stainless steel shaft.

.5 Grease lubricated ball bearing at drive end and sleeve bearing at suction end.

.6 Packed stuffing box.

.7 Direct drive with flexible coupling.

.8 Steel base.

3 EXECUTION

3.1 GENERAL:

.1 Ensure that pumps are installed such that no piping or equipment loads are imposed on the pump body. Provide stanchions or hangers for this purpose. Refer to manufacturer's installation instructions for details.

.2 Pumps shall be aligned by qualified millwright and alignment certified.

.3 Check pump rotation.

.4 Pipe drain tapping to floor drain.

.5 "Start-up" strainer baskets in strainer/suction guides must be removed prior to commissioning of systems.

.6 Provide air cock and drain connection on horizontal pump casings.

.7 Provide line sized gate valve and strainer on suction and line sized soft seated check valve and memory stop balancing valve on discharge.

.8 Decrease from line size, with long radius reducing elbows or reducers.

.9 Shave or replace pump impellers to meet actual operating conditions.

.10 Where remote control panels are used, this contractor shall allow for wiring from panel to pumps.

.11 Provide seismic restraints for pumps.

.12 Secure control panels for seismic loads.

3.2 IN-LINE CIRCULATORS:

.1 Install as indicated by flow arrows.

.2 Support at flanges on outlets of unit.

.3 Install with bearing lubrication points accessible.

4 EQUIPMENT SCHEDULE

PUMPS

UNIT NO	**P-1/P-2**	**P -3/P-4**
SERVICE LOCATION	BOILER CIRC. PRIMARY LOOP	SECONDARY LOOP
PUMP TYPE	IN-LINE	IN-LINE
CAPACITY (L/s)	1.84	4.00
(GPM)	29.10	63.39
LIQUID: WATER GLYCOL (%)	30	30
LIQUID TEMP. (C)	82.22	82.22
(F)	180.00	180.00
DIFF.PRESS. (kPa)	60	137
(Ft)	20	45
MIN. EFFIC. (%)		
IMPELLOR DIA. (mm) (ins)		
PUMP (r/min)	1750	1750
PUMP MOTOR (HP)	1/3	3
VOLTS/PHASE/Hz	115/1/60	208/3/60
MANUFACTURER	Bell & Gossett	Bell & Gossett
MODEL NO		
SERIES	Series 60 -1x1x 5 1/4	Series 60 -2x2x 7
SEE NOTE(S)		1, 2

Notes
1. One stand-by.
2. motor c/w VSD

END OF SECTION

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 REFERENCE STANDARDS

.1 Do refrigeration system work in accordance with latest version of B.C. Power Engineers and Pressure Vessels Safety Act and Regulations ("Refrigeration Code"), CSA B52 and ANSI B31.5.

1.3 PERMITS AND QUALIFICATIONS

.1 Ensure that a permit is obtained before anyone commences to install or alter any refrigeration system.

.2 Every person who installs or makes alterations or repairs to a refrigeration system shall be the holder of a valid and subsisting refrigeration contractors licence and all persons repairing equipment with ODS/CFC's shall have completed an Environment Canada approved training program.

1.4 WARRANTY

.1 Contractor hereby warrants that refrigerant piping system loss of refrigerant will be in accordance with GC24, but for 5 years.

1.5 SHOP DRAWINGS

.1 Refrigeration trade shall prepare an electrical control schematic for each type of system (product refrigeration only) and submit shop drawings for review.

1.6 ELECTRICAL WIRING

.1 Refrigeration trade shall carry out and be responsible for all refrigeration control wiring unless otherwise noted, including all line voltage wiring from disconnect switch to units.

.2 Refrigeration trade shall provide electric heating tracer cable on drain lines in all cold rooms with temperatures below 1.7°C [35°F].

.3 Power wiring to units to be by the Electrical Contractor.

2 PRODUCTS

2.1 REFRIGERANT TUBING

.1 Provide processed tubing for refrigeration installation, deoxidized, dehydrated and sealed.

.2 Hard copper tube, type L, to ASTM B88M.

.3 Annealed copper tube to ASTM B280, with minimum wall thickness as per CSA B52.

2.2 FITTINGS

.1 Service: design pressure 2070 kPa [300 psig] and temperature 121°C [250°F]

.2 Brazed: wrought copper to ANSI B16.22 or cast bronze to MIL-F-1183E.

.3 Flanged: bronze or brass, Class 150 and Class 300 to ANSI B16.24.

.4 Flare: Bronze or brass, for refrigeration, to ANSI B16.26.

.5 Long radius type for elbows and return bends.

2.3 JOINTS

.1 Brazing materials shall be SIL-FOS-15 phosphor-copper-silver alloy for copper piping jointed by copper fittings and silver solder for brass fittings.

.2 Flexible connections: 3/8" nominal or less shall be made using coiled soft copper tubing. For larger sizes, use seamless flexible bronze hose with bronze wire braid covering. Use factory sealed neoprene jacket unit where freezing may occur.

2.4 VALVES

.1 Shut-Off Valves:

.1 Line size; selected for low pressure drop.

.2 Acceptable Products:

.1 Sizes ¼" to 5/8" dia. - Henry Standard, Mueller Linemaster Special.

.2 Sizes 7/8" dia. and larger - Henry Wing Cap (back seating, Mueller Globemaster.

.3 All sizes may be Henry or Mueller ball valves.

.2 Solenoid Valves:

.1 With field replaceable coil, serviceable without removing valve from line.

.2 Coil voltage to suit field requirements.

.3 Provide upstream of thermostatic expansion valves.

.4 Acceptable Products: Alco 240 RA series.

.3 Expansion Valves:

.1 Thermostatic type with external equalizer, adjustable superheat setting, capacity and bulb charge to suit operating conditions.

.4 Water Regulating Valves:

.1 Pressure activated two-way straight-through type.

.2 For three-way regulators, install balancing valve in by-pass, adjusted to maintain constant system flow rate irrespective of valve position.

.5 Charging and Purging Valves

.1 Valves to be the same size as line size into which they are connected or 12 mm [½"] whichever is the larger.

.2 Valve complete with a removable seal cap chained to the valve body.

.3 Acceptable Products: Henry Standard type, Mueller Linemaster Special.

2.5 SIGHT GLASS

.1 Provide sight glass in liquid line following filter drier.

.2 Sight glass shall be combination moisture-liquid indicator and with a protective removable cap.

.3 Sight glass to be fitted in-line.

.4 Acceptable Products: Henry Dri-Vue, Mueller Vuemaster, Sporlan See All.

2.6 ACCESS FITTINGS

.1 Provide Schraeder access fittings in each suction connection from an evaporator, located adjacent to the superheat sensing element of the expansion valve.

.2 Fittings to be used for checking the superheat of the suction gas.

.3 Access fitting shall be soldered into a tee and shall be complete with a quick-seal cap.

2.7 FILTER DRIERS

.1 Provide a filter drier in the liquid line from the condenser. Shut-off valves shall be installed on each side of drier and sight glass.

.2 Filter drier shall be selected to have a pressure drop of not more than 13 kPa [2 psig] when passing 150% of the system flow rate.

.3 Removable core with flare connections.

.4 Desiccant drier material shall be replaceable.

.5 Acceptable Products: Alco Extra-Klean, Catch-All, Henry Dri-Cor, Mueller Drymaster II, Sporlan.

2.8 REFRIGERANT DRIERS

.1 Driers shall be in-line or angle type with copper or brass shell.

.2 Desiccant drier material shall be replaceable.

2.9 STRAINERS

.1 Refrigerant strainers shall be angle replaceable cartridge type with brass shell.

.2 Cartridge material and screen size shall be suitable for refrigerant and piping material utilized in the system.

2.10 PRESSURE GAUGES - REFRIGERATION

.1 Acceptable Manufacturers:

.1 Marsh, Moeller, Trerice, Weiss, Weksler, Winters.

.2 Minimum Requirements:

.1 Panel surface mounting type, flanged type.

.2 Flush panel mounting type, flush mount case style.

.3 Seamless phosphor bronze Bourdon tube type, with minimum 65mm [2-1/2"] dia. dial, unless otherwise indicated.

.4 Cast aluminum, black steel or stainless steel case, with stainless steel or chrome plated face ring.

.5 Accuracy +/- 2% of scale range.

.6 Scales to be calibrated in both pressure and corresponding temperature of refrigerant.

.7 Scale Range:

Operating Pressure	**Scale Range**
-50 - 690 kPa	-100 - 1035 kPa
690 -2750 kPa	0 - 3450 kPa
Operating Pressure	**Scale Range**
15" VAC - 100 psig	30" VAC - 150 psig
100 - 400 psig	0 - 500 psig

.3 Note:

.1 Gauges complete with recalibrator and restrictor.

.2 Install a needle valve (carp) ahead of each gauge.

2.11 EVAPORATOR DRAINS

.1 Each evaporator shall be fitted with a copper drain line, size as shown.

.2 Drain line shall be complete with a running trap.

2.12 FLEXIBLE CONNECTIONS

.1 Braided tin-bronze convoluted flexible connections.

.2 Design pressure 2070 kPa [300 psig].

.3 Acceptable Products: Anaconda

2.13 REFRIGERANT TUBE SUPPORTS

.1 Middle Attachments (Rod):

.1 Carbon steel black (electro-galvanized for mechanical rooms) continuous threaded rod - Grinnell Fig. 146 Myatt Fig. 434.

.2 Pipe Hangers:

.1 Uninsulated pipe, up to 1-1/4" - Grinnell 97C.

.2 Insulated pipe, up to NPS 1 - Grinnell fig. 269 or Myatt fig. 120.

.3 Insulated pipe, NPS 1-1/4 - Grinnell Figs. 65 or 260 or Myatt Figs. 122 or 124.

.4 Maximum horizontal pipe hanger spacing:

Pipe Size	Maximum Spacing	Rod Diameter
up to NPS ¾	1.5 m [5 ft]	10 mm [3/8"]
NPS 1 & NPS 1¼	1.8 m [6 ft]	10 mm [3/8"]

.3 Wall Supports:

.1 Horizontal pipe adjacent to wall; angle iron wall brackets with specified hangers.

.2 Vertical pipe adjacent to wall; exposed pipe wall support for lateral movement restraint - Grinnell Figs. 262 or 263.

.4 Note:

.1 On insulated piping, where the insulation is specified to have a continuous sealed vapour barrier, (cold services) install oversized clevis hangers and insulation protection shields (Grinnell Fig. 167 or equivalent) with metal thickness and lengths as recommended by Grinnell.

.2 Hangers for copper pipe shall be copper plated or plastic dipped unless pipe hangers bear on piping insulation (cold services).

.3 Cold Services - refrigerant suction lines.

2.14 GAUGE BOARD

.1 For each condensing unit, furnish a gauge board of 1.35 mm [16 ga] thick steel with angle iron supports and reinforcing. Gauge board shall be prime coated, then finished with enamel. Mount high and low pressure gauges, maker's nameplate, suitable lamicoid identifying labels, filter drier and sight glass on the board.

.2 In each mechanical room containing the condensing units, provide one central board. Each gauge board shall be construction from 1.35 mm [16 ga] thick steel with angle iron supports and reinforcing. Gauge board shall be prime coated, then finished with enamel. Mount high and low pressure gauges, maker's nameplate, suitable lamicoid identifying labels, filter driers, sight glasses and defrost timers on the board.

3 EXECUTION

3.1 GENERAL

.1 Install and test in accordance with the B.C. Refrigeration Code and CSA B52.

3.2 INSTALLATION

.1 Refrigerant Tubing:

- .1 Fittings shall be "Sil-Fos" brazed or silver soldered as specified. Solder will not be permitted. Special precautions shall be taken to prevent the overheating of copper tube. No joint shall be made without a pressurized nitrogen flow through the joint.
- .2 Tubing shall be cut square and have all burrs removed.
- .3 Piping shall be kept meticulously clean. All cleaned piping in the process of erection, whether installed or awaiting installation shall be capped or plugged.
- .4 Piping shall be installed in true vertical and horizontal planes close to walls and ceilings, with specified pitch. Provide suitable offsets to account for expansion.
- .5 Piping connections to equipment and terminal apparatus shall be supported independently and arranged to give easy access for maintenance.
- .6 Provide rubber grommets where refrigerant piping passes through a metal surface.
- .7 Grade horizontal pipe carrying gases 1:240 down in direction of flow.
- .8 Locate double risers in hot gas or suction piping as indicated.
- .9 Locate trap every 4.5 m [15 ft.] of vertical rise in any suction riser 9 m [30 ft.] or more in length.
- .10 Install piping to prevent condensate or oil from flowing back into compressor or evaporator.

.2 Strainers:

- .1 Provide full size strainer ahead of each automatic valve. Where multiple expansion valves with integral strainers are used, install single main liquid line strainer.
- .2 On steel piping systems provide adequate strainer in suction line to remove scale and rust inherent in steel pipe.
- .3 Provide shut-off valve on each side of strainer to facilitate maintenance.

.3 Refrigerant Driers:

- .1 Provide full flow permanent refrigerant drier in low temperature systems and systems utilizing hermetic compressors.
- .2 Mount drier vertically in liquid line adjacent to receiver with three valve bypass assembly to permit isolation of drier for servicing.

.4 Filter Driers:

- .1 Filter-driers may be used in systems instead of separate strainers and driers.
- .2 Install with three valve bypass assembly to permit isolation for servicing.

.5 Solenoid Valves:

- .1 Provide solenoid valves in liquid line of system operating with single pump-out or pump-down compressor control, in liquid line of single or multiple evaporator systems and in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into suction line when system shuts down.
- .2 Provide solenoid valves with manually operated stems.

.6 Expansion Valves:

.1 Size expansion valves properly to avoid penalty of being undersized at full load and of being excessively oversized at partial load.

.2 Properly evaluate refrigerant pressure drop through system to determine the available pressure drop across the valve.

.3 Select valves for maximum load at design operating pressure and minimum 42°C [108°F] of superheat.

.4 Locate remote expansion valve sensing bulb immediately after evaporator outlet and suction line.

.7 Charging Valves:

.1 Provide refrigerant charging connections in liquid line between receiver shut-off valve and expansion valves.

.8 Flexible Connectors:

.1 In general install suction and hot piping connections to compressors with three directional changes for distance of minimum six pipe diameters before reaching point of support.

.2 Flexible connectors shall only be utilized at or near compressor where it is not physically possible to absorb vibration within piping configuration.

3.3 ELECTRICAL:

.1 In cold storage rooms, use one conduit to bring wiring into a compartment, piercing the wall insulation only once, just under the ceiling insulation. Seal inside on conduit at point where it penetrates wall.

3.4 REFRIGERANT TESTS

.1 Each refrigerant system shall be tested as follows before operation with dry nitrogen gas to a pressure not less than 1.5 times the system working pressure. During the test, each joint shall be tested for leaks with a solution of soap and water. Compressors with refrigerant holding charge shall remain isolated from system.

.2 The system shall then be evacuated to not less than 33.25 Pa (250 microns) absolute and left for 24 hours, during which time the pressure shall not have increased more than 33.25 Pa (250 microns). The system shall then be pressurized to 14 kPa [2 psig] with refrigerant to be used and shall be evacuated to 66.5 Pa [500 microns] absolute and then shall be immediately fully charged with the refrigerant to be used in the system and each joint checked with an electronic testing device. Tests shall be performed before insulation is applied. The refrigerant charge shall be applied immediately after acceptance of tests. In the event of any tube or any other component failure resulting in the loss of any part of the refrigerant charge, another charge shall be applied.

.3 All damaged or defective components shall be replaced with new (not reconditioned) components. A cracked or defective tube shall be replaced. If a defect of any description occurs in an insulated tube, the insulation shall be stripped to localize the leak. The amount of insulation so stripped shall be replaced with new - to be finished as specified.

3.5 START-UP AND ADJUSTMENT

.1 Provide necessary instruments, gauges and testing equipment required. Adjust controls, to obtain design requirements and manufacturer's ratings.

.2 Test and record cooling apparatus entering and leaving air temperatures, dry bulb and wet bulb.

.3 Test and record voltage and running amperes and compare to motor nameplate data, and starter heater rating against design requirements.

.4 Ensure that refrigerant temperatures are accurate to within 0.5°C [0.9°F] of design requirements.

.5 In cooperation with controls contractor's representative, set and adjust automatic control system to achieve required sequence of operations.

.6 Bring equipment into operation, trial run and make up any loss of oil and refrigerant.

.7 Test reports to be submitted for review and inclusion in Maintenance Manuals.

END OF SECTION

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 SCOPE

.1 Provide for cleaning and degreasing of all systems that use glycol or water as a heat transfer medium.

.2 Provide for cleaning and disinfection of domestic hot and cold systems.

.3 Provide all temporary strainers, connections and by-pass lines as required.

.4 Provide equipment to add chemicals to the systems as specified herein.

.5 Provide equipment to operate and control the system as specified herein. Provide appropriate protection so that capped off unused piping does not corrode.

.6 Provide corrosion coupons for all closed and open loop circulation systems as specified herein.

.7 Piping systems to be chemically treated include the following new systems:

.1 Hot water heating system(s).

.2 Glycol system(s).

1.3 QUALITY ASSURANCE

.1 The water treatment chemicals and treatment process shall be supplied and performed by the Contractor. This work shall be supervised by the Water Treatment Specialist who, upon completion, shall certify that the process is satisfactory and submit a report outlining the cleaning operation and the treatment process.

1.4 REFERENCE STANDARDS

.1 Do HVAC water treatment in accordance with ASME Boiler Code Section VII, and requirements and standards of regulating authorities, except where specified otherwise.

1.5 SUBMITTALS

.1 Submit shop drawings including proposed chemicals, quantities, procedures and equipment to be supplied. Provide written operating instructions and system schematics.

.2 Provide written report containing log and procedure of system cleaning, giving times, dates, problems encountered and condition of water.

.3 Submit written report containing test results and list of chemicals added every 14 days from time of commissioning to acceptance.

.4 Notify Departmental Representative 48 hours prior to chemical cleaning so that work may be verified and reviewed.

1.6 WATER TREATMENT SERVICE

.1 The Water Treatment Specialist shall provide supervision of installations, set-up and adjustments and shall submit a written report on system operations.

.2 All chemicals, feed systems and test equipment shall be provided by the Water Treatment Specialist.

.3 Treatment chemicals shall not contain hydrazene.

.4 Treatment chemicals shall be non-foaming.

.5 The Water Treatment Specialist shall instruct the maintenance personnel before substantial completion. Written instructions of the treatment, dosages control charts and test procedures shall be included in the maintenance manuals.

.6 The Water Treatment Specialist shall provide monthly visits to check chemical treatment, take water samples and recommend any necessary changes to treatment, and provide a written report for a period of one year after substantial completion. Provide sufficient chemicals to treat the system from the time of commissioning to acceptance of the building. In addition, provide a stock of chemicals, filters and corrosion coupons suitable for twelve (12) months normal operation. The minimum amount of chemicals provided shall include the following:

.1 One spare drum (200L) of chemicals for each open system requiring treatment.

.2 One spare pail (20L) of biocide for each open system requiring treatment.

.3 One spare pail (20L) of chemicals for each closed system requiring treatment.

.7 Provide a test kit suitable for all chemical treatments used. The test kit shall be made available for on-site tests and provide a Myron 3 range TDS meter to check conductivity. Hand over the kit to the Building Operator at project completion - obtain receipt.

.8 Provide one mild steel and one copper corrosion coupon package to monitor corrosion rate for each open and closed systems.

2 PRODUCTS

2.1 MATERIALS

.1 System Cleaner:

.1 Use a Sodium Metasilicate, Sodium Nitrite and a wetting agent compound, which in solution removes grease and petroleum products. Concentration level to be determined by Water Treatment Specialist. (PACE Chemicals Ltd. - PURGEX L-24 or approved equal.)

.2 Closed System Treatment (Hot Water, Chilled Water):

.1 Use a Borated Nitrite-Molybdate based corrosion inhibitor. Maintain levels at 200 to 400 ppm. (PACE Chemicals Ltd. - BAR COR CWS-91 or approved equal.) Note: The use of Nitrite only, Molybdate only or Sulphite only will not be accepted.

.3 Glycol System:

.1 Charge hot water and/or heat recovery system(s) and chilled water system(s) with a 30% solution (by volume) in water of inhibited propylene glycol equivalent to DOWFROST.

.4 Glycol System:

.1 Charge hot water and/or heat recovery system(s) with a 30% solution (by volume) in water of ethylene glycol equivalent to DOWTHERM I.G., Union Carbide Thermofluid 17.

2.2 EQUIPMENT

.1 Chemical Feed System - Closed Systems (hot water heating):

.1 Bypass Pot Feeder: All closed water systems shall have a by-pass chemical pot feeder with a 7.6 litre [2 gal.] capacity. It shall be constructed of heavy-duty cast iron or welded steel (suitable for 1380 kPa [200 PSI] working pressure), with quick opening cap and complete with NPS ¾ connections. Isolating valves shall be installed on the inlet, outlet and drain.

.2 Side Stream Filters: All closed systems shall have side stream filters. 304L stainless steel filter housing to accept 30 micron - 63 mm x 1016 mm [2.5” x 40”] long filter cartridges and c/w swing bolt lid. Minimum flow rate of 35 litres [9 gals] per minute. A Flow Indicator with stainless steel impeller shall be installed in conjunction with the side stream filter all isolating valves shall be installed as per manufacturer's instructions. Include 10 filter replacement cartridges for each side stream filter unit.

.3 Chemical Feed Piping:

.1 Schedule 40 black steel

.4 Corrosion Coupon and Holder Assembly:

.1 Mild steel copper corrosion coupon

.2 Holder, NPS ¾ or NPS 1 connection.

.3 Provide malleable or cast iron cross, NPS ¾ or NPS 1 connection connection.

.2 Glycol Feed System:

.1 Automatic feed system with manual override, (Neptune Model 161-4XAX or approved equal), comprising the following:

.1 Pump: 7.5 litre /min [2 GPM] at 690 kPa [100 psi], bronze gears, stainless steel shaft and carbon bearings, Buna N lip seals. Motor, 1725 rpm, 1/3 HP, 115/1/60 VAC. (Albany Model CEP93-3.)

.2 Tank: 205 litre [45 gal] cylindrical, polyethylene tank with hinged poly cover, steel support stand with bottom mount pump shelf, all required connections and agitator bracket.

.3 Agitator: Direct drive, 1725 rpm, ¼ HP, 115/1/60 VAC c/w bracket mount and stainless steel shaft and propeller. (Neptune Model A-2)

.4 Pressure Switch: Glycol addition shall be controlled by an adjustable pressure switch with high and low set points. When the pressure in the loop reaches the low set point, the pump shall start and feed glycol until the high set point pressure is achieved and the pump stops.

.5 Control Panel: NEMA 4X enclosure, 115/1/60 VAC and shall consist of the following:

.1 Power supply cord with moulded plug.

.2 H-O-A switch for pump motor.

.3 Pump "ON" indication.

.4 "LOW" tank level indication with audible alarm.

.5 Push button to silence.

.6 Contacts for remote connection.

.6 Accessories:

.1 Float switch for low level cut off of the pump.

.2 Pressure switch.

.3 Relief valve piped back to the tank.

.7 Provide a pressure gauge located in the discharge piping.

.8 Specific gravity hydrometer, Taylor Instruments Standard quality, Model H4130, scale range 1.000 - 1.200, divisions at 0.002, length 300 mm [12"].

.9 Provide a chart showing the specific gravity of the specified solution by volume, at a specified temperature

.3 Glycol Feed System: (secondary antifreeze heating, heat recovery systems)

.1 Manual feed system including the following:

.1 Tank: 205 litre [45 gal] cylindrical, polyethylene tank with hinged poly cover and steel support stand with agitator bracket. (Neptune Model TM 45PT or approved equal.)

.2 Agitator: Direct drive, 1725 rpm, ¼ HP, 115/1/60 VAC c/w stainless steel shaft and propeller (Neptune Model A-2 or approved equal.) Mixer mounts to bracket supplied as part of tank stand.

.3 Pump: Hand operated fill pump, diaphragm style, 250 kPa [36 psi] minimum head, NPS ¾ connections, equivalent to Monarch L-30A.

.4 Provide a pressure gauge located in the discharge piping.

.5 Specific gravity hydrometer, Taylor Instruments Standard quality, Model H4130, scale range 1.000 - 1.200, divisions at 0.002, length 300 mm [12"].

.6 Provide a chart showing the specific gravity of the specified solution by volume, at a specified temperature.

3 EXECUTION

3.1 GLYCOL ANTIFREEZE SYSTEM

.1 Label all drain valves with "GLYCOL - DO NOT DRAIN".

.2 Pre-mix solution in mixing tank, demonstrate specific gravity of solution to Departmental Representative at sample points and charge system(s) using feed pump. After system has been filled, check specific gravity of solution in each system. Leave mixing tank filled with specified glycol solution.

END OF SECTION

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 Refer to Section 23 05 49 for required seismic restraint of ductwork.

1.2 REFERENCE STANDARDS

.1

.2 The construction and installation of ductwork and plenums shall be in accordance with the latest edition of the following referenced SMACNA manuals and ASHRAE handbooks.

.1 SMACNA - H.V.A.C. Duct Construction Standards.

.2 SMACNA - H.V.A.C. Air Duct Leakage Test Manual.

.3 ASHRAE - Handbook - Equipment Volume.

1.3 GENERAL

.1 Duct sizes on drawings indicate clear inside dimensions. For acoustically lined or internally insulated ducts, maintain inside duct dimensions.

.2 Where duct sizes are shown in nominal metric sizes, round and oval duct sizes may be supplied in the nearest available sizes in equivalent imperial units.

.3 Proper sized openings shall be arranged for in the correct locations through all slabs and walls. Openings shall be planned to include for the installation of fire dampers at all rated fire separations.

.4 Where ducts penetrate roofs, provide roof curbs with flashing and counterflashing.

.5 Arrange for 100 mm [4"] high by 100 mm [4"] wide concrete curbs around all duct penetrations through floor slabs outside of duct shafts.

.6 The project drawings are diagrammatic and although efforts have been made to provide information regarding the number of offsets and transitions, not all are necessarily shown. Changes may be required in duct routings, elevation and duct shape to eliminate interference with structure and other services. All required adjustments shall be established when coordinating and field measuring the work prior to fabrication and must be provided as part of the contract and all associated costs must be considered and included.

.7 Ductwork used on this project shall be clean and free from scale, corrosion and deposits. All ductwork shall be degreased and wiped clean of all oil and other surface films with appropriate solvents prior to installation.

.8 All ductwork shall be delivered clean to the site and maintained in clean condition. Dirty ductwork shall be removed from site.

.9 Where welded ductwork is indicated, the welding shall be continuous with Everdur welding. Tack welding is unacceptable except as specifically noted. Paint damaged areas with zinc coating after welding.

.10 Provide seismic restraints for ductwork in accordance with SMACNA "Guidelines for seismic restraints of mechanical systems and plumbing piping systems".

2 PRODUCTS

2.1 GALVANIZED STEEL

.1 Galvanized steel shall have a 380 g/sq.m. [1-1/4 oz/sq.ft] galvanizing coat both sides to ASTM A525 G90.

2.2 DUCTWORK AND PLENUM PRESSURES

.1 Provide ductwork and plenums fabricated from galvanized steel for the static pressure categories listed below.

.1 500 Pa [2" W.G.] static pressure

.1 All supply ductwork downstream from air valves to terminal air outlets.

.2 All supply ductwork and plenums on systems without mixing boxes/air valves.

.3 All return air ductwork and plenums, except where otherwise specified.

.4 All exhaust and relief air ductwork and plenums, except where otherwise specified (welding/sawdust exhaust).

.5 All outdoor air ductwork and plenums, except as otherwise specified.

2.3 DUCTWORK - 500 PA [2" W.G.] STATIC PRESSURE

.1 Provide galvanized iron ductwork for system operating pressures 500 Pa [2" W.G.] and less. Ductwork shall be constructed, reinforced, sealed and installed to withstand 1-1/2 times the working static pressure.

.2 Construct rectangular ductwork in accordance with Section I including Tables 1-5, 1-10, 1-11, 1-12, 1-13 and Figs. 1-4 through 1-18 of the SMACNA Duct Standards.

.3 Nomasco "Ductmate System, Lockformer TDC " or Exanno "Nexus System" may be used for rectangular duct joints.

.4 At least two opposite faces of all rectangular ductwork must be joined together using a type of joint, which cannot pull apart.

.5 Construct rectangular duct fittings in accordance with Section II including Figs. 2-1 to 2-11 and Figs. 2-16 to 2-18 of the SMACNA Duct Standards.

.6 Construct round ductwork in accordance with Section III including Table 3-2 and Figs. 3-1 and 3-2 of the SMACNA Duct Standards, but excluding beaded crimp joints and snaplock seams.

.7 Construct round duct fittings in accordance with Section III including Table 3-1 and Figs. 3-3 through 3-6 of the SMACNA Duct Standards. Round elbows shall have a centreline radius of 1.0 times duct diameter. Sheet metal gauge of fittings and elbows shall be not less than the thickness of that specified for longitudinal seam straight duct. Adjustable elbows are not permitted.

2.4 PLENUMS - 500 PA [2"] STATIC PRESSURE

.1 Provide galvanized steel low pressure plenums suitable for 500 Pa [2" W.G.] positive or negative pressure, for central plant ventilating and air conditioning equipment.

.2 Construct plenums in accordance with Section VI including Figs. 6-1 through 6-3 of the SMACNA Duct Standards.

.3 Where the building structure does not form the bottom surface of a walk-in plenum, fabricate plenum floor panels of 1.78 mm (14 ga.) galvanized steel, with angle iron reinforcing such as to limit deflection of the floor panels to a maximum of 6.4 mm [1/4"] under a concentrated load of 115 kg [250 lbs] at mid span.

.4 Where plenum floors are internally lined, install a 1.47 mm [16 ga.] thick galvanized steel panel on top of the insulation.

.5 Apply silicone sealant CGE Silpruf 2000 series or Dow Corning 781/732 between plenum base angles and concrete or curbs before bolting together.

.6 Reinforce all openings in plenum walls with 40 mm x 40 mm x 4.8 mm [1-1/2" x 1-1/2" x 3/16"] angle iron, secured to the main vertical and horizontal reinforcing angles.

.7 Construct access door and casing around door as per SMACNA, casing access doors, Fig. 6-12. Section C-C with angle iron frame sized to suit plenum wall. Doors constructed of 16 gauge metal.

.8 Arrange access doors so that they open against the airflow and static pressure.

.9 Weld all joints on condensate drain pans. Construct the pans from 1.45 mm [16 ga.] thick stainless steel type #302 or #304. Install a minimum of 32 mm [1-1/4"] piping connection, complete with water seal at least 100 mm [4"] deep, from the pan drain connection to the nearest building drain. Install drain connections so that they shall completely drain the pans.

.10 Seal piping penetrations through plenum walls, with gland seals as detailed in Fig. 6-10 of the SMACNA Duct Standards.

.11 Bulkheads mounting air filters and air coils shall be airtight to prevent air bypass around filters and/or coils.

2.5 DUCTWORK - ALUMINUM

.1 The following ductwork shall be fabricated from aluminum:

.1 Exhaust ductwork from showers/baths, to the extent noted on the drawings.

.2 Discharge ductwork through the roof, where noted on the drawings.

.2 Low Pressure Aluminum ductwork shall be constructed in accordance with Clause 2.2 "Ductwork - 500 Pa [2"] Static Pressure".

.3 For round and rectangular aluminum ductwork, use four gauges heavier than that scheduled in Table 1-5 or Tables 1-14, 1-15, 1-16 of the SMACNA Duct Standards for galvanized ductwork.

.4 Aluminum shall be utility grade.

.5 Support aluminum ductwork using aluminum straps, cadmium plated threaded rods, aluminum flat bar or aluminum angle hangers. Support shall be similar to that specified for galvanized iron ductwork.

2.6 DUCTWORK - ACOUSTICALLY LINED

.1 Where rectangular ductwork is indicated to be acoustically insulated with flexible acoustic duct liner, liner shall be installed in accordance with instructions and Figures 2-22 through 2-25, SMACNA Duct Standards. Duct sizes shown are inside the duct liner.

.2 Where round ductwork is indicated to be acoustically insulated, it shall consist of two concentric round ducts with 25 mm [1"] thick flexible fibrous glass duct liner between the two ducts. The inner duct shall be perforated and correspond to the duct diameter noted on the drawings. The outer duct shall be suitable for the static pressure and shall be sealed airtight where it joins the adjacent ductwork.

2.7 DUCTWORK – OUTDOORS

.1 The internally or externally insulated supply, return and exhaust ducts (down stream of heat recovery coils) including silencers, located outdoors on the roof, shall be constructed watertight.

.2 All joints shall be caulked with a water impervious sealant. TDC clips should be continuous on the top and sides of the ducts.

.3 The top of the finished product (waterproof membrane) should be pitched to avoid pooling of water.

.4 After pressure testing, the exterior of the ducts and the duct silencers shall be wrapped with a waterproof membrane. The details of this membrane need to be researched but could be as follows:

.1 Membrane consisting of a SBS rubberized asphalt compound, integrally laminated to a reinforced aluminum foil, providing a waterproof membrane. Product similar to Bakor Foilskin.

2.8 PLENUM INSULATION COVERING

.1 Sheet Metal

.1 Provide 0.76 mm [22 ga] galvanized sheet metal covering on acoustically lined plenum walls for a distance of 1.2 m [4 ft] downstream from cooling coils.

2.9 AIR DISTRIBUTION PLATES

.1 Provide perforated air distribution plates at the discharge of supply fans as shown on the drawings.

.2 For construction of plates refer to Mechanical Detail MD 21 042, Section 23 06 01.

.3 Modify and reposition plates as necessary to balance airflow through downstream filters and coils to plus or minus 15%.

2.10 COIL END COVERS

.1 Provide coil end casings to eliminate coil frame air leakage.

.2 Provide for cooling coil ends to drip condensate to the coil drain pan. Insulate the inside of the coil end casing to prevent casing condensation and provide closure panels to retain insulation.

2.11 WIRE MESH SCREENS

.1 Provide wire mesh screens in all air intake openings where noted on the drawings.

.2 Screens shall be constructed from aluminum wire 1.3 mm diameter [16 ga].

.3 Screen mesh shall be 12.7 mm [1/2"].

.4 Mount screens in 0.66 mm thick [20 ga] folded aluminum frames.

2.12 COUNTER FLASHINGS

.1 Counter flashings - galvanized sheet steel of 0.8 mm [22 gauge] minimum thickness.

.2 Counter flashings are attached to mechanical equipment and lap the base flashings on the roof curbs.

.3 All joints in counter flashings shall be flattened and solder double seam. Storm collars shall be adjustable to draw tight to pipe with bolts. Caulk around the top edge. Storm collars shall be used above all roof jacks.

.4 Vertical flange section of roof jacks shall be screwed to face of curb.

3 EXECUTION

3.1 DUCTWORK & PLENUM INSTALLATION

.1 Where a duct contains a fire or smoke damper, construct the duct so that the free area of the duct is maintained through the fire or smoke damper.

.2 Where a duct is to be internally insulated, enlarge the duct so as not to reduce the duct free area.

.3 Make the taper of diverging transitions less than 20 deg. and the taper of converging transitions less than 30 deg., in accordance with Fig. 2-9 of the SMACNA Duct Standards. Maximum divergence upstream of equipment to be 30 deg. and 45 deg. convergence downstream.

.4 Make the inside radius of any rectangular duct elbow at least equal to the duct width, measured in the direction of the radius. If space conditions do not permit a full radius elbow to be installed, use square elbows with multi-blade turning vanes.

.5 Turning vanes shall be single wall type. Vanes in galvanized sheet metal ducts shall be constructed from galvanized steel, minimum thickness 0.76 mm [22 ga]. Vanes shall be spaced at 40 mm [1-1/2"] centres and shall turn through 90 deg., with a radius of 50 mm [2"]. Vanes shall not include a straight trailing edge. Refer to Figs. 2-3 and 2-4 of the SMACNA Duct Standards. Vanes and runners in aluminum ducts shall be constructed from aluminum. Aluminum vanes shall be 0.86 mm thick [18 ga].

.6 For 500 Pa [2"] pressure systems, install tie rods to limit the maximum unsupported vane length to 914 mm [36"]. Refer to Fig. 2-4 of the SMACNA Duct Standards.

.7 For 750 Pa [3"] and greater pressure systems, install tie rods to limit the maximum unsupported vane length to 460 mm [18"]. Refer to 2-4 of the SMACNA Duct Standards.

.8 Install duct necks before grilles, registers and diffusers and cushion heads after diffuser take-offs as required to suit site conditions.

.9 Where indicated, install adjustable air turning devices, where full radius take-off fittings cannot be installed, in accordance with Fig. 2-16 of the SMACNA Duct Standards. Adjustment shall be accessible outside the duct with lockable quadrant operator or through the grille or register with key-operated worm gear mechanism.

.10 Cross-break or bead all metal duct panels unless otherwise noted.

.11 Do not cross-break duct panels on 750 Pa [3"] and greater static pressure systems.

.12 Do not cross-break bottom duct panels when ductwork is handling moisture.

.13 Roof mounted ducts shall have standing seams and shall be sealed weather tight.

.14 Grade all ductwork handling moisture, a minimum of 1:120 [1" in 10 ft] back to the source or at low points in the ductwork, provide a 150 mm [6"] deep drain sump and 32 mm [1-1/4"] dia. drain connection with deep seal trap and pipe to drain.

.15 Construct ductwork handling moisture with three sided bottom sections and a separate top panel. Install the three sided bottom sections and internally seal the transverse joints with CGE Silicone Sealant "Silpruf". Then install the top panels and seal the top panel seams and joints.

.16 Provide floor drains in outside air and humidifier sections with deep seal traps.

.17 Provide moisture collection sections inside all louvres for outside air and exhaust air.

.18 Support ductwork using galvanized steel straps, cadmium plated threaded rods, flat bar or angle hangers. Attachments to the structure shall be compatible with the structure and selected for the load of the ductwork. Install ductwork hangers in accordance with Section IV including Tables 4-1 through 4-3 and Figs. 4-1 through 4-9 of the SMACNA Duct Standards.

.19 Support duct risers at their base and at each floor and at not greater than 3.7 m [12 ft] intervals.

.20 Prior to the fabrication of ductwork, co-ordinate and field measure all ductwork to ensure a complete installation respecting all other services. Provide all necessary fittings, offsets, and alternate construction methods to facilitate the installation.

.21 Arrange ductwork and plenums so that duct and plenum mounted equipment can be easily removed.

.22 Arrange access doors so that they open against the airflow and static pressure.

.23 Provide necessary baffling in manufactured or built-up mixed air plenums to ensure good mixed air temperature with variations of not more than ± minus 5°C [23°F] under all operating conditions.

.24 Ducts passing through non-rated fire separations, sound insulated walls and through non-rated walls and floors shall be tightly fitted and sealed on both sides of the separation with silicon sealant to prevent passage of smoke and/or transmission of sound. (U.L.C. approved fire stop sealant is not a requirement). Where ducts are insulated provide a 0.61 mm [24 ga] thick galvanized steel band tightly fitted around insulation and then caulk to band.

.25 During construction, protect openings in ductwork, from dust infiltration, by covering with polyethylene, and protect floor outlet duct openings with metal caps.

.26 Where ductwork is required to pass through open web steel joists, coordinate with the joist fabricator before fabricating ductwork.

.27 Where ducts penetrate roofs, install sleeves and roof curb c/w flashing and counterflashing. Pack sleeves in roof with fibreglass insulation.

.28 Provide drip pans under piping and shields for protection of electrical panels and equipment.

.29 Unless noted otherwise, line all builder's shafts and air plenums used as ducts and plenums with sheet metal.

3.2 DUCTWORK LEAKAGE TEST

.1 Leakage test all 750 Pa [3"] and greater static pressure supply ductwork installed under this contract, as recommended in the SMACNA H.V.A.C. Air Duct Leakage Test Manual, 1985 Standards, to a static pressure 500 Pa [2" W.G.] in excess of the specified ductwork design static pressure.

.2 Use equipment capable of demonstrating leakage.

.3 Test the first 30 m [100 ft] of installed ductwork in the presence of the Departmental Representative.

.4 Test a 30m [100ft] section of 500 Pa [2"] static pressure ductwork, where complete systems over 30m [100 ft] long are installed under this contract to a static pressure of 500 Pa [2" W.G.].

.5 The total allowable leakage for the entire system shall be not greater than 5 percent of the total system capacity.

.6 Submit test reports for all ducts tested.

3.3 DUCTWORK AND PLENUM CLEANING

.1 Responsibility

.1 This Contractor shall be responsible for and ensure that all ductwork, installed under this contract is internally CLEAN, when handed over to the Departmental Representative. This responsibility includes the entire systems, from outdoor air intakes to air terminals and from air terminals to relief outlets. It includes all ductwork, lined and unlined, all plenums and all equipment within or connected to ducts and plenums.

.2 The surfaces shall be considered clean when all foreign materials capable of particulating and visible to the naked eye are removed.

.2 Installation Procedure

.1 All ductwork shall be wiped clean prior to installation.

.2 Close all dampers immediately following installation thus checking the operation and retarding movement of contaminants through the system.

.3 Seal all openings at the end of each day and at such other time as site conditions dictate.

.4 Floor openings to be capped with sheet metal or floor grilles plus 0.15 mm [6 mils] thick poly sheet.

.5 Other openings to be covered with 0.15 mm [6 mils] thick poly sheet taped so as to be air tight.

.3 Cleaning Procedure

.1 On completion of the duct and plenum installation and prior to the installation of air terminals and prior to balancing of the air systems, but not until the areas are substantially clean (floors have been swept and vacuumed) and all "dirty" construction has been completed, employ an approved Cleaning Agency to vacuum clean the following:

.1 All air handling units.

.2 All plenums.

.3 All supply and return air ducts.

.4 All exhaust air ducts.

.2 All components within each system shall be thoroughly cleaned and shall include but not be limited to the following: coils, fans and motors, silencers, air terminals and mixing boxes / air valves.

.3 When connecting to existing supply ductwork, clean existing supply ducts upstream from connection back to the filters. Clean existing supply ductwork downstream from new connections to outlets.

.4 Cleaning shall generally be by high capacity power vacuum. High-pressure compressed air, wire brushing and/or non-toxic solvent cleaning shall be used where dirt or scale cannot be removed otherwise. Coils shall be de-scaled.

.5 The Cleaning Contractor shall be responsible for removing and replacing filter media. This contractor will remove the temporary filters and replace with new after cleaning the systems.

.6 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 still to be balanced.

.7 Reinstall any grilles, registers and diffusers, which may have been removed for cleaning purposes.

.8 After the duct systems have been cleaned they should be resealed if they are not being used. Provide filter media on the return air terminals if the return air fans are run after cleaning has been completed.

.9 The Cleaning Agency shall perform a full inspection of the duct interior. Utilizing a fibre optic borescope with dedicated light source, inspect interior ductwork surfaces, and ductwork accessories including terminal units, mixing boxes / air valves, ductwork liners, duct-mounted coils, filters, dampers, humidifiers and all other appurtenances within the ductwork system.

.10 Spot checks will be made by the Departmental Representative during the cleaning process to verify that the required standard is being met. When substantial performance is claimed, final spot checks will be made to verify that the ducts are clean. Make available for the use of the Departmental Representative a fibre optic borescope with dedicated light source. If any ducts are found to be unclean, then they shall be recleaned.

.11 Submit a report from the cleaning agency that certifies all specified air systems have been cleaned.

END OF SECTION

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 QUALITY ASSURANCE

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards

2 PRODUCTS

2.1 AIR BLENDERS

.1 Minimum Requirements:

.1 Units factory built and tested.

.2 Completely fixed devices, with no moving parts.

.3 2 mm [12 ga] thick aluminum, all welded construction.

.4 Blender mounted on discharge side of supply fans shall function as a diffuser in maintaining even velocity over entire face of final filters and coils.

.5 Factory engineered and fabricated discharge cone / transition / diffuser assembly. Unit shall be built with flanges to fit up to fan discharge and outlet equipped with mounting plate to fit up to plenum walls.

.6 Standard of Acceptance: Blender Products Inc.

2.2 BACKDRAFT DAMPERS - MEDIUM DUTY

.1 Minimum Requirements:

.1 1.4 mm thick [16 ga] galvanized steel or aluminum channel frame.

.2 1.2 mm thick [15 ga] aluminum blades, complete with stiffening ribs/bends.

.3 Full blade length shafts; brass, ball or nylon bearings.

.4 Felt or neoprene anti-chatter blade strips.

.5 Blade connecting linkage with eyelet and pin bearings.

.6 Maximum blade length of 760 mm [30"], use multiples for larger dimensions.

.7 Manufacturer's label.

.8 Where a balanced backdraft damper (BBD) is indicated the damper shall incorporate an adjustable counterbalance weight and lever.

.9 Maximum pressure drop across damper at 4.06 m/s [800 FPM] shall be 45 Pa [0.18" w.g.]

.2 Standard of Acceptance: Airolite 625, Penn CBD-6.

2.3 BALANCING DAMPERS

.1 Construction in accordance with SMACNA Duct Standards - Figs. 2-14 and 2-15.

.2 Minimum Requirements:

.1 Rectangular ducts:

.1 Up to 300 mm [12"] deep - single blade (butterfly type).

.2 330 mm [13"] to 400 mm [16"] deep - two opposed blades, mechanically interlocked with pivots at quarter points.

.3 430 mm [17"] deep and over - multiple opposed blades, mechanically interlocked with blades not greater than 200 mm [8"] deep and pivots equally spaced.

.2 Round Ducts:

.1 Single blade (butterfly type).

.3 Material:

.1 Minimum 1.47 mm [16 ga] thick galvanized steel blade on all butterfly dampers.

.2 Minimum 1.47 mm [16 ga] thick galvanized steel blades on multi-blade dampers with rigidly constructed galvanized steel frame (no frame required on single blade dampers).

.4 Bearings:

.1 End bearings on all low pressure single blade dampers above 300 mm [12"] dia.

.2 Bearings on multiple blade dampers shall be bronze oilite type.

.5 .5 Operating Mechanism:

.1 Lockable quadrant type with end bearing on accessible rectangular ducts up to 400 mm [16"] deep and on accessible round ducts.

.2 Wide pitch screw mechanism type with crank operator on accessible rectangular ducts 430 mm [17"] and over in depth and on inaccessible rectangular and round ducts.

.3 Override limiting stops.

.4 No blade movement in set position.

2.4 DUCT AND PLENUM ACCESS

.1 Locations: Refer to Part 3 (Execution).

.2 Dimensions:

.1 Doors:

.1 500 mm [20"] wide x 1370 mm [54"] high.

.2 Head of door 1780 mm [70"] above floor.

.2 Panels:

.1 380 mm x 500 mm [15"x20"].

.2 Where the far corners of the duct are closer than 500 mm [20"] and the equipment within the duct is closer than 300 mm [12"] the size may be reduced to 400 mm x 300 mm [16"x12"] or 450 mm x 250 mm [18"x10"] elliptical.

.3 Where space will not permit the above dimensions to be attained they should be matched as closely as possible and where necessary additional access be provided.

.3 Products:

.1 Doors - construct in accordance with SMACNA Duct Standards Fig. 6-12 except for latch type. 40 mm [1-1/2"] thick insulation.

.2 Panels - Nailor Hart, Ventlok, 25 mm [1"] thick insulation.

.3 Gaskets - neoprene or foam rubber.

.4 Hardware:

.1 Panels up to 400 mm x 300 mm [16"x12"] - 2 sash locks.

.2 Panels - 380 mm x 500 mm [15"x20"] - 4 sash locks.

.3 Doors - piano hinge and Ventlok 310 latches c/w front and inside handles and front door pull.

2.5 DUCT CONNECTORS - VIBRATION ISOLATION

.1 Provide flexible duct connections to provide vibration isolation at all duct and plenum connections to fan and air handling units. See Figure 2-19 SMACNA Duct Standards.

.2 Minimum Requirements:

.1 Pre-assembled 75 mm [3"] minimum long flexible connection with 75 mm [3"] long 0.62 mm [24 ga] galvanized steel duct connectors on each side of the flexible connection. Flexible connector - fiber glass fabric with elastomer coating.

.3 Centrifugal fans with 900 mm [36"] diameter and larger fan wheels, use 150 mm [6"] long flexible connection.

.4 Standard of Acceptance: Duro Dyne "Durolon", Dynair "Hypalon", Ventfabrics "Ventlon".

2.6 DUCTWORK - FLEXIBLE - PLAIN

.1 Provide factory fabricated plain, flexible air ductwork for the following applications:

.1 Connections to air terminals.

.2 Connections to round fire dampers (up to 300 mm [12"] diameter).

.2 Minimum Requirements:

.1 Non-corrosive spiral wire reinforcing with flexible vinyl coated fiberglass cloth membrane.

.2 Suitable for up to 2500 Pa [10" w.g.] positive static pressure and 250 Pa [1" w.g.] negative static pressure.

.3 U.L. or U.L.C. labelled, Class 1, duct connector.

.4 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

.3 Standard of Acceptance: Flexmaster FAB4, Thermaflex SLP10,

2.7 DUCTWORK AND PLENUM SEALERS

.1 Provide duct sealing compounds for use in fabrication of all ductwork and plenum joints.

.2 Low Pressure Systems - SMACNA Seal Classification B. Medium and High Pressure Systems - SMACNA Seal Classification A.

.3 Standard of Acceptance:

.1 Foster 32-14, Hardcast Versa Grip, Hardcast Foil Grip 1402, Robson’s Duct Seal-WB, United Duct Sealer, Trans Continental Multi-Purpose.

.4 Where accessible, apply sealer to inside of joints on ducts and plenums under positive pressure - e.g. on the discharge side of fans.

.5 Apply sealer to outside of joints on ducts and plenums under negative pressure - e.g. on the suction side of fans.

2.8 FIRE DAMPERS

.1 Minimum Requirements:

.1 Fire dampers shall be U.L.C. or Warnock Hersey tested and shall bear the testing agency's label.

.2 Fire dampers shall meet requirements of the National Building Code and authorities having jurisdiction.

.3 All fire dampers shall be “dynamic”; rated to close under airflow..

.4 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire separation.

.5 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type in horizontal position with vertical airflow.

.6 Fire dampers in low-pressure ductwork may be multi blade or curtain type.

.7 Fire dampers in medium and high-pressure ductwork shall be curtain type.

.8 Curtain fire dampers shall have blades retained in a recess so free area of connecting ductwork is not reduced.

.9 Fusible links: U.L.C. approved with a melting point of 74°C [165°F] on supply, return and exhaust air systems. Use fusible links with a melting point of 141°C [286°F] on all return and exhaust air systems if used for smoke venting.

2.9 FIRE DAMPERS - CEILING

.1 Minimum Requirements:

.1 U.L.C. tested and labelled.

.2 Spring loaded heat retardant blanket or insulated damper blades.

.3 74°C [165°F] fusible links.

.4 Where diffuser/grille neck is smaller than diffuser/grille face area, provide U.L. listed C.K. 2000 thermal blanket over ceiling space side of exposed diffuser/grille.

.5 Install above each diffuser/grille mounted in fire rated ceiling.

.6 Provide transition plates (round to rectangular).

.2 Standard of Acceptance: Controlled Air CFS/CFSR, Ruskin CFSR, Nailor Hart.

2.10 FIRE DAMPERS - COMBINATION REGISTER DAMPER

.1 Minimum Requirements:

.1 Warnock-Hersey tested and labelled.

.2 Combined opposed blade damper with spring tensioned fusible link.

.3 Fasten to 3.23 mm thick [10 ga] steel sleeve, all welded with integral flange on register side.

.2 Standard of Acceptance: E.H. Price VCS-4, Tuttle & Bailey 90A.

2.11 FIRE STOP FLAPS

.1 Minimum Requirements:

.1 Single damper flap with spring catch.

.2 U.L.C. tested and labelled.

.3 Construct of minimum 1.35 mm [16 ga] thick sheet steel with 1.6 mm [1/16"] thick [asbestos] on unexposed side and corrosion-resistant pins and hinges.

.4 U.L.C. approved fusible links with a maximum melting point of 74°C [165°F].

.5 Arranged so as not to reduce duct free area.

.2 Standard of Acceptance: Ruskin CFSF.

2.12 FLOW MEASURING DEVICES - AIR

.1 Flow Measuring Station

.1 Minimum Requirements:

.1 1.47 mm thick [16 ga] galvanized steel casing with duct connecting flanges.

.2 Aluminum honeycomb air straightening cell.

.3 Total pressure sensors and static pressure sensors interconnected by copper manifolds.

.4 Total and static pressure external ports with fittings for connecting to flow meter or control system.

.5 Identification label listing unit size, design air quantity and direction of air flow.

.2 Accessories:

.1 Magnehelic differential pressure gauge scaled in air volume (L/s).

.3 Standard of Acceptance:

.1 Air Monitor FAN E and D.A.M.D.

.2 Airflow Probe (Duct or Fan Inlet)

.1 Minimum Requirements:

.1 Aluminum construction.

.2 Multiple traverse probes.

.3 Traverse probe to contain multiple total and static pressure sensors located along exterior surface of probe and internally connected to their respective averaging manifolds.

.4 Threaded end support rod and mounting plate with gasket and signal fittings.

.5 Fan inlet probes (two per inlet) shall have dual end support swivel brackets suitable for mounting in the fan inlet bell.

.6 Capable of producing an output signal linear and scaled to air volume (4-20 mADC, 0-10 VDC, 0-5VDC).

.7 Capable of local digital display of continuous indication of air volume.

.2 Standard of Acceptance:

.1 Air Monitor VOLU-probe/7200AZ (Duct).

.2 Air Monitor VOLU-probe/7200AZ (Fan Inlet).

2.13 INSTRUMENT TEST PORTS

.1 Application:

.1 Provide instrument test ports in each plenum access door (unless more than one door serves a plenum compartment).

.2 Locate ports to permit easy reading of instruments.

.2 Minimum Requirements:

.1 1.35 mm [16 ga] thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 25 mm [1"] minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

.3 Standard of Acceptance: Duro Dyne IP1 or IP2.

3 EXECUTION

3.1 BALANCING DAMPERS

.1 Provide balancing dampers at points on low pressure supply, return and exhaust systems where branches are taken from larger duct as required for proper air balancing.

.2 Provide balancing dampers at each run out to a grille or diffuser.

.3 Identify the airflow direction and blade rotation and open and closed position.

.4 On all round ductwork larger than 300 mm [12"] diameter and on externally insulated rectangular ductwork, provide sheet metal bridge to raise quadrant type operators above the insulation thickness (coordinate with Section 23 07 13). Provide an open end bearing where bridges are used. Bridges on uninsulated round ducts shall be at least 25 mm [1"] high.

.5 Where quadrant type operators are used, the lever shall be arranged parallel with the damper blade.

3.2 BACKDRAFT DAMPERS

.1 Install backdraft dampers on all exhaust and relief openings through the building walls and roof on all exhaust fans where control dampers are not called for or indicated.

3.3 CONTROL DAMPERS - AUTOMATIC

.1 Packaged equipment specified to be complete with control dampers, shall include control dampers as normally supplied by the equipment manufacturer unless otherwise noted.

.2 All other automatic control dampers are specified in the Controls Sections.

.3 Under this section be responsible for receipt, handling, storage and installation of control dampers supplied under the Control Sections.

.4 The indicated size of control dampers is the dimension outside the frame. Oversize the ductwork to include the depth of the damper frame if the pressure drop across the damper exceeds 25 Pa [0.1" w.g.].

.5 Control damper frames shall be fitted tightly into ductwork and sealed airtight.

.6 Check that dampers are installed square and true. Ensure that damper end linkages are easily accessible.

.7 Do not install control dampers within the thickness of any wall unless otherwise indicated.

3.4 DUCT AND PLENUM ACCESS

.1 Locations: Provide access doors and panels as follows:

.1 Doors: where shown on the drawings.

.2 Panels:

.1 Every 12 m [40 ft] on all ductwork.

.2 At the base of each duct riser.

.3 Both sides of equipment blocking the duct e.g.

.1 air flow measuring stations

.2 coils

.4 At or to one side of other equipment in duct e.g

.1 backdraft dampers (counter weight side)

.2 balance dampers serving multiple outlets/inlets

.3 bearings (fans/motors)

.4 control dampers

.5 control sensors

.6 fire dampers (rectangular ducts and round ducts 330 mm [13"] dia. and larger - latch side)

.7 smoke detectors (upstream from device)

.5 Panels need not be provided where access is available through a door or a register mounted on the side of the duct.

.3 Patches:

.1 Where required for cleaning and where access panels are not specified, e.g. on both sides of turning vanes.

.4 Flexible duct - on round duct and round fire dampers up to 300 mm [12"] dia.

.2 Seal frames airtight.

.3 Install so as not to interfere with airflow.

.4 Install to provide easiest possible access for service and cleaning.

.5 Do not use sheet metal screws for attaching access panels to ductwork.

.6 Round ducts 330 mm [13"] dia. and larger shall include a short collar for the installation of access panels.

.7 Small rectangular ducts shall be transitioned to a minimum dimension across the duct of 330 mm [13"] for the installation of access panels.

3.5 DUCT CONNECTORS - VIBRATION ISOLATION

.1 Ensure flexible duct connectors do not reduce duct free area on suction side of fans.

3.6 DUCTWORK – FLEXIBLE

.1 Installed lengths shall be limited to 6 times duct diameter but not longer than 1200 mm [4 ft].

.2 Connect to ductwork and diffusers with stainless steel worm drive clamps or Panduit adjustable clamps or Thermaflex duct strap applied over two wraps of duct tape. Use stainless steel clamps on connections to fire dampers.

.3 Minimum centreline radius of flexible ductwork bends shall be 1.5 times the duct diameter, alternatively, sheet metal elbows may be used at branch takeoffs and boot/diffuser connections.

.4 Support with 25 mm x 0.76 mm [1"x22 ga] galvanized steel straps at a maximum of 600mm [24"]. Straps shall completely encircle duct.

.5 Support clear of ceiling assembly, light fixtures and hot surfaces.

3.7 FIRE DAMPERS

.1 Install in accordance with the SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems - Fourth Edition 1992.

.2 Fire damper sleeves must not extend more than 75 mm [3"] from wall on each side.

.3 Fire dampers must be installed within wall thickness of fire separation.

.4 Wall openings sized to allow sleeve/damper expansion.

.5 Arrange dampers so that linkages and locking catches are accessible from the access side of fire damper.

.6 Install so as to close in the direction of normal airflow.

.7 Size so that the free area of duct is maintained through the assembly.

.8 Install in galvanized steel sleeve, retained in place with retaining angles on all four sides at each face of wall.

.9 Connect ductwork to damper sleeves using break-away duct joints on all faces.

3.8 FLOW MEASURING DEVICES - AIR

.1 Install in accordance with manufacturers recommendations. The minimum distances from air turbulence - producing fittings, transitions etc. shall be maintained.

.2 When specified mount air volume gauges at a convenient height for easy visual inspection and install interconnecting piping.

END OF SECTION

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 QUALITY ASSURANCE

.1 Product of a manufacturer who regularly engages in production of such units and who issues complete catalogue data on such products.

1.3 SUBMITTALS

.1 Submit shop drawings detailing all attenuator data specified in the schedule. The data submitted shall apply to this project application.

.2 Provide engineering certification of sound attenuator performance (insertion loss, pressure drop and regenerated noise under stated operation conditions) certified by a Professional Engineer and supported by test results, if required by the Departmental Representative.

2 PRODUCTS

2.1 SOUND ATTENUATORS

.1 Minimum Requirements:

.1 Fabricate attenuators to SMACNA Standards, air-tight at twice the operating pressure, with sufficient strength to withstand normal handling, transportation installation and operational stresses and consistent with the ductwork in which the attenuator will be installed. Split spot welds or sagging insulation will result in rejection of a sound attenuator.

.2 The attenuators shall be inorganic, incombustible, impart no odours to the air, and shall not erode due to airflow over the internal surfaces.

.3 If the internal velocity through a sound attenuator may cause erosion of the insulation, provide glass fibre cloth to protect the insulation from erosion.

.4 Provide label on attenuators with manufacturer's name and flow direction.

.5 Paint attenuator inside and out with an anti-rust prime coat paint.

3 EXECUTION

3.1 SOUND ATTENUATORS

.1 Inspect attenuators arriving on site to ensure that they meet the specified requirements. Report any deficiencies to the manufacturer and to the Departmental Representative.

.2 Install attenuators in accordance with manufacturer's instructions.

END OF SECTION

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 QUALITY ASSURANCE

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

1.3 SUBMITTALS

.1 Fan shop drawings shall include sound rating data and fan curves showing operating point plotted on curves.

.2 Fan shop drawings shall include motor efficiencies. Refer to Section 23 05 13 for minimum motor efficiencies.

1.4 GENERAL

.1 Motors powered by variable speed drive controllers shall be EEMAC class B with Type F "inverter duty" insulation, shall have a 1.15 service factor on sine wave power, 1.0 service factor on PWM power and meet NEMA Code MG-1, 1993 Part 31.

2 PRODUCTS

2.1 FANS - GENERAL

.1 Provide fans selected for maximum efficiency and generating noise levels on site not exceeding the level calculated from the ASHRAE Guide (1987* Systems, Ch. 52, Table 5). If fans are not specified at maximum efficiency, advise mechanical engineer before tendering and submit alternate price for maximum efficiency fans. If approval to supply noisier fans is not obtained prior to tendering, provide equipment meeting ASHRAE levels on site without loss in efficiency.

.2 Submit fan sound power levels with shop drawings measured to applicable AMCA standards, or other data acceptable to the Departmental Representative. Provide test data, if requested. Indicate on shop drawings the test configuration, including ductwork, and any end reflection corrections applied to the data and / or if such corrections have been omitted.

.3 Fans: statically and dynamically balanced, constructed in conformity with AMCA-99-83. Dynamically balance fans to 1.5-mm/s vibration amplitude, maximum measured on bearing housings. Provide fan shafts with critical speed at least 1.5-times operational speed.

.4 Ratings: based on tests performed in accordance with AMCA 210, and ASHRAE 51-85. Units shall bear AMCA certified rating seal.

.5 Refer to Section 23 05 13 for high efficiency motor requirements.

.6 Refer to drawings for motor position, rotation and discharge arrangements.

.7 For motors less than 10 H.P. provide standard adjustable pitch drive sheaves having +/-10% range. Use mid-position of range for specified RPM.

.8 For motors 10 H.P. and larger, provide fixed pitch drive sheaves with split tapered bushing and keyway. Provide final drive sheaves of size to suit final balancing.

.9 Match drive and driven sheaves.

.10 V-belts shall conform with the American Belt Manufacturers standards. Multiple belts shall be matched sets.

.11 Minimum drive rating shall be 150% of nameplate rating of motor

.12 Not less than a 2-belt configuration is required for each drive for motors 3/4 H.P. and larger.

.13 Provide belt guard with tachometer ports for all belt drive fans.

.14 Bearings shall have a minimum L-10 life of 100,000 hours based on the maximum safe speed of the fan class.

.15 Where required, fans shall be treated to suit the airstream in which they are used.

.16 Provide secure attachment points for seismic restraints. Mounting brackets shall be suitable for seismic loading.

2.2 FANS - MOTORS AND VARIABLE SPEED DRIVES

.1 Provide motors and variable frequency drive / motor assemblies generating noise levels which are imperceptible in the occupied space, and outside building, relative to fan noise. Provide acoustical data confirming required performance prior to tendering. If approval is not obtained prior to tendering, provide equipment meeting specified imperceptible requirement without loss in efficiency.

2.3 FANS - CABINET

.1 Minimum Requirements:

.1 Steel cabinet arranged for ducted inlet and outlet connections c/w duct collars (where shown) or ceiling exhaust opening c/w exhaust grille (where shown).

.2 Acoustically insulated cabinet.

.3 Centrifugal fan on rubber isolators.

.4 Backdraft damper.

.5 Access panel.

.6 Integral motor thermal overload protection.

.7 Motor disconnect plug and integral receptacle.

.2 Accessories:

.1 Solid state speed control - where scheduled.

2.4 FANS - CEILING EXHAUST

.1 Minimum Requirements:

.1 Centrifugal blower, motor vibration isolated.

.2 Built-in backdraft damper.

.3 White plastic exhaust grille.

.4 Adjustable hanger bracket.

.5 Pre-wired outlet box, plug-in receptacle.

.2 Accessories:

.1 Solid state speed control - where scheduled.

2.5 FANS - CEILING VENTILATORS

.1 Minimum Requirements:

.1 Variable speed commercial ceiling fans

.2 Large diameter propeller blades, all metal construction.

.3 Baked enamel white finish.

.4 Variable speed motor (all motors impendence protected)

.5 Totally enclosed, permanently lubricated ball-bearing motors.

.6 Arranged for up/downward blowing.

.2 Accessories:

.1 Manual, infinitely variable on/off speed control switch (one control for each fan).

.2 "Down-rod" suitable for suspension height.

2.6 FANS - CENTRIFUGAL

.1 Minimum Requirements:

.1 Welded steel fan wheel with airfoil backward inclined blades, unless otherwise specified.

.2 Bearings: Heavy-duty pillow-block grease lubricated ball or roller self aligning type.

.3 Gasketted scroll access panel, secured with quick release fasteners.

.4 20 mm [3/4"] scroll drain and brass plug.

.5 Enamel painted steel fan wheels and inside scrolls.

.6 Prime coat painted outside scroll including supports and steel accessories.

.7 Rust preventative coating on fan shafts.

.8 Drip proof motor.

.9 On single inlet fans provide extended lubricators on inlet side bearings.

.2 Accessories:

.1 Belt drives.

.2 Belt guards c/w tachometer holes.

.3 Coupling guards.

.4 Fan inlet safety screens.

.5 Steel frame base and motor slide rails (refer to section 23 05 48).

2.7 FANS – CENTRIFUGAL (PLENUM)

.1 Minimum Requirements:

.1 Welded steel fan wheel with backward inclined blades, unless otherwise specified.

.2 Bearings: Heavy-duty pillow-block grease lubricated ball or roller self aligning type.

.3 Gasketted scroll access panel, secured with quick release fasteners.

.4 20 mm [3/4"] scroll drain and brass plug.

.5 Enamel painted steel fan wheels.

.6 Rust preventative coating on fan shafts.

.7 Drip proof motor.

.8 Fan assembly fully enclosed with expanded mesh screen, approved to WCB Standards.

.9 Direct drive fans shall be designed specifically for the duty and allow for easy motor replacement. Provide heavy-duty mechanical coupling and bearings for arrangement 8 where called for.

.10 Belt drives with belt guards c/w tachometer holes.

.11 Coupling guards.

.12 Fan inlet safety screens.

.2 Accessories:

.1 Steel frame base and motor slide rails (refer to section 23 05 48).

2.8 FANS - IN-LINE CENTRIFUGAL

.1 Minimum Requirements:

.1 In-line centrifugal fan with axial flow construction.

.2 Square housing, steel with galvanized finish.

.3 Access panel to provide cleaning and service access.

.4 Backward inclined, non-overloading wheel.

.5 Drip-proof motor.

.6 Permanently lubricated pillow block ball bearings.

.7 Rust preventative coating on shafts.

.8 Belt or direct driven as scheduled.

.2 Accessories:

.1 Belt guard, motor cover, where externally belt driven.

.2 Plug-in electrical disconnect switch, mounted on the outside of the fan housing.

.3 Insulated housing lining.

.4 Solid state speed controller where scheduled.

2.9 FANS - UTILITY

.1 Minimum Requirements:

.1 Steel wheel and reinforced scroll on integral supports.

.2 Gasketted scroll access panel, secured with quick release fasteners.

.3 20 mm [3/4"] scroll drain and brass plug.

.4 Rust preventative coating on shaft.

.5 Enamel painted fan wheels and scrolls.

.6 Weatherproof enamelled cover for motor drive.

.7 Belt driven sets with adjustable motor bed plate and variable pitch drive sheave.

2.10 FANS - ROOF EXHAUST

.1 Minimum Requirements:

.1 Centrifugal non-overloading wheel.

.2 Belt or direct drive as scheduled.

.3 Spun aluminum housing .

.4 Upblast discharge, where scheduled.

.5 All parts corrosion resistant.

.6 Vibration isolators.

.7 Wiring post.

.8 Head mounted disconnect switch.

.9 Discharge birdscreen.

.2 Accessories:

.1 Roof curb - as scheduled.

.2 Backdraft damper - as scheduled.

2.11 GAUGES - AIR PRESSURE

.1 Minimum Requirements:

.1 Ranges:

.1 Supply fans: 0-1500 Pa 0-6" w.g.

.2 Return/exhaust fans: 0-500 Pa 0-2" w.g.

.2 Standard of Acceptance:

.1 Dwyer Series 2000.

3 EXECUTION

3.1 FANS

.1 Install fans as indicated, complete with vibration isolators and seismic restraints as specified in Sections 123 05 48 and 23 05 49.

.2 Install fans with flexible connections on inlet ductwork and on discharge ductwork. Ensure metal bands of connectors are parallel with minimum 25 mm [1"] flex between ductwork and fan during running.

.3 Install connectors such that connectors are clear of the air stream. Provide flange extensions as necessary. Ensure accurate alignment of duct to fan.

.4 Provide safety screens where fan inlet or outlet is exposed.

.5 Provide belt guards on belt driven fans.

.6 Provide and install sheaves and belts required for final air balance.

.7 Assist the Balancing Agency in altering blade pitch angles as required for final air balance. Provide access to fan wheel for blade adjustment.

.8 Mount floor mounted fans on 100 mm [4"] thick concrete housekeeping bases (bases under Division 3).

.9 Mount roof mounted fans on curbs 200 mm [8"] minimum above roof.

3.2 GAUGES - AIR PRESSURE

.1 Mount gauges for easy visual inspection.

.2 All piping to be neatly formed in true vertical/horizontal lines free from kinks.

.3 Seal all penetrations of plenums or ducts.

4 EQUIPMENT SCHEDULE

FAN SCHEDULE

UNIT NO	**EF-1**	**EF- 2 & EF-3**	**EF-4**	**EF-5**
SERVICE				
LOCATION	ROOF	ROOF	DNA ROOM	PTSS. ROOM
FAN TYPE	CENTRIFUGAL	CENTRIFUGAL	CEILING CABINET	
AIR FLOW (L/s) (CFM)	180 382	282 600	172 364	172 364
FAN S.P. (Pa) (ins)	63 0.25	63 0.25	63 0.25	63 0.25
FAN DRAW (BHP)				
TURNDOWN (%) FLOW				
FAN (RPM)	1140	1140	1000	1000
ARRANGEMENT				
DRIVE TYPE	DIRECT DRIVE	BELT DRIVE	DIRECT DRIVE	DIRECT DRIVE
FAN MOTOR (HP)	1/4	1/4	139 W	139 W
VOLTS/PHASE/Hz	115/1/60	115/1/60	115/1/60	115/1/60
MANUFACTURER	GREENHECK	GREENHECK	GREENHECK	GREENHECK
MODEL NO	NYD-75-A	NYB-100	CSP-A410	CSP-A410
SEE NOTE(S)	1	1	2, 4	3, 4

NOTES:
1. FAN MOTOR TO BE CONTROLLED BY THE CO SENSOR AND C/W OVERRIDE MANUAL SWITCH, INTERLOCKED WITH THE MOTORIZED DAMPER WHICH IS SERVICING THE SAME AREA
2. FAN TO BE CONTROLLED BY THE PROGRAMMABLE TIME CLOCK SWITCH, WALL MOUNTED.
3. FAN TO BE CONTROLLED BY THE T-STAT C/W OVERRIDE MANUAL SWITCH.
4. C/W BACK DRAFT DAMPER.

FAN SCHEDULE

UNIT NO	**EF-6**	**CF-1**	**CF-2**
SERVICE			
LOCATION	SPRINKLER ROOM	WORK STATION	RECEPTION AREA
FAN TYPE	CENTRIFUGAL		
AIR FLOW (L/s)	48	6110	6110
(CFM)	102	13,000	13,000
FAN S.P. (Pa)	63		
(ins)	0.25		
FAN DRAW (BHP)			
TURNDOWN (%) FLOW			
FAN (RPM)	950	320	320
ARRANGEMENT			
DRIVE TYPE	DIRECT DRIVE		
FAN MOTOR (HP)	FRAC.	FRAC.	FRAC.
VOLTS/PHASE/Hz	115/1/60	115/1/60	115/1/60
MANUFACTURER	GREENHECK	CANARM	CANARM
MODEL NO	CSP-A110	CP-48	CP-48
SEE NOTE(S)	2, 3	1	1

NOTES:

1. FAN TO BE CONTROLLED BY THE FRMC5 VARIABLE SPEED SWITCH, WALL MOUNTED.
2. FAN TO BE CONTROLLED BY THE HUMIDITY SENSOR C/W OVERRIDE MANUAL SWITCH.
3. C/W BACK DRAFT DAMPER.

END OF SECTION

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 QUALITY ASSURANCE

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards

2 PRODUCTS

2.1 AIR VALVES

.1 General:

.1 Manufacturers, other than those listed in the acceptable manufacturers list, wishing to bid shall make a detailed submission responding to each point outlined in the specification in the exact same form. A listing of valve for valve taken from the drawings, shall be included showing the design selection and the alternate proposed with airflow capacities and minimum static pressure requirement.

.2 Minimum Requirements:

.1 Rated to ARI Standard 880-89 with ARI seal. Provide identical products to tested unit.

.2 Air valves shall be supplied as a factory assembly unit, comprising, basic unit, access section, reheat coil and attenuator as specified.

.3 At an inlet velocity of 10 m/s [2000 FPM] the differential static pressure required to operate any air valve size shall not exceed 37 Pa [0.15" w.g.] for any unit with an attenuator section and without a reheat coil.

.4 Air valves shall incorporate a multi-point flow sensor.

.5 Casing constructed from 0.76 mm [22 ga] thick galvanized steel. Provide attachment tabs on the top of the casing for ceiling hangers.

.3 Unit Internal Insulation:

.1 Standard Insulation:

.1 25 mm [1"] fiberglass insulation. Exposed face of insulation to be faced with non-woven mat. All exposed raw edges and joints to be sealed with galvanized metal.

.4 Control Dampers:

.1 Heavy gauge steel damper with peripheral gasket and self-lubricated bronze oilite or Delrin bearings.

.2 Air leakage past closed damper not to exceed 2% of the nominal rating at 750 Pa [3"] inlet static pressure.

.5 Reheat Coils:

.1 Water reheat coils enclosed in galvanized steel casing and factory installed on air valves.

.2 Copper tubes and aluminum fins. Coil performance shall be in accordance with ARI Standard 410.

.3 Capacities as scheduled.

.6 Access Panels:

.1 200 mm x 125 mm [8" x 5"] lift-off galvanized access panel. Positive gasket seal and camlocks.

.2 Mounted in frame and located upstream of reheat coil on the top and bottom of air valve

.7 Sound Attenuators:

.1 Standard Attenuator:

.1 Casing constructed from 0.76 mm [22 ga] thick galvanized steel. Provide attachment tabs on the top of the casing for ceiling hangers.

.2 Attenuator lined with 25 mm [1"] fiberglass insulation. Exposed face of insulation to be faced with non-woven mat. All exposed raw edges and joints to be sealed with glasfab and or metal nosing insulation coating / sealer.

.8 Selection Range:

Inlet Size	Selection Range (L/s)	Minimum Turndown (L/s)	Outlet Size (Supply)
6	38 – 180	38	305 X 203
8	181 – 330	62	305 X 254
10	331 – 550	108	356 X 318
12	551- 770	153	406 X 381
14	771 – 1000	212	508 X 445
16	1001 – 1200	274	610 X 447

.9 Acoustic Requirements:

.1 Provide air valves as indicated on the project drawings and schedules, such that the noise criteria specified in Table 1 below, are not exceeded under the following site conditions. Meet all applicable Codes and all other specified requirements.

.1 375 Pa (1.5") static pressure on supply and return/exhaust units.

.2 Armstrong Cortega 769 ceiling tile.

.3 Price SPD/ASPD series square plaque diffuser selected for 700 fpm neck velocity, as specified.

.4 Room absorption equivalent to a typical office or single hospital bed only (plus ceiling) (for Hospital applications).

.2 Conduct full mock-up tests with representative air valves, suspended ceiling, diffuser and simulated room absorption, to demonstrate that specified NC 30/35 criteria will be met.

.3 Submit proposed test details prior to testing. Note that test data are to include measured noise level (as opposed to sound power) under mock-up conditions, as indicated in ARI 880-1998, Fig. 1, together with mock-up room test details, dimensions and measured absorption (using reference sound source). Submit statement of test accuracy.

.4 Provide measured data, together with details of added treatment required to meet the criteria, e.g. Thermaflex MK-E lined flexible connector, additional treatment to control radiated noise, etc.

Table No. 1
MAXIMUM ALLOWABLE BACKGROUND NOISE LEVELS, NC

Max. NC	Areas
30	Director's Office / Managers' Office
30	Conference Room / Board Room / Library / Classrooms / Seminar Rooms.
35	Offices / Psych. Assessment / Counselling
35	Multi-Purpose
35	Exam Rooms / All Testing Rooms
45	Storage
--	Mechanical / Electrical / Communications

.10 Air Valve Identification:

.1 The manufacturer shall number the air valves in accordance with numbers shown on the drawings. Secure 50 mm [2"] high, Gothic style self-adhesive, black stick on-letters, (Letrasign or Brady Quick-Align) on one side and on the bottom of all air valves.

.11 Standard of Acceptance:

.1 E.H. Price SDV-5000 (supply)

3 EXECUTION

3.1 AIR TERMINAL UNITS - AIR VALVES

.1 Installation

.1 Install in accordance with manufacturers recommendations.

.2 Arrange for suitable ceiling access to units. Provide access doors or locate near easily removable ceiling components.

.3 Support air terminal units independently of ductwork.

.4 Install units with a minimum of four duct diameters of straight inlet duct, same size as the inlet, upstream of the inlet.

.5 Where inlet flow deflections and/or turbulence alter factory calibration by more than 10%, installer shall field adjust the air volume calibration settings to compensate.

4 EQUIPMENT SCHEDULE

AIR VALVE SCHEDULE

Air Valve No.	Serving Room #	Unit Size	Min.		Design.		RHC Flow		See Note
			l/s	cfm	l/s	cfm	l/s	gpm	
VAV-1	Exercise & Monitory	6	31	66	130	277	0.04	0.6	1,2,
VAV-2	Cell security space	8	59	126	190	404	0.07	1.1	1,2,
VAV-3	SGT & work station	6	41	86	260	553	-	-	3
VAV-4	Mail Room	6	45	95	149	316	0.05	0.8	1,2
VAV-5	Open work stations	12	198	420	660	1399	0.23	3.6	1,2
VAV-6	Guest office & office	10	98	207	310	660	-	-	3
VAV-7	Traffic recon.	6	41	87	150	320	-	-	3
VAV-8	Open space perimeter	10	123	261	410	869	-	-	3
VAV-9	Conference room	10	166	351	500	1064	0.19	3.0	1,2
VAV-10	Recep. Area	6	36	76	120	254	0.04	0.7	1,2
VAV-11	Main work stations	8	95	200	265	563	0.11	1.7	1,2
VAV-12	Victim Services	6	35	75	95	202	-	-	3
VAV-13	Office manager	6	27	57	95	202	0.03	0.5	1,2
VAV-14	Washrooms	8	60	127	180	383	0.07	1.1	1,2
VAV-15	Storage,DNA,Coori..	6	42	89	150	320	0.05	0.8	1,2,4
VAV-16	Interview Room	6	29	61	115	244	-	-	3

Notes:
1. Coil selected for max airflow; EAT=13C[55F], LAT=27C[80F], EWT=82C[180F], LWT=71C[160F]
2. Unit c/w integral attenuator and re-heat coil.
3. unit c/w attenuator.
4. VAV-15 for storage, DNA and corridor spaces. The design air volume to provide enough heating to the spaces to maintain the space temp. at 16C. The min. air flow to provide the ventilation air for the spaces.

END OF SECTION

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 QUALITY ASSURANCE

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards

2 PRODUCTS

2.1 AIR TERMINALS

.1 General:

- .1 Grilles, registers and diffusers shall be product of one manufacturer.
- .2 Refer to drawings for sizes and air quantities.
- .3 Base air outlet application on space noise level of NC 30 maximum.
- .4 All air terminals must be checked for compatibility with ceiling types. Refer to Architectural reflected ceiling plans.
- .5 Ceiling tee-bar modules are in soft conversion metric measurements unless where specifically noted otherwise.
- .6 The manufacturer (other than the design listed) shall match performance data and indicate a specific comparison for each item, with the shop drawing submission.
- .7 All ceiling mounted air terminals shall be provided with means for attachment of two seismic security wires at opposite corners of each air terminal.
- .8 Provide concealed baffles, where necessary, to direct air away from walls, columns or other obstructions within the radius of air terminal operation.
- .9 Provide auxiliary frames for diffusers located in drywall ceilings and grilles mounted in gyproc walls in public areas. In other areas the grilles should be attached to the ductwork, flanged to the outside of the wall opening.

.2 Specific:

- .1 Type S-1– Administration Supply Air Diffuser
  - .1 4-way type.
  - .2 Steel construction.
  - .3 White finish.
  - .4 Round inlet duct connection with same size of the connection duct.
  - .5 Suitable for installation in T-bar ceiling.
  - .6 Acceptable products: E.H. Price SPD, Krueger, Titus.
- .2 Type S-2 – Administration Supply Air Grille
  - .1 Steel construction double deflection supply air grille, 19 mm blade spacing.
  - .2 Side wall or drywall ceiling mounted.
  - .3 Front blades parallel to short dimension.
  - .4 Countersunk screw holes c/w oval-head screws.
  - .5 White finish.
  - .6 Acceptable products: E.H. Price, Krueger, Titus.

.3 Type S-3 – Administration Supply Air Diffuser
- .1 4-way type.
- .2 Steel construction.
- .3 White finish.
- .4 Round inlet duct connection with the same size of the connection duct.
- .5 Suitable for installation in drywall ceiling.
- .6 Acceptable product: E.H. Price SPD, Krueger, Titus.

.4 Type S-4 – Cells, Holding Cell Supply Air Grille
- .1 Maximum security perforated face grille.
- .2 All welded construction and integral wall sleeves.
- .3 5 mm hot rolled steel with 3 mm diameter holes staggered 60º on 11 mm centers.
- .4 5 mm hot rolled steel, length as required, stitch welded seams.
- .5 25 mm x 25 mm x 5 mm hot rolled steel angle frame with security bars.
- .6 Etched and clear lacquer finish.
- .7 Acceptable products: Virtucom SCO; Chubb OP-20V; Simpson V-2

.5 Type E-1 – Cells and Holding Cell Exhaust Grille:
- .1 Maximum security perforated face grille.
- .2 All welded construction and integral wall sleeves.
- .3 5 mm hot rolled steel with 3 mm diameter holes staggered 60º on 11 mm centers.
- .4 5 mm hot rolled steel, length as required, stitch welded seams.
- .5 25 mm x 25 mm x 5 mm hot rolled steel angle frame with security bars.
- .6 Etched and clear lacquer finish.
- .7 Acceptable products: Virtucom SCO; Chubb OP-20V; Simpson V-2

.6 Type E-2 – Administration Ceiling Eggcrate Exhaust Grille:
- .1 Eggcrate core (12 x 12 x 12).
- .2 Aluminum construction.
- .3 White finish.
- .4 Suitable for installation in dry wall ceiling.
- .5 Acceptable products: E.H. Price 80-F-A-B12. Krueger, Titus.

.7 Type E-4, R-1 – Administration Side Wall/Ceiling Return/Exhaust Grille:
- .1 Steel construction double deflection return/exhaust air grille, 19 mm blade spacing, 0º deflection.
- .2 Side wall or drywall ceiling mounted.
- .3 Front blades parallel to short dimension.
- .4 Countersunk screw holes c/w oval-head screws.
- .5 White finish.
- .6 Acceptable products: E.H. Price 530-F-S-A-B12. Krueger, Titus.

.8 Type E-3 – Shower Exhaust Grille:

.1 Constructed of extruded aluminum.

.2 19 mm deep core with 6 mm thick aluminum bar.

.3 Border: 3 mm thick aluminum with mitred and welded corners.

.4 Core secured with tamperproof screws to angle mounting frame and anchoring lugs on angle mounting frame set in ceiling on wall.

.5 Acceptable product: E.H. Price SGA-15A-1G-B12, Krueger, Titus.

.9 Type DG-1 – Fire Rated Door Grille:

.1 Constructed of 16 gauge CRS frame and louver blades.

.2 Model with UL labeled.

.3 Security fasteners.

.4 Mineral bronze baked on powder coat to be verified by Arch..

.5 Acceptable product: 1900-A of Air Louvers Inc.

2.2 LOUVRES - STATIONARY

.1 General:

.1 Extruded aluminum frames and blades.

.2 All welded construction with exposed joints ground flush and smooth or mechanically fastened with stainless steel fasteners.

.3 Lower assembly sealed and watertight.

.4 Removable 1.3 mm [16 ga] dia. aluminum wire birdscreen with 12 mm [1/2"] mesh. Birdscreen mounted in 0.66 mm [20 ga] thick aluminum folded frame. Frame to be installed inside louvre.

.5 Factory applied baked enamel finish. Colour by Architect.

.2 Specific:

.1 Drawing designation - type "L-1".

.2 Service – Intake, and Exhaust air.

.3 Frame 150 mm [6"] deep.

.4 150 mm [6"] deep blades inclined at 45 deg. to the horizontal.

.5 Blades at 90 mm [3-1/2"] on centres.

.6 Blades arranged with up-turned rain stops on trailing edges and drip channels on leading edges.

.7 Jamb drainage channels.

.8 Blades and frame 2 mm [12 gauge] thick extruded aluminum.

.9 Standard of Acceptance: Airolite K6776.

.10 Size: see drawings.

2.3 HOODS - GOOSENECK

.1 Minimum Requirements:

.1 Galvanized steel construction.

.2 Thickness and fabrication to ASHRAE & SMACNA standards.

.3 12 mm [1/2"] aluminum wire birdscreen mounted in removable U-frame.

.4 Mount unit on minimum 300 mm [12”] high curb base.

3 EXECUTION

3.1 AIR TERMINALS

.1 Install with cadmium plated screws in countersunk holes where fastenings are visible.

.2 Install ductwork as high as practical, using offsets where required to obtain maximum duct neck lengths for diffusers.

.3 Refer to Architectural Reflected Ceiling plans for exact locations of air terminals.

.4 Paint ductwork behind grilles with matte black paint where duct or insulation surfaces are visible.

.5 Attach registers and grilles to branch ducts with duct necks having minimum length to prevent grille or register damper from protruding into branch duct.

.6 Where air terminals are installed in mechanical grid ceilings, provide at least two 12 ASWG galvanized steel wire seismic security bridles per air terminal tied either to the building structure or to ceiling hanger wires. Attach security bridles at opposite corners of each air terminal and in such a manner that the air terminal cannot fall.

.7 Hand over door grilles to the General Contractor for installation.

.8 Install wood framing in walls or ceiling for registers and grilles (except security grilles).

.9 Hand over grilles and registers to carpentry trade for installation.

.10 Supply metal frame from security grilles and hand over to masonry trade for installation.

3.2 LOUVRES

.1 Provide all necessary flashing and counterflashing for louvres installed in walls.

.2 Caulk louvre and flashing and counterflashing to make installation water tight.

.3 Blank-off panels shall be constructed to SMACNA standards, minimum 20 Ga. Sandwich panel with 25 mm [1”] thick fibreglass insulation.

.4 All blank-off panels shall have a painted flat black enamel finish.

.5 Provide access to bird screen.

END OF SECTION

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 FILTERS – QUALITY ASSURANCE

.1 Filters shall be product of and supplied by one manufacturer.

.2 Filter media shall be ULC listed and labelled, Class I or Class II.

.3 Filters suitable for air at 100% RH and air temperatures between 3oC [37oF] and 50oC [122oF].

.4 Dust holding capacity: Air Filter Institute (AFI) Test.

.5 Efficiency: based on ASHRAE 52-76, atmospheric dust spot efficiency. "Absolute filter" efficiency shall be tested with 0.3 Poly-alpha-olefin (P.A.O.) smoke.

.6 Representative filters shall have been tested by an independent test laboratory and test results shall be made available on request.

2 PRODUCTS

2.1 FILTERS - GENERAL

.1 Filter identification shall be clearly marked on each filter.

.2 Provide two (2) sets of filter media (for each filter) - one for initial installation and one for handover to the Departmental Representative as a spare. This does not apply to HEPA filters. Obtain signed receipt.

.3 All panel filter media used during "temporary heating" shall be replaced by new media on substantial completion.

.4 All filters sections shall be designed for 2.54 M/s [500 ft/min] maximum air flow.

.5 Roll type filters, automatic advance or otherwise will not be considered as an acceptable means of filtration.

.6 The use of permanent washable type impingement filters is generally not acceptable.

2.2 FILTERS - PANEL TYPE (SYNTHETIC)

.1 Minimum Requirements:

- .1 Multi-graduated laminant of variable density 3 ply Dacron fibers permanently bonded.
- .2 Self-gasketting friction fit.
- .3 Unitized internal heavy wire frame.
- .4 Efficiency: MERV 7 15 per ASHRAE Standard 52.2 and an average dust spot efficiency of 25% to 30% per ASHRAE Standard 52.1.

.2 Standard of Acceptance:

- .1 Tri-Deck.

2.3 FILTERS – CARTRIDGE TYPE FILTERS.

.1 Minimum Requirements:

- .1 Media: deep pleated, disposable, 65% efficiency, to CAN/CGSB-115.14.
- .2 Holding frame: galvanized steel with bracing.
- .3 Media support: welded wire grid.
- .4 Performance: 65%
- .5 Fire rated: to ULC-S111
- .6 Standard of Acceptance:AAF Dri-Pak, Farr N/S.

2.4 FILTERS – FINAL (SYNTHETIC)

.1 Minimum Requirements:

.1 Progressively structured filter medium made from unbreakable synthetic microfibre media, bag-type filters.

.2 Front frame made from corrosion resistant hard polyurethane foam.

.3 Filter pockets self-supporting with integral wire struts, leak-free bonds.

.4 Efficiency: as scheduled.

.2 Standard of Acceptance:

.1 Viledon.

2.5 FILTER - HOLDING FRAMES

.1 Built-up Frames:

.1 Provide separate holding frames for each bank of panel filters and each bank of final filters.

.2 Factory fabricated from 1.6 mm [16 ga] galvanized steel with spring retaining clips and neoprene gaskets.

2.6 FILTER HOUSINGS

.1 Minimum Requirements:

.1 Factory manufactured. Rigid galvanized steel casing, minimum 1.47 mm [16 ga] thick.

.2 Housing to have a high degree of sealing integrity. Filters shall fit tightly in housing with no air leakage between filters and between filters and housing.

.3 Extruded aluminum or steel tracks for slide-out, side withdrawal of filters.

.4 Hinged access door for filter servicing.

.2 Standard of Acceptance:

.1 AAF Poly-Seal, Cambridge Side-Flo, Farr Glide/Pack.

2.7 FILTER GAUGES

.1 Application:

.1 Across each filter bank. (Provide 2 individual gauges for combined panel and final filter banks).

.2 Minimum Requirements:

.1 Ranges:

.1 Panel filters: 0-250 Pa [0-1" w.g.].

.2 Final filters: 0-500 Pa [0-2" w.g.].

.3 Standard of Acceptance:

.1 Dwyer Series 2000.

.2 Dwyer Photohelic Series 3000 (Where filter pressure drop is monitored by the BMS).

3 EXECUTION

3.1 FILTERS

.1 Do not operate fan system connected to filter banks until filters (temporary or permanent) are in place. Provide new filters at handover to the Departmental Representative. Replace filters used during construction.

.2 Provide filter banks in arrangement shown with removal and access indicated. Demonstrate removal of filters prior to substantial completion.

.3 Provide and install Dwyer filter pressure gauges across each filter installation.

3.2 FILTER GAUGES

.1 Mount gauges for easy visual inspection.

.2 All piping to be neatly formed in true vertical/horizontal lines free from kinks.

.3 Seal all penetrations of plenums or ducts.

3.3 FILTER HOLDING FRAMES

.1 Built-up frames shall be installed and bolted together (and sealed air-tight with specified duct and plenum sealers) to form a filter bank.

.2 Provide necessary reinforcing for filter banks over three frames high. Brace with vertical steel stiffeners, min. 1.78 mm thick [14 ga] riveted or bolted to frames and attached to top and bottom of plenum. When bolting frames together provide spaces between holding frames as necessary to centre filters on coils (see drawing sections).

END OF SECTION

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 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

2 PRODUCTS

2.1 BREECHING AND CHIMNEYS - ALL FUELS

.1 Minimum Requirements:

.1 Chimney, ULC labelled, Type A, all fuels.

.2 Sectional prefabricated double wall with high temperature mineral wool insulation with mated fittings and couplings.

.3 Outer stainless steel casing, inner stainless steel liner.

.2 Accessories:

.1 Include for all required components necessary such as pipe lengths, tees, elbows, supports, roof flashing, storm collar, fire stop spacer, rain cap etc.

.3 Standard of Acceptance:

.1 Metalbestos Model SS

2.2 GAS VENT

.1 Minimum Requirements:

.1 Chimneys, ULC labelled, Type B, gas vent only.

.2 Sectional prefabricated double wall with mated fittings and couplings.

.3 Outer galvanized steel casing, intermediate air space, inner aluminum alloy liner.

.2 Accessories:

.1 Include for all required components necessary such as pipe lengths, tees, elbows, support plates, roof flashings, storm collar, wall thimble, firestop spacer, vent cap etc.

.3 Standard of Acceptance:

.1 Metalbestos RV - 75 mm to 200 mm [3" to 8"] I.D.

.2 Metalbestos TL - 250 mm to 300 mm [10" to 12"] I.D.

.3 Metalbestos CJ - 365 mm to 760 mm [14" to 30"] I.D.

2.3 VENT CONNECTORS

.1 Minimum Requirements:

.1 0.60 mm thick [24 gauge] galvanized steel up to 400 mm [16"] diameter.

2.4 EXPANSION COMPENSATORS

.1 Minimum Requirements:

.1 Multiply T321 stainless steel bellows construction.

.2 Telescoping stainless steel internal liner.

.3 Rated for minimum 3000 movement cycles.

.4 125# welded plate steel flanges.

.5 Minimum 75 mm [3"] axial movement.

.6 Suitable for continuous operation at maximum system pressure, temperature, and velocity.

.7 Suitable for continuous exposure to flue gases (natural gas and No.2 fuel oil).

.8 Minimum clear inside diameter to match breeching I.D.

.2 Standard of Acceptance: Flextech Industries Inc. Model FBXL-PP-CS-TL. Submit shop drawings.

3 EXECUTION

3.1 CHIMNEYS

.1 Install in accordance with manufacturers recommendations.

.2 Support chimneys at bottom, roof and intermediate levels as indicated. Install thimbles where penetrating roof, floor, ceiling.

.3 Install chimneys penetrating roofs as indicated, complete with flashings to suit installation.

.4 Install guy wires as necessary.

.5 Exposed metal parts outside building to be painted with heat and corrosion resistant primer and finish paint.

3.2 EXPANSION COMPENSATORS

.1 Install in accordance with the manufacturer's recommendations.

.2 Provide adjacent breeching sections with oversize flanges as required to maintain clear inside breeching diameter through the compensator.

END OF SECTION

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 REFERENCE STANDARDS

.1 Install packaged boiler(s) in accordance with current Regulations of the Province of B.C., CSA B51, ASME Codes, CSA B140.7.2., CAN1-3., Canadian Electric Code, CSA B139, CSA B139S1, CAN1-B149.1, ANSI B31.1, except where specified otherwise.

1.3 SUBMISSIONS

.1 Submit certificate of inspection from B.C. Safety Authority.

1.4 START UP

.1 Manufacturers representative to provide start-up and burner adjustment service and maintenance and operating instructions to Departmental Representative's maintenance staff. Test reports to be submitted for review and inclusion in maintenance manuals

2 PRODUCTS

2.1 GENERAL

.1 Packaged boiler: complete with burner and necessary accessories and controls, and ready for attachment of water supply, return and drain piping, fuel piping, electrical connections, and chimney connection. UL/ULC labeled.

.2 Designed and constructed in accordance with ASME Code requirements.

.3 The pressure vessels shall bear Canadian Registration Number (CRN) for The Province of British Columbia before being shipped from the factory.

.4 Electrical components CSA approved.

.5 The packaged boiler must receive factory tests to check the construction, controls, and operation of the unit. Boilers to be test fired before shipment.

.6 Include erection and wiring diagrams and an operating and maintenance manual with boiler package.

.7 Check all available drawings and ensure that the boiler proposed will fit in the space allotted and can be maintained and operated in a normal manner without difficulty.

2.2 BOILERS - CAST IRON

.1 Minimum Requirements:

.1 Package modular hot water heating boiler consisting of individual, self contained cast iron modules, each of which can operate completely independent of the other units.

.2 25 mm [1"] thick insulated steel jackets for assembly into one complete extended jacket, easily removable for servicing.

.3 Atmospheric type stainless-steel burners.

.4 Draft hood for each module.

.2 Accessories and Controls:

.1 Provide all standard items as described in the manufacturer's published product specification including the following:

.1 Combination gas valves which combines main shut-off cock, pressure regulator and main magnetic gas valve.

.2 Intermittent electronic ignition pilot.

.3 Electrically energized vent dampers.

.4 Gas regulator.

.5 ASME pressure relief valve(s).

.6 Temperature/pressure gauge.

.7 24 volt transformer for gas valve(s).

.8 Immersion high limit aquastat on each module.

.9 Common manual reset hi-limit. Penn A19ADB-2.

.10 Low water cut-off with manual reset and retard feature to prevent manual lock-out on short power interruptions. McDonnell Miller #902M.

.11 Supply and return headers with all necessary fittings and connections.

.12 Factory designed electronic boiler 2-stage control system to provide sequential firing of heating modules to maintain constant supply water temperature and to reset supply and water temperature in relation to outdoor temperature. Provide all necessary components including outdoor air sensor and supply water sensor.

.3 Note:

.1 All control wiring, line or low voltage shall be provided by the Controls Contractor.

.4 Standard of Acceptance:

.1 Hydrotherm Multi-Temp MR-B series.

.2

2.3 BOILER SEQUENCE CONTROL

.1 Hot Water Boiler Sequencing:

.1 Supply lead lag programming control to integrate the multiple boiler installation and automatically sequence the firing of the boilers in balance with changing load conditions.

.2 This control shall automatically program the individual boilers in or out of operation in response to temperature variations as sensed by a temperature sensor installed in the supply water header common to all boilers.

.3 The temperature sensor, through a controller, shall operate two ON-OFF pneumatic-electric (P.E.) switches, one for each boiler, each wired into its respective boiler control operating high limit cut-off (ON-OFF) control circuit. The P.E. switches shall be sequenced (see below) at a fall in flow water temperature to 200oF, 198oF respectively.

.4 A manual selector switch shall alternate the two boilers through the P.E. switches to the following sequence:

Sequence	Lead Boiler	Second Boiler
A	#1	#2
B	#2	#1

3 EXECUTION

3.1 INSTALLATION

.1 Install boilers on a 150 mm [6”] concrete housekeeping pad or concrete piers and level, as required.

.2 Do not deviate from required service and maintenance clearances as required by code.

.3 Mount unit level. Anchor boiler with bolts and inserts suitable for seismic loading.

.4 Make required piping and electric connections including any control wiring between boiler control panel and oil pump starter.

.5 Pipe relief valves and air vents on hot water boilers to floor drain.

.6 Burner pilot light shall be connected to "uninterruptible" gas supply on dual fuel (oil and gas) boilers.

.7 Start up procedures shall include boil out with phosphate free chemical as directed by the manufacturer.

.8 Natural gas fired installation to CAN1-B149.1-M86.

.9 Manufacturers representative to:

.1 Certify Installation.

.2 Provide start-up and burner adjustment service

.3 Carry out on-site performance verification tests.

.4 Provide maintenance and operating instructions.

.10 Test reports to be submitted for review and inclusion in maintenance manuals.

3.2 BOILER EFFICIENCY TEST

.1 Test boiler in accordance with the ASME short form test procedure after installation and hook up, but before handling units over to the Departmental Representative. Forward to the Departmental Representative for his approval all appropriate data and calculations. Make any and all alterations as necessary and repeat the tests as often as required until the test results prove that each unit performs as specified. Make all temporary connections, provide all meters, equipment and instruments, provide all departmental representative personnel required. Forward three (3) copies of the approved test results to the Departmental Representative.

4 EQUIPMENT SCHEDULE

UNIT NO	**B -1 & B-2**
INPUT (kW)	111
(MBH)	380
OUTPUT (kW)	95
(MBH)	325
PRESSURE:	
MAX.OPERATING (kPa)	414
(PSI)	60.00
MAX.COMBUSTION EFFI.	85.60%
HOT WATER SUPPLY TEMP.(ºC)	90
(F)	194
HOT WATER RETURN TEMP. (ºC)	74
(F)	164
NUMBER OF BURNER TUBES	8
OVERALL WEIGHT (KG)	542
BOILER WATER CONTENT(ltr)	48.3
DIMENSIONS BOILER SHELL	
OVER LENGTH (mm)	1007
OVERALL WIDTH (mm)	1010
OVERALL HEIGHT (mm)	1227
CONTROL	VITOGAS - 100
LIQUID PROPANE MIN.PRESS (kPa)	2.70
VOLTS/PHASE/Hz	115/1/60
MANUFACTURER	VIESSMANN
MODEL NO.	GS10-96

END OF SECTION

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 SOURCE QUALITY CONTROL

.1 Factory leak test air-cooled condenser coils at minimum gauge pressure of 2.4 MPa [350 psi].

.2 Factory leak test evaporator coils at minimum gauge pressure of 2.4 MPa [350 psi].

1.3 PERMITS AND QUALIFICATIONS

.1 Ensure that a permit is obtained before anyone commences to install or alter any refrigeration system.

.2 Every person who installs or makes alterations or repairs to a refrigeration system shall be the holder of a valid and subsisting refrigeration contractors licence and all persons repairing equipment with ODS/CFC's shall have completed an Environment Canada approved training program.

1.4 WARRANTY

.1 Contractor hereby warrants that refrigerant piping system loss of refrigerant and satisfactory operation of compressor will be in accordance with GC24, but for 5 years.

1.5 SHOP DRAWINGS

.1 Refrigeration trade shall prepare an electrical control schematic for each type of system (product refrigeration only) and submit shop drawings for review.

1.6 ELECTRICAL WIRING

.1 Refrigeration trade shall carry out and be responsible for all refrigeration control wiring unless otherwise noted, including all line voltage wiring from disconnect switch to units.

.2 Refrigeration trade shall provide electric heating tracer cable on drain lines in all cold rooms with temperatures below 1.7^{o}C [35^{o}F].

.3 Power wiring to units to be by the Electrical Contractor.

1.7 DELIVERY

.1 Ship equipment factory dehydrated and sealed with holding charge of refrigerant or dry nitrogen with tracer or a full charge of refrigerant and charge of lubricating oil.

2 PRODUCTS

2.1 CONDENSING UNITS - AIR COOLED

.1 General:

.1 Units shall be self-contained, packaged factory assembled and pre-wired suitable of outdoor use consisting of casing, compressor, condensing coil and fans, integral sub-cooling coil, controls, liquid receiver and screens.

.2 Casing:

.1 Heavy welded steel frame and galvanized steel panels, baked enamel finish.

.2 Removable access panels.

.3 Compressors:

.1 General:

.1 Provide compressor unit consisting of accessible hermetic motor-compressor with cylinder unloaders, crankcase heater, suction and discharge service valves, spring isolators and remote mounted control panel.

.2 Minimum Requirements:

.1 Construct compressor unit with cast iron housing and head, heat treated forged steel or ductile iron shaft, aluminum alloy connecting rods, automotive type pistons with rings to prevent leakage, high strength alloy suction and discharge valves and oil immersed sealing surfaces. Statically and dynamically balance rotating parts.

.2 Provide reversible oil pump lubrication system to ensure adequate lubrication during starting, stopping and normal operation.

.3 Provide compressor with automatic capacity reduction equipment consisting of suction valve unloaders. Lifting mechanism shall be operated by (oil pressure) (gas discharge pressure) (solenoid valve). Provide for unloaded compressor start.

.4 Compressor motor shall be constant speed 1750 r/min., suction gas cooled, with overheating protection designed for full voltage starting complete with starter.

.5 Provide crankcase heater to evaporate refrigerant returning to crankcase during shut down. Energize heater when compressor is not operating. Provide separate power connection.

.6 Provide secure attachment points for seismic anchoring.

.3 Controls:

.1 Provide the compressor with adjustable high and low-pressure cutouts and an automatic differential oil pressure safety control.

.2 Factory wired steel control panel shall contain automatic and manual capacity controllers, switches for manual or automatic operation of oil pump, switch and pilot light for crankcase heater, terminal strip for connection to interface equipment, and gauges to show high pressure, low pressure and oil pressure.

.4 Refrigerant Circuit:

.1 Liquid line filter drier(s).

.2 Liquid line service valve(s) with gauge port.

.3 Suction line service valve(s) with gauge port.

.5 Condenser:

.1 Direct drive propeller fans.

.2 Fan safety guards.

.3 Condenser coil with aluminum fins bonded to copper tubes.

.4 Head pressure control to enable unit to operate at a low ambient temperature.

.6 Controls:

.1 Factory wired in separate enclosure.

.2 24 volt control circuit, control power transformer.

.3 Magnetic contactors for compressor(s) and fan(s).

.4 Overload devices for compressor(s) and fan(s).

.5 Anti-short cycle timer.

.6 High and low pressurestats.

.7

.8

2.2 COOLING COIL

.1 General:

.1 Submit shop drawings.

.2 Product

.1 Direct expansion “A” type coil.

.2 Nominal 9.5 mm copper seamless tubing with bonded aluminum fins.

.3 Ratings: ARI-210 certified.

.4 Fins: Aluminum fins continuous across entire coil width, with full fin collars for maximum fin-tube contact and even spacing. Fins mechanically bonded to tubes. Fins not to exceed 12 in 25 mm.

.5 Tubes: 16 mm O.D. seamless copper tubes with return bends brazed into tube ends.

.6 Casing: Galvanized steel, formed end supports and top and bottom channels with additional center support on coils over 1067 mm.

.7 Distributor: Compatible with condensing unit.

.8 Testing: To Canadian Refrigeration Code. Dehydrated, sealed with nitrogen charge.

3 EXECUTION

3.1 GENERAL

.1 Install and test in accordance with the B.C. Refrigeration Code and CSA B52.

3.2 INSTALLATION

.1 Clearances: provide clearance around unit for service and maintenance.

.2 Provide condensate drains complete with necessary drain trap from equipment to floor drains.

.3 Anchor unit with attachments suitable for seismic loading.

3.3 START-UP AND ADJUSTMENT

.1 Supply initial charge of refrigerant and oil for each refrigeration system. Losses of oil or refrigerant prior to acceptance of equipment or due to defects covered under guarantee shall be replaced.

.2 Charge the system with refrigerant and test entire system for leaks after completion of installation. Repair leaks; put system into operation and test equipment performance.

.3 Test and record cooling apparatus entering and leaving air temperatures, dry bulb and wet bulb.

.4 Test and record voltage and running amperes and compare to motor nameplate data, and starter heater rating against design requirements.

.5 Ensure that refrigerant temperatures are accurate to within 0.5°C [0.9°F] of design requirements.

.6 Shut-down system if initial start-up and testing takes place in winter and machines are to remain inoperative. Repeat start-up and testing operation at beginning of first cooling season.

.7 Provide cooling season start-up, winter season shut-down for first year of operation.

.8 Test reports to be submitted for review and inclusion in Maintenance Manuals.

3.4 CONDENSING UNIT AIR COOLED

.1 Install condensing unit on concrete foundation with sole plates, concrete inertia base, seismic restraints and spring isolators, level, grout and bolt in place.

.2 Arrange piping for easy dismantling.

3.5 COOLING COIL

.1 Locate in AHU-1

.2 Install DX coil to provide ”draw through” configuration.

.3 Provide airtight seal between coil and duct or unit cabinets.

.4 Cooling coil supports shall use Type 304 stainless steel.

.5 All bolts and fastenings shall be stainless steel.

.6 Provide coil drain pans under all coils; not just cooling coils. Drain lines for coils other than cooling coils may be capped outside of unit casing.

.7 Ensure coils and fins and flanges are not damaged. Replace loose and damaged fins. Comb out bent fins unless they need to be replaced.

.8 Drain line from drain pans shall be minimum NPS13/4.

.9 Pipe drain lines to floor drain with deep seal trap and trap primer.

.10 Provide 6 mm [1/4"] petcock cracked open for continuous air venting on steam face and bypass coils.

.11 Face and bypass coils shall be connected to condensate piping with braided flexible hose.

.12 Demonstrate to the Departmental Representative that all face and bypass dampers fully open and fully enclose the coil sections.

4 EQUIPMENT SCHEDULE

Unit No.	**CC-1**
Type	DX Coil
Cooling Capacity	20 tons (nominal)
Coil net face area M2	1.93
Tube diameter	12.7 mm
Number of rows	6
Fin spacing	276/m
Air flow	3777 ℓ/s
Air velocity	2.20 m/s
EDB	26.67 ºC
EWB	19.50 ºC
LDB	13.37 ºC
LWB	12.97 ºC
Refrigerant	R-410c
Liquid Temp.	46 ºC
Suction Temp.	7.2 ºC
Based on	TRANE indoor M-series climate changer air handler

Unit No.	**CU-1**
Type	Air Cooling
Location	North side of building
Capacity	70 kW (20 tons)
Refrigerant charge	R410c
Suction connection OD	40 (1 5/8”)
Liquid connection OD	16 (5/8”)
Condenser Coil	
Tube size mm (in) OD	Plate Fin
Face Area M2 (sf)	4.9 (52.9)
Rows/ mm/25mm	2 / 9
Condenser Fan	
No. Used / Diameter mm (in)	2 / 711(28”)
Air volume L/S (CFM)	6893 (14600)
Motor hp	2 x 1.00 HP
RPM	1100
Power supply	208 V, 60 cycles, 3 phase
MCA	98A
Based on	Trane OdyssevTm split system units(SSC2)

5 PACKAGED AIR CONDITIONING UNIT

Tag	AC-1
Service	Server Room
Location	Ceiling Space
Manufacturer	Liebert
Nominal Capacity (Btu/hr)	1 Ton
Indoor Unit	AC-1
Model	MMD12E
Capacity (Btu/hr)	
Total	14,100
Sensible	11,600
Air Flow (CFM)	600
External Static Pressure (in. wg)	0.3
Fan Motor (HP)	0.2
Electric Reheat (kW)	3.6
Footprint (in.)	
Height (in.)	
Weight (lb.)	
Humidifier	
Capacity (lb/hr)	
Type	Steam Generating
Reheat Capacity (KW)	11.5
Refrigerant Type	R-407C
Electrical (V/ph/Hz)	208/1/60
Full Load Amps (FLA)	25
Wire Sizing Amps (WSA)	31.3
Breaker Size (OPD)	35
Remarks	1,2,3,4,6,7
Outdoor Unit	CU-2
Model	PFC014A
Compressor	
QTY	Scroll / 1
Refrigerant Type	R-407C
Condenser	Air Cooled
Footprint (in.)	
Height (in.)	
Weight (lb.)	
Electrical (V/ph/Hz)	208/1/60
Full Load Amps (FLA)	8.5
Wire Sizing Amps (WSA)	10.6
Breaker Size (OPD)	15
Remarks	2, 4, 5, 6

Note:
Factory installed disconnect switch.
Factory installed starter.
Field installed leak detection sensor.
Head Press Control.
Hot gas bypass.

1. Control to be BACNet Compatible.
2. Field installed filter section.

END OF SECTION

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 QUALITY ASSURANCE

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards

2 PRODUCTS

2.1 HEAT RECOVERY VENTILATORS - ROTARY TYPE

.1 General

.1 Factory packaged, self-contained and pre-wired unit, CSA certified (bearing CSA sticker).

.2 Packaged heat recovery ventilator consisting of a rotary type heat exchanger, ventilation air fan, exhaust air fan, necessary dampers, temperature sensors and controls, suitable for operation with low outdoor air temperatures (-40oC [-40oF]).

.3 Units shall be listed per UL1995 and bear the UL label.

.4 Energy transfer ratings of the energy recovery wheel shall be ARI Certified. Tested and rated in accordance to AMCA 210, ARI 1060 and ASHRAE 84-91 Test procedures for airflow and thermal effectiveness.

.5 Performance shall be as scheduled.

.6 Single point power connection only, voltage as identified in the schedules.

.7 All units shall be run tested prior to shipment.

.8 Unit shall be capable of providing a constant volume of air at a specified external static pressure at all wheel operating speeds.

.9 The unit shall be warranted to be free from defects in material and workmanship for a period of five years from the purchase date.

.2 Cabinet

.1 Unit shall include pre-painted galvanized steel finish. Cabinet shall withstand 10 years without cracking, chipping, peeling, brazing or spotting.

.2 All panels exposed to the weather shall be a minimum of 1.19 mm [18 ga] galvanized steel.

.3 Unit shall be internally lined with galvanized sheet metal creating a double wall.

.4 Where top panels are joined there shall be an overlapping, standing seam to ensure positive weather protection.

.5 All metal-to-metal seams shall be factory sealed, requiring no caulking at job site.

.6 Unit base to be designed for curb mounting. Unit base shall overhang the curb for a positive seal against water run-off.

.7 Cabinet shall be insulated throughout with a minimum 25 mm [1"] foil faced fire retardant material.

.8 Main access panels shall be hinged and provide access to all components requiring servicing.

.9 Outdoor and exhaust side filters with service access. Provide MERV 13 minimum efficient air filters.

.3 Fans

.1 Supply air and exhaust air fans with separate single speed motors, in draw-through configuration.

.2 Fan ratings are based on tests made in accordance with AMCA Standard 210.

.3 Fans must be selected to operate on a stable, efficient part of the fan curve when delivering air quantities scheduled against static of the system.

.4 Fan shafts shall be mounted in permanently lubricated, sealed ball bearing pillow blocks. Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at maximum cataloged operating speeds

.5 Fan blades shall be statically and dynamically balanced and tested prior to shipment.

.6 Fan shall be provided with internal vibration isolation mounts.

.7 Motors shall be continuous duty, permanently lubricated and matched to the fan loads. Motor selection shall include a 15% service factor.

.8 Adjustable sheaves on belt-driven fans with motors less than 10 hp shall allow independent balancing of exhaust and supply airflows.

.4 Energy Recovery Wheel

.1 Wheel shall be of the enthalpy type for both sensible and latent heat recovery and be designed to ensure laminar flow. Energy recovery device shall transfer moisture entirely in the vapor phase.

.2 Energy transfer ratings must be ARI Certified to Standard 1060 and bear the ARI certification symbol for ARI Air-to-Air Energy Recovery Ventilation Equipment Certification Program based (Ratings "in accordance with 1060" without certification are not acceptable).

.3 Wheel design shall consist of removable segments for ease of service and/or cleaning Wheel shall be constructed of lightweight polymer media to minimize shaft and bearing loads. Polymer media shall be mounted in a stainless steel rotor for corrosion resistance.

.4 Desiccant shall be silica gel for maximum latent energy transfer. Silica gel desiccant shall be permanently bonded to wheel media to retain latent heat capability after cleaning. (Wheels with sprayed on desiccant coatings, or with desiccant applied after wheel formation are not acceptable.)

.5 Energy recovery drive belt material shall be high strength urethane and shall be factory installed in a pre-stretched state, eliminating the need for field belt tension adjustment. Refer to Belt Drive Requirements.

.6 Cross leakage of less than 1%.

.7 Fifteen year warranty on flat plate heat exchanger

.5 Hot water coil

.1 Hot water coil shall be factory tested and rated in accordance with ARI 410.

.2 Coils shall have copper tubes with permanently expanded aluminum fins, 10 fins per inch or less.

.6 Controls

.1 Unit shall be provided with factory mounted and factory wired control, requiring only field connection to the building DDC system and/or remote sensing devices and wiring to unit mounted terminal strips.

.2 All service connectors shall be quick disconnect type.

.3 Unit circuitry shall allow the following operational characteristics: dry contacts for occupancy control, remote fan interlock on call for ventilation, selection of low or high speeds, remote sensor contacts, interlock with building DDC system. Dry contacts for all control functions to be building DDC system compatible.

.4 Controls will receive building DDC system on/off signal, and shall control operation of each fan independently.

.5 Dirty filter contacts

.6 Rotary wheel independent speed control, building DDC system compatible.

.7 Accessories

.1 Frost Control Options:

.1 Variable wheel speed (Unit shall have an energy recovery wheel speed control, controlled to prevent frost buildup on the wheel).

.2 Corrosion resistant external finish suitable for outdoor installation.

.3 Two speed fan.

.4 Duct-Mounted Smoke Sensor with controller for field installed control of fan operation.

.5 Flow Measuring Station.

3 EXECUTION

3.1 HEAT RECOVERY VENTILATORS INSTALLATION

.1 Install in accordance with manufacturer’s recommendations.

.2 Start-up Heat Recovery Ventilators in accordance with manufacturer’s start-up instructions. Provide start-up report to the Departmental Representative, and include in O & M manual.

4 EQUIPMENT SCHEDULE

HEAT RECOVERY UNITS
CUSTOM BUILT

UNIT NO	**HRV-1**
LOCATION	Mech. Room
COMPONENTS:	
O.Air Damper	Yes
Exh. Air Damper	Yes
Filter Type	Flat
Insulation	1.5lb insulation
Panel wall type	Solid double wall
Prefilter-type	Pleated Media-MERV 7
Primary Filter type	Cartridge 85% eff-MERV 13
Access / inspection door	Right
Filter air flow (l/s)	1410
Mid - life prefilter PD	157 Pa
Prefilter PD	157 Pa
Filter area	1.85sm
Fan Module	
Supply fan	
Motor (hp)	5 HP
Motor RPM	1800 RPM
Motor CLASS	ODP E + motor
Motor voltage	208 / 3
Cycle	60 cycly/sec.
E.S.P (Pa)	275
Fan airflow (l/s)	1410
Min. temp. (°C)	-12
Design Temp.(°C)	7
Exhaust fan	
Motor hp	2 HP
Motor RPM	1800 RPM
Motor CLASS	ODP E + motor
Motor voltage	208 / 3
Cycle	60 cycly/sec.
E.S.P	200 Pa
Fan airflow (l/s)	1410
Min. temp. (°C)	-12
Design Temp.(°C)	21

HEAT RECOVERY UNITS
CUSTOM BUILT

UNIT NO	**HRV-1**
Energy recovery module	
Type	Energy Wheel
Wheel size	1410 l/s
Insulation	1.5lb insulation
Motor voltage	208 / 3
Cycle	60 cycly/sec.
Variable effectiveness	yes
Winter outside EDB (°C)	-14
Winter outside EWB (°C)	-15
Winter ventilation DB (°C)	10.61
Winter ventilation WB (°C)	5.47
Winter ventilation RH	44.17%
Winter supply LDB (°C)	10.61
Winter supply LWB (°C)	5.47
Winter supply RH	44.17%
Winter return EDB (°C)	21.22
Winter return EWB (°C)	11.67
Winter exhaust LDB (°C)	-2.67
Winter exhaust LWB (°C)	-4.2
Total efficiency	70.15%
Out side air ESP (Pa)	50
Return air ESP (Pa)	200
Supply air wheel PD (Pa)	300
Exhaust air wheel Pd (Pa)	300
Pre-heat coil module	
Type	Horizontal coil
Insulation	1.5lb insulation
System type	30% Glycol heating water
EDB (°C)	10.61
LDB (°C)	25.55
Total capacity (kw)	34
Entering fluid Temp.	82.22 °C
Fluid Temp. Drop	11.11 °C
Standard fluid flow rate	1.7 l/s
Air pressure drop (Pa)	35
Reference Module	Indoor M-series Climate Changer air handler
MANUFACTURER	Trane

Note :
1. Provide defrost control as per spec.

END OF SECTION

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 QUALITY ASSURANCE

.1 Unit and major components shall be product of the same manufacturers regularly engaged in production of such units who issues complete catalogue data on such products.

.2 Unit shall be factory built, and carry all necessary approvals. Coils shall be water tested and ARI certified. Fan shall be run and tested to performance. Test results shall be submitted for vibration sound and airflow performance.

.3 Allow travel costs for Departmental Representative to inspect unit(s) at the factory prior to shipping to. Provide 5 working days notice to the Departmental Representatives to schedule this trip.

.4 Review project schedule and ensure that shop drawing submission and review unit delivery is compatible with project requirements. Allow a minimum of 6 weeks for shop drawing review process.

.5 Manufacturers shall provide construction methods to achieve sound data as specified and provide data obtained by either:

.1 AMCA lab simulation

.2 Test data of actual unit

.3 All sound data shall be measured and provided in accordance with ARI Standard 260P

1.3 SUBMITTALS

.1 Provide all technical information relevant to the product being provided, including but not limited to all the information shown in the schedules.

.2 Product data shall include dimensions, weights, capacities, certifications, casing construction details, gauges and finishes of material.

.3 Submit fan curve details, showing operating points at clean filter, dirty filter and mid-point loaded filter with the parameters specified. Select fans at maximum efficiency for specified duty.

.4 Submit sound power levels for air handling unit inlet and outlet and casing radiation at rated capacity in accordance with AMCA.

.5 Shop drawings shall include motor efficiencies for all motors. Refer to Section 15010 for minimum motor efficiencies.

.6 Submit each air-handling unit on a separate 1:25 scale drawing showing construction details and dimensions of entire unit and internal components.

.7 Submit manufacturer's recommended installation instructions.

1.4 GENERAL

.1 Motors powered by variable speed drive controllers shall be EEMAC Class B with Type F insulation, shall have a 1.15 service factor and shall be suitable to be driven by PWM variable speed drive controllers. The motor manufacturer shall submit in writing confirmation that the motors are designed to withstand voltage peaks of 1400 volts and a voltage rate of rise of 2000 volts / microsecond at a frequency of 20 kHz.

2 PRODUCTS

2.1 AIR HANDLING UNIT

.1 General

.1 Factory fabricated and assembled modular components as indicated. Field fabrication of the units will not be accepted. Field assembly of unit sections is acceptable if the unit cannot be installed as a single unit. Include for cost of any field assembly.

.2 Overall dimensions and configurations are to be as shown on the plans. However, such a constraint, as this may impose, does not absolve the manufacturer from responsibility for the engineering, operational integrity and performance of the unit provided.

.3 Unit shall carry all necessary approvals.

.4 Refer to Section 15960 - Mechanical Schedules for capacity requirements / design parameters / component type. All other features normally required for complete and safe operation are an implicit requirement and shall be included.

.2 Electrical

.1 Wiring shall be factory CSA approved.

.2 Complete factory power wiring in EMT conduit from motors and lights to point power connections.

.3 Provide one 120volt/1Phase connection to a junction box for marine lights.

.4 Provide power connections from each fan motor to junction boxes on the outside of the unit casing.

.5 Electrical Contractor to provide disconnects, starters and power wiring to unit junction boxes. If variable speed drives are used (provided by and installed by Division 23), Division 26 shall wire to disconnect switches (could be integral with VSD) and from disconnect switches to VSD's and from VSD's to motor junction boxes. If a disconnect is placed between a VSD and the motor, an auxiliary sets of contacts is required to let the VSD know that it has been shut off.

.6 Provide power connections from each fan motor to VSD’s and to junction boxes on the outside of the unit casing for indoor units.

.7 Provide factory installed empty 25mm [1”] conduit throughout the length of the unit with J-boxes in each section for control contractor’s use.

.3 Mounting Frame

.1 Casings shall be supported on welded structural channel supports designed for support of entire unit without deflection.

.2 Steel base shall be suitable for seismically bolting unit to roof curbs or house keeping pads or welding unit to embedded steel plates in concrete roof curbs or house keeping pads/curbs. Refer to 15242 for seismic restraint requirements.

.3 Integral lifting lugs for hoisting.

.4 Unit(s) shall mate to the concrete mounting curb provided under Division 3. When flashed to the mounting curb it shall provide a weatherproof whole.

.5 Provide suitable means for seismically securing units.

.4 Floor

.1 Plenum floors shall be rigid of welded construction using, as a minimum, structurally reinforced 2.52 mm [12 ga] M.S. checker plates; be free from dishing and be formed as a drain pan with a standing upturned angle. All seams and corners shall be continuously welded. Floor shall be completely flooded after assembly and written certification submitted by the manufacturer indicating that there are no leaks.

.2 Floor shall be finished with two-component epoxy polyamide non-skid paint.

.3 All pipe/duct penetrations through the floor shall have minimum 40 mm [1½"] sleeve up-stand, welded.

.4 Removable open gratings shall be provided over all floor openings.

.5 The underside of the base shall be insulated with 50mm [2"] thick 64 kg/cu.m [4 lb/ft^3] density glass fibre acoustic insulation.

.5 Drain Pans

.1 Coil drain pans of 1.47 mm [16 ga] minimum stainless steel shall be recessed into the floor and shall be an integral part of the floor paneling, a minimum of 150 mm [6"] and 50 mm [2"] deep respectively with welded corners. Drain pans under each "wet" coil must extend upstream and downstream as required to ensure no carryover. Drain pans shall also extend under cold coil headers and return bends.

.2 The drain pan shall be sloped to outlet and outlet pipe bottom invert shall be below bottom of pan. The drain pan shall be provided with an interior 32 mm [1-1/4"] copper pipe drain piped to the outside of the unit.

.3 Provide drain pans under all coil banks to allow for cleaning. Cap all drain connections at exterior of unit for dry coils.

.4 Provide information to Contractor indicating minimum required exterior trap depths.

.6 Access Doors

.1 Access doors shall be provided for access to all internal parts, fully lined, with welded steel door frame and Ventlock310 latches c/w front and inside handles and front door pull. Arrange access doors so that they open against the airflow and static pressure. Door seal shall be close cell neoprene bulb type.

.2 Doors shall be 600 mm [24"] wide by 1500 mm [60"] high unless casing size requires a shorter door or equipment removal requires a wider door.

.3 Access doors shall include 250 mm [10"] diameter windows. Windows should be a maximum of 1700mm from roof or mechanical room floor.

.7 Fans

.1 Fan sections shall be equipped with a structural steel channels located under the isolator loads to add rigidity, eliminate floor deflection, and distribute loads to the perimeter structural channel.

.2 Centrifugal fans shall be rated in accordance with AMCA Standard Test Code Bulletin 210. Fans shall bear the AMCA sticker.

.3 All fans and fan assemblies shall be dynamically balanced during factory test run.

.4 Fan shafts shall be selected for stable operation at least 25% below the first critical RPM.

.5 Backwardly inclined and airfoil fans shall be used.

.6 Bearings: Heavy-duty pillow-block grease lubricated ball or roller self-aligning type. Bearings shall have an average life of 200,000 hours at design operating conditions in accordance with AMSI B3.15. Inboard bearing lube line shall be extended to the outboard bearing.

.7 Bearing support shall be from a rigid structural steel base frame. This frame shall be internally isolated and seismically restrained from the fan cabinet structural frame.

.8 Drives shall be adjustable on fans with motors 5 H.P. or smaller. On fans with motors above 5 H.P. fixed drive shall be provided. Include for one sheave change per fan, during the air balance procedure.

.9 Drives shall be selected for 150% of motor nameplate horsepower and including 2 belts minimum.

.10 Sheaves shall be keyed to drive shafts.

.11 Motor mounting shall be adjustable to allow for variations in belt tension.

.12 Plenum fan assemblies fully enclosed with expanded mesh screen, approved to WCB Standards.

.13 Belt drives with belt guards c/w tachometer holes.

.14 Fan inlet safety screens.

.8 Vibration Isolation

.1 Vibration isolators and seismic restraints shall be in strict accordance with Section 15241 – VIBRATION ISOLATION. Substitute vibration isolators will not be accepted.

.9 Control Dampers

.1 Control dampers to be T.A. Morrison – (1000) airfoil or Ruskin CD-50.

.2 Control dampers to be located on the inside of the unit so that damper actuators are accessible from inside the unit.

.3 For mixing plenums, arrange dampers to enhance mixing of air streams.

.10 Coils - Liquid

.1 Refer to Section 15735 for requirements.

.2 Coils (except cooling coil) shall be fully enclosed within casing and mounted on epoxy primed and painted angle iron racks manufactured to allow coils to slide out or allow. No air bypass around coils will be permitted.

.3 Support racks for cooling coils shall be 304 S. Steel.

.4 Removable coil access panel(s) to permit removal of coil through casing wall. Provide individual access panel for each coil section as it should not be necessary to disconnect all coil sections to remove an access panel for removal of a single coil section.

.11 Louvres/Hoods

.1 Outside louvers and hoods with 25mm [1”] birdscreen.

.12 Filters - General

.1 Filter media shall be ULC listed, Class I or Class II.

.2 Filters: suitable for air at 100% RH and air temperatures between 3^{o}C [37^{o}F] and 50^{o}C [122^{o}F].

.3 Efficiency: based on ASHRAE 52-76, atmospheric dust spot efficiency.

.4 Dust holding capacity: Air Filter Institute (AFI) Test.

.5 Representative filters shall have been tested by an independent test laboratory and test results shall be made available on request.

.6 Filter identification shall be clearly marked on each filter.

.7 Provide two (2) sets of filter media (for each filter) -one for installation and one for handover to the Departmental Representative as a spare. Obtain signed receipt.

.8 Filter holding frames fabricated from 1.6 mm [16 ga] galvanized steel with spring retaining clips and neoprene gaskets.

.9 No air bypass around filter frames will be allowed. Provide access space for servicing all filters. Install filter slide rails and doors for side access where required.

.10 Each filter section shall be designed to receive standard sized filters only. The use of odd-sized filters is not permitted.

.13 Filters - Panel Type

.1 Minimum Requirements:

.1 50 mm [2"] thick disposable pleated cotton media.

.2 Enclosing frame shall be constructed from rigid, heavy duty high wet strength beverage board with diagonal support members bonded to both sides of each pleat.

.3 Efficiency: 25% to 30%

.2 Standard of Acceptance:

.1 AAF AM-AIR 300, Farr 30/30.

.14 Filters - Final

.1 Minimum Requirements:

.1 300 mm [12"] deep disposable pleated fine glass fibre media.

.2 Rigid galvanized steel enclosing frame.

.3 Efficiency: as scheduled.

.2 Standard of Acceptance:

.1 AAF Varicel, Farr Riga-Flo.

.15 Filter Gauges

.1 Application:

.1 Across each filter bank. (Provide 2 individual gauges for combined panel and final filter banks).

.2 Minimum Requirements:

.1 Ranges: Panel filters - 0-250 Pa [0-1" w.g.]; Final filters: 0-500 Pa [0-2" w.g.].

.3 Sensing probes and shut off vent valves for each filter bank. Provide space between filter banks for pressure sensing.

.4 Standard of Acceptance:

.1 Dwyer Series 2000.

.2 Dwyer Photohelic Series 3000 (Where filter pressure drop is monitored by the B.M.S).

.16 Implosion / Explosion Doors

.1 Doors shall be in accordance with W.C.B. Regulations, constructed as for hinged access doors.

.2 Latches shall be Brixon Safety Latches (Brixon Manufacturing Co., 859 North Prior Avenue, St. Paul, Minnesota, 55104. Available in Vancouver from Air Systems Supplies).

.3 Latches shall be complete with handles and shall have an adjustable release force as follows:

Latch Model	Release Force Range\
2H	2.3 to 15 kg [5 lbs. to 33 lbs.]
3H	9 to 82 kg [20 lbs. to 180 lbs.]
4H	20 to 118 kg [45 lbs. to 260 lbs.]

.4 Refer to drawings for locations of implosion / explosion doors and required number of latches.

.5 Provide heavy duty safety chains to limit door swings.

.6 Adjust tensions on implosion / explosion door latches so that doors open at a static pressure differential not greater than 500 Pa [2" w.g.] above / below the specified static pressure rating of the plenum.

.7 Perform tension tests on doors to verify that doors open at the settings on the latches.

.8 Adjust tensions on latches, if necessary and permanently mark the final setting of adjustment screws.

.17 Heat Recovery Units

.1 Provide packaged heat recovery units as specified in the schedules.

.2 Provide access to unit for cleaning.

.3 Provide integral drain pan in floor under entire unit with exterior drain connection.

.4 Provide by-pass dampers for:

.1 100% outside air flow not through unit.

.2 100% by-pass of warm air stream (return air) when not needed.

.3 Freeze/frost protection.

.18 Variable Speed Controllers

.1 For smaller V.S.D.'s which are suitable for unit mounting provide suitable stand-off panels on outside of AHU casing for field mounting of variable speed drive units. Provide rubber grommet isolators at attachment points to AHU casing.

.19 Plenum Cleanliness

.1 Wash clean all plenums and corridor areas before shipping.

3 EXECUTION

3.1 UNIT INSTALLATION

.1 Where air units are fabricated and shipped in component sections, the components shall be field assembled using bolted, gasketted companion flanges to make a single airtight unit. Test for leakage and seal as required.

.2 Install units as indicated and to manufacturers' recommendations.

.3 Maintain proper clearance around equipment to permit performance of service maintenance, coil removal and repair.

.4 Make ductwork, piping, and wiring connections to the unit in accordance with the drawings.

.5 Pipe from condensate drains to drain complete with trap. Install unit so that the curb / housekeeping pad height is sufficient to accommodate depth of 'P' trap.

.6 Install suspended unit with bracing or cable restraints to accommodate seismic loading.

.7 Seismically secure floor mounted AHU’s to curbs or house keeping pads by either bolting or welding to embedded steel plates. Ensure curbs/housekeeping pads are securely attached to structure.

4 EQUIPMENT SCHEDULE

AIR HANDLING UNITS

UNIT NO	**AHU-1**
LOCATION	Mech. Room
COMPONENTS:	
O.Air Damper	Yes
Min. O.AIR Damper	Yes
R.Air Damper	Yes
Exh. Air Damper	Yes
Filter Type	Flat
Insulstion	1.5lb insulation
Panel wall type	Solid double wall
Prefilter-type	Pleated Media-MERV 7
Primary Filter type	100 mm high eff-85% eff-MERV 13
Access / inspection door	Right
Filter air flow	3760 l/s
Mid - life prefilter PD	157 Pa
Prefilter PD	157 Pa
Filter area	1.85sm
Heating Coil	Horizontal coil
Coil casing	Galvanized
Air flow	3760 l/s
EDB	7.2 °C
LDB	22.8 °C
Air pressure drop	24.9 Pa
Entering fluid Temp.	82.22 °C
Fluid Temp. Drop	11.11 °C
Standard fluid flow rate	1.52 l/s
Coil fin type	Prima-Flo H
Coil fin material	Aluminum
Face velocity	2.73 m/s
Face area	1.36 sm
Cooling Coil (DX)	CC-1 Refer to section 23 62 00 for CC-1 schedule
Fan Module	
Supply fan	
Motor hp	15 HP

AIR HANDLING UNITS

UNIT NO	**AHU-1**
Motor RPM	2244 RPM c/w VSD
Motor CLASS	Energy eff. open drip proof motor c/w VSD
Motor voltage	208 / 3
Cycle	60 cycly/sec.
E.S.P	300 Pa
Fan airflow	3760 l/s
Min. temp. (°C)	-12
Design Temp.(°C)	7
Return fan	
Motor hp	5 HP
Motor RPM	1703 RPM c/w VSD
Motor CLASS	Energy eff. open drip proof motor c/w VSD
Motor voltage	208 / 3
Cycle	60 cycly/sec.
E.S.P	175 Pa
Fan airflow	3760 l/s
Min. temp. (°C)	-12
Design Temp.(°C)	21
Module	Indoor M-series Climate Changer air handler
MANUFACTURER	Trane

SEE NOTE(S)

1. Custon Built Air handling Unit - See Specification Section 23 73 11
2. Refer to Component schedules for Details.

END OF SECTION

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 WARRANTY

.1 Refrigeration compressors to be warrantee for five [5] years.

2 PRODUCTS

2.1 AIR CONDITIONING UNITS - LAN ROOM

.1 General:

.1 Packaged unit for ceiling mounting and sized to fit 600 mm x 1200 mm [2 ft. x 4 ft.] Tee-bar grid ceiling opening.

.2 Cabinet:

.1 Zinc coated cabinet with baked enamel finish insulated with 25 mm [1"] thick insulation.

.2 Hinged supply and return grilles.

.3 All components shall be serviceable through removable side panels and hinged grilles.

.4 25 mm [1"] thick disposable air filters.

.3 Fan:

.1 Centrifugal double width, 3 speed direct drive fan.

.4 Refrigeration System:

.1 Fully protected heat pump duty rated hermetic compressor with vibration isolation, seamless copper tube, aluminum fin evaporator coil stainless steel condensate pan, expansion valve with external equalizer, filter drier, manual reset high head pressure switch and refrigerant sight glass.

.5 Condenser:

.1 Coaxial, counter flow design made to ASME specifications. Condenser shall be piped into the refrigeration system. Head pressure shall be controlled by an adjustable head pressure actuated 2-way regulating valve.

.6 Electrical:

.1 Electrical components including all contactors, relays, control transformers and capacitors shall be prewired and mounted within the hermetic cooling section. Terminal blocks shall be provided for both control and power connections. A "Liqui-Tect" sensing device shall be installed at the evaporator drain pan to stop unit operation prior to an overflow condition.

.7 Controls:

.1 A remote control panel shall be provided with thermostat and a system on/off switch.

.2 The thermostat and on/off switch shall be mounted in the return air stream.

3 EXECUTION

3.1 GENERAL

.1 Install units as indicated and to manufacturers' recommendations.

.2 Provide and install all necessary refrigerant piping and electrical connection between "split" units.

3.2 EQUIPMENT PREPARATION AND START-UP

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

3.3 AIR CONDITIONING UNITS - LAN ROOM

.1 Co-ordinate installation of computer room air conditioning unit with computer room raised floor installer. Position air outlets to suit computer equipment locations.

.2 The refrigeration contractor shall install and terminate interlock wiring between the air conditioning units and the associated remote condensing units on the roof.

.3 Provide a condensate drain trap at each unit. The inlet leg of the traps should be a minimum of 25 mm [1"] higher than the outlet leg.

.4 Condensate drain piping should be graded towards the plumbing drain at minimum 1:200 [1/16 inch per foot].

.5 Install remote control panel, liquid detection panel.

.6 Secure unit and floor stand to structure in accordance with seismic loading requirements

.7 Manufacturers representative to check out and start up units.

4 EQUIPMENT SCHEDULE

SPLIT UNITS FOR SERVER ROOM

UNIT NO	**AC-1**
LOCATION	Server Room
TOTAL (kW)	3.63
(BTUh)	12400
SENS. (kW)	3.19
(BTUh)	10900
SUPPLY FAN:	
AIR FLOW HIGH (L/s)	283
(CFM)	600
AIR FLOW LOW (L/s)	227
(CFM)	480
FAN MOTOR (HP)	0.20
(W)	149.00
MODEL NO	MinMate2-MMD12E
	CU-2
FAN MOTOR (HP)	0.20
(W)	149.00

SPLIT UNITS FOR SERVER ROOM

UNIT NO	**AC-1**
AIR VOLUME (L/S) (CFM)	1039.00 2200.00
VOLTS/PHASE/Hz	208/1/60
REFRIGERANT CHARGE	R410a
MODEL NO	MinMate2-PFC014A
MANUFACTURER	Liebert MinMate2

END OF SECTION

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 PRODUCTS

2.1 COILS - DIRECT EXPANSION

.1 Ratings: ARI certified.

.2 Fins: Aluminum fins continuous across entire coil width, with full fin collars for maximum fin-tube contact and even spacing. Fins mechanically bonded to tubes. Fins not to exceed 12 in 25 mm [1"].

.3 Tubes: 16 mm [5/8"] O.D. seamless copper tubes with return bends brazed into tube ends.

.4 Casing: Galvanized steel, formed end supports and top and bottom channels with additional center support on coils over 1067 mm [42"].

.5 Distributor: Compatible with condensing unit.

.6 Testing: To Canadian Refrigeration Code. Dehydrated, sealed with nitrogen charge.

2.2 COILS - LIQUID

.1 Ratings: ARI Standard 470-72 certified.

.2 Fins: Aluminum fins continuous across entire coil width, with full fin collars for maximum fin-tube contact and even spacing. Fins mechanically bonded to tubes. Fins not to exceed 12 in 25 mm [1"].

.3 Tubes: 16 mm [5/8"] O.D. Seamless copper tubes with return bends brazed into tube ends.

.4 Headers: Cast iron or steel pipe.

.5 Casing: Galvanized Steel, formed end supports and top and bottom channels with additional center support on coils over 1067 mm [42"].

.6 Casing (cooling coils): Coil frames shall be 304 SS.

.7 Connections: Drain and vent threaded plug connections.

.8 Testing: Factory air pressure test under water to 1700 kPa [250 psig] and hydraulic tested to 860 kPa [125 psig].

.9 Glycol Coils: Where glycol coils are specified, coils shall be suitable for use with ethylene or propylene glycol at the scheduled percentage by volume.

2.3 COILS - FACE AND BYPASS

.1 Ratings: ARI certified.

.2 Standard of Acceptance: WING VIFB, Mark Hot Lamiline.

.3 Finned heating elements: Seamless 16 mm [5/8"] vertical copper tubes with rectangular fins. Each tube individually secured to steam and return headers by a brazed joint with provision for individual tube expansion.

.4 Headers: Steel or copper.

.5 Casing: 1.7 mm [14 ga] thick steel, galvanized and painted with rigid framework.

.6 Dampers: Clam shell dampers shall completely enclose the heating coil passes, isolating them from the air stream. Volume of air passing through coil shall not vary more than +/- 5% regardless of position of internal dampers. Damper actuators to be supplied by the Controls Contractor.

.7 Testing: Factory tested to 1700 kPa [250 psig] steam and hydraulically to 3450 kPa [500 psig].

2.4 COILS - ELECTRIC (DUCT HEATERS)

.1 Minimum Requirements:

.1 Coils:

.1 Insert type for installing in ductwork or flanged type for connecting to ductwork.

.2 C.S.A. approved.

.3 Open coil resistance wire elements sheathed elements.

.2 Control Panels: Factory attached or EEMAC type 1 panels for remote mounting.

.1 Power and control wiring terminals.

.2 Unfused disconnect.

.3 Contactors.

.4 Control transformer with secondary fuse.

.5 Overheat protection - manual reset with external button.

.6 Automatic reset linear thermal cut-out.

.7 Control wiring terminals for airflow proving switch, fan interlock and single stage thermostat.

2.5 BASEBOARD HEATERS - ELECTRIC

.1 Standard of Acceptance:

.1 Ouellet OFM series. CSA approved.

.2 20-gauge steel body 150 mm [6"] high.

.3 Steel tubular heating element with aluminum fins.

.4 Integral over-temperature protection.

.5 Accessories:

.1 Wall mounted line voltage, low voltage thermostat.

.6 Capacity:

.1 As noted on the drawing.

.2 Electrical service: 208/1/60

.3 Unit Heater - Electric

2.6 CABINET UNIT HEATERS – HOT WATER

.1 Cabinet:

.1 Arrangement as scheduled.

.2 1.6 mm [16 ga] thick cold rolled steel suitably braced for rigidity.

.3 Easily removable front panels on floor or wall mounted units.

.4 Hinged front panel on ceiling mounted units.

.5 Integral inlet and outlet grilles or duct collars.

.6 Prime coat painted internally and externally.

.2 Coils: Aluminum fins mechanically bonded to seamless copper tubes.

.3 Fans: Centrifugal double width wheels, statically and dynamically balanced, direct driven, sleeve bearings, resiliently mounted.

.4 Motors: Multi-speed, tapped wound permanent split capacitor type with sleeve bearings, built-in thermal overload protection and resilient rubber isolation mounting.

.5 Accessories:

.1 3 speed switch wall mounted.

.2 Access door with screw or camlock fastener

2.7 UNIT HEATERS – HOT WATER

.1 Application: Horizontal or vertical arrangement as scheduled.

.2 Casing: 1.2 mm [18 ga] thick cold rolled steel, gloss enamel finish, with threaded connections for hanger rods.

.3 Coils: Seamless copper tubing, silver brazed to steel headers and with evenly spaced aluminum fins mechanically bonded to tubing.

.4 Fan: Direct drive propeller type, factory balanced, with anti-corrosive finish and fan guard on horizontal units.

.5 Motor: speed as indicated, continuous duty, built-in overload protection, and resilient motor supports.

.6 Air Outlet:

.1 Horizontal Unit: four-way adjustable louvres.

3 EXECUTION

3.1 COILS - INSTALLATION

.1 Provide airtight seal between coil and duct or unit cabinets.

.2 Cooling coil supports shall use Type 304 stainless steel.

.3 All bolts and fastenings shall be stainless steel.

.4 Connect water supply to bottom of supply header and return water connection to top in order to provide self-venting and reverse return arrangement.

.5 Provide coil drain pans under all coils; not just cooling coils. Drain lines for coils other than cooling coils may be capped outside of unit casing.

.6 Ensure coils and fins and flanges are not damaged. Replace loose and damaged fins. Comb out bent fins unless they need to be replaced.

.7 Drain line from drain pans shall be minimum NPS1¼.

.8 Pipe drain lines to floor drain with deep seal trap and trap primer.

.9 Face and bypass coils shall be connected to condensate piping with braided flexible hose.

.10 Demonstrate to the Departmental Representative that all face and bypass dampers fully open and fully enclose the coil sections.

3.2 HEATING UNITS INSTALLATION

.1 Install according to piping layout. Provide for pipe movement during normal operation.

.2 Refer to manufacturer's installation drawings.

.3 Verify electrical service work with characteristics stamped on unit.

.4 Venting:

.1 On up-fed units provide screw driver vent on convectors and standard air vent with cock on continuous wall convectors.

.2 On unit heaters and cabinet unit heaters provide standard air vent with cock unless piping is installed above units and is self-venting into mains.

.3 Pitch heating elements to assist air venting.

.5 Valves:

.1 Install isolating gate valve on supply and lock shield globe valve on return, together with control valve shown or specified in the Controls Section.

.2 In public areas use lock shield type on supply and return for isolation.

.6 Install, where indicated, NPS 1-1/4, all copper flexible expansion compensator.

.7 Check for correct element lengths in heating cabinets as work progresses. Scheduled length is actual finned length.

.8 Install unit heaters at heights indicated. Where not indicated, follow Departmental Representative's instruction. Set discharge pattern required.

.9 Provide supplementary suspension steel as required.

.10 Touch up scratches in factory paint finishes on units.

4 EQUIPMENT SCHEDULES

UNIT & CABINET UNIT HEATERS - LIQUID

UNIT NO	**UH - 1/2**	**UH - 3/4/5**
HEATER TYPE	Heating water properller unit heater	
LOCATION	Indent Bay	Security Bay Garage Bay
CAPACITY (kW)	17.9	15.3
(MBH)	61.0	52.3
AIR:		
FLOW (L/s)	660.7	519.1
(CFM)	1400.0	1100.0
EAT. (C)	12.8	12.8
(F)	55.0	55.0
LAT. (C)	40.0	40.0
(F)	104.0	104.0
LIQUID:		
GLYCOL (%)	30	30
FLOW (L/s)	0.4	0.3
(GPM)	6.1	5.3
P.D. (kPa)	0.7	0.7
(Ft)	0.2	0.2
ENT. (C)	28.3	28.3
(F)	83.0	83.0
LVG. (C)	22.8	22.8
(F)	73.0	73.0
MOTOR (r/min)	1000	1000
ARRANGEMENT	Vertical	Vertical
FAN MOTOR (HP)	0.08	0.05
VOLTS /PHASE/Hz	115/1/60	115/1/60
MANUFACTURER	Trane	Trane
MODEL NO	S-84	S-72

UNIT & CABINET UNIT HEATERS - LIQUID

UNIT NO	**UH - 1/2**	**UH - 3/4/5**
SEE NOTE(S)	1,2	1,2

NOTES:
1 - SPEED CONTROLLER
2 - ADJUSTABLE LOUVRE DIFFUSER

FORCE-FLOW HEATER-FLUID

UNIT NO	**FF - 1**	**FF - 2**	**FF- 3**
HEATER TYPE		FORCE FLOW	
LOCATION	VEST.-SOUTH	VEST.-EAST	VEST.-NORTH
CAPACITY (kW)	1.35	1.20	1.29
(MBH)	4.60	4.10	4.40
AIR:			
FLOW (L/s)	134	179	192
(CFM)	284	380	407
EAT. (C)	21.11	21.11	21.11
(F)	70.00	70.00	70.00
LAT. (C)	29.44	29.44	29.44
(F)	85.00	85.00	85.00
LIQUID:			
GLYCOL (%)			
FLOW (L/s)	0.03	0.03	0.03
(GPM)	0.46	0.41	0.44
P.D. (kPa)	6	6	6
(Ft)	2.10	2.10	2.10
ENT. (C)	82.2	82.2	82.2
(F)	180	180	180
LVG. (C)	71.1	71.1	71.1
(F)	160	160	160
ARRANGEMENT		VERTICAL RECESSED	
FAN MOTOR (W)		60	
VOLTS /PHASE/Hz		115/1/60	
MANUFACTURER		TRANE	

FORCE-FLOW HEATER-FLUID

UNIT NO	**FF - 1**	**FF - 2**	**FF- 3**
MODEL NO	FFHB-020-1-K-M0-C-0-C-B-A-A-2-A-000-D-1-		
SEE NOTE(S)	1.2.3.4.5.6.7.8.9		

NOTES:
1 -SPEED CONTROLLER
2 -ADJUSTABLE LOUVRE DIFFUSER
3-VERTICAL RECESSED TYPE, FRONT
4- FROUT STAMPED LOURVERS INLET AND OUTLET.
5- C/W KEYLOCK ACCESS DOOR
6- HOT WATER COIL
7- DISCONNECT SWITCH
8- 25MM THROWAWAY FILTER
9- WALL MOUNTED FAN SPEED SWITCH W/ SETPOINT DIAL

BASEBOARD HEATERS - ELECTRIC

UNIT NO	**EB-1**
HEATER TYPE	baseboard heater
LOCATION	Water entry room
CAPACITY (kW)	2.0
(MBH)	6.9
ARRANGEMENT	Wall mounted
VOLTS /PHASE/Hz	208/1/60
MANUFACTURER	Ouellet
MODEL NO	OFM-2008
SEE NOTE(S)	1

NOTES:
1 – With wall mounted T-stat (OFM-RT-208 & C1015-03)
2 – Color to be verified by Arch.

HEATING COIL

UNIT NO	**HC - 1**	**HC - 2**	**HC- 3**	**HC- 4**	**HC- 5**	**HC-6**
HEATER TYPE			HATING COIL			
LOCATION	CELL MEZZ.	CELL MEZZ.	CELL MEZZ.	CELL MEZZ.	Corridor Ceiling	Corridor Ceiling
CAPACITY (kW)	3.19	1.82	2.96	4.66	2.70	1.70
(MBH)	10.90	6.20	10.10	15.90	9.20	5.80
AIR:						
FLOW (L/s)	111	76	104	159	281	70
(CFM)	235	160	220	336	595	148
EAT. (C)	10.56	10.56	10.56	10.56	10.56	18.33
(F)	51.00	51.00	51.00	51.00	51.00	65.00
LAT. (C)	33.33	29.44	32.78	33.89	18.33	37.78
(F)	92.00	85.00	91.00	93.00	65.00	100.00
LIQUID:						
GLYCOL (%)	30	30	30	30	30	30
FLOW (L/s)	0.07	0.04	0.06	0.10	0.06	0.04
(GPM)	1.09	0.62	1.01	1.59	0.92	0.58
P.D. (kPa)						
(Ft)						
ENT. (C)	82.22	82.22	82.22	82.22	82.22	82.22
(F)	180.00	180.00	180.00	180.00	180.00	180.00
LVG. (C)	71.11	71.11	71.11	71.11	71.11	71.11
(F)	160.00	160.00	160.00	160.00	160.00	160.00
ARRANGEMENT	Duct mounted	Duct mounted	Duct mounted	Duct mounted	Duct mounted	Duct mounted
SEE NOTE(S)	1	1	1	1	1	1

NOTES:
1. Space temp. sensor to control the heating coil.

END OF SECTION

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 PRODUCTS

2.1 RADIANT CEILING PANELS - LINEAR EXTRUSION

.1 Standard of Acceptance: Sterling / Frenger Linear Panels

.2 Quality Assurance:

.1 Test data to be based on a panel installed in the ceiling with 21°C [70°F] ambient air temperature and 19.5°C [67°F] AUST with natural convection. Certified test data shall clearly indicate AUST.

.3 Construction:

.1 The radiant ceiling system shall consist of extruded aluminum having an overall thickness of approximately 2.9 mm [0.11"]. Copper tubing of 12.7 mm ID shall be mechanically attached to the aluminum faceplate. A non-hardening heat conductive paste shall be placed between the copper tubing and the aluminum faceplate.

.2 The surface configuration of the radiant panel extrusions shall be fine fluted and designed to conceal the longitudinal extrusion seams from the room. The use of paint to fill the seams shall not be permitted.

.3 Panel sections shall be 152mm [6"] and 203mm [8"] wide as required.

.4 Panel Output:

.1 Panel outputs are based on 82°C [180°F] entering water temperature, 71°C [160°F] leaving water temperature and 21°C [70°F] ambient air temperature.

.2 Provide minimum panel outputs as follows:

Drawing Notation	Panel Width Mm [ins] Nominal	No. of Tubes	Output (Watts/Linear Metre)¦
RP-x	610 [24]	8	476

.5 Finish: Panels shall be finished with manufacturer's standard white colour unless specified otherwise.

.6 Panel widths are minimum acceptable.

.7 Notes:

.1 Manufacturer shall submit complete (scale) drawings showing layouts, inter-connections and circuiting details of areas where radiant panels are indicated. These drawings shall be coordinated with and interference shall be cleared with other trades. Shop drawings shall indicate locations of supply and return hook-ups in addition to inter-connection details for each zone.

.2 Pipe connections (soft copper, type L) from radiant panel sections or from the pipe headers at the extruded panel assemblies to the main piping shall include a minimum of 1000mm [39"] excess length for panel removal.

.3 All piping from panels to piping mains shall be insulated. Refer to Section 23 07 19. Piping between panels does not require insulation.

.4 Panel sections shall be interlocked at the factory. The interlocking shall be such that no differential displacement occurs between the panels. Interlocked sections shall be parallel.

.5 Radiant panels shall run continuous from wall-to-wall and shall be field trimmed to length ensuring adequate expansion allowance while maintaining panel end coverage by architectural mouldings. Inactive filler panels will be permitted only where indicated on drawings.

.6 Header system for multiple panel circuitry by the mechanical contractor shall be as recommended by the manufacturer . Individual serpentine panel coils connected in series is unacceptable for multiple panel zones.

.7 Inter-connection of radiant panels by manufacturer shall consist of 12.7mm ID [½" nominal] Type "L", soft copper tubing (ie. 360° interconnecting loops and 180° return U-bends). Individual serpentine panel coils connected in series is unacceptable for multiple panel zones.

.8 Ceiling support mouldings for radiant panels to be supplied and installed by Division 9. Ensure ceiling openings and wall mouldings are installed as per radiant panel shop drawings.

.9 Hanger wires for safety and seismic restraint shall be installed at 1200mm [4ft] o.c. or as recommended by the manufacturer.

3 EXECUTION

3.1 RADIANT CEILING PANEL INSTALLATION

.1 Panel to be installed in drywall ceilings or in tee-bar ceilings as shown.

.2 Cooperate with other trades to achieve a neat well coordinated overall installation.

.3 The panel manufacturer shall supervise the installation of the panels and shall submit an inspection report after inspecting the completed installation.

.4 All radiant panels shall be installed by personnel wearing white gloves to avoid soiling the panels.

.5 Provide all necessary trim to properly install the radiant panels in ceiling areas. Trim or cut the radiant panels to fit in any ceiling openings less than the required size. This trimming shall be done by skilled personnel and in such a way that the trimming is not visible once the panel is installed.

.6 All radiant panels shall be insulated on the non-active face, refer to Section 23 07 19.

.7 All isolating valves and balancing fittings for panels shall be located over adjoining accessible tee bar ceilings only.

.8 The panel manufacturer shall ensure that the panel sizes suit the ceiling modules - to allow clearance for the thermal expansion of the lay-in radiant panels.

.9 Check that each panel rests flat on the supporting tee bars or mounting frame along the full length and the full width.

.10 The tee-bar members in tee-bar ceilings will be provided by others. The tee-bar members will suit the panel installation.

.11 The panels shall be located where shown on the architectural reflected ceiling plans.

.12 All system piping shall be thoroughly cleaned, flushed, drained and refilled before radiant panels are connected into the system.

4 EQUIPMENT SCHEDULE

RADIANT PANELS

PANEL No	LOCATION	ACTIVE LENGTH (m)	NO OF CIRC.	NO OF ACTIVE TUBES	FLOW (L/min)	CAPACITY (kW)	NOTES
RP-1	Open office area	4.5	2	8	3.32	2.14	1,2,3,4
RP-2	Open office area	4.5	2	8	3.32	2.14	1,2,3,4
RP-3	Trafic Recons.	3.6	2	8	2.64	1.70	1,2,3,4
RP-4	Guest Office	3.8	2	8	2.82	1.82	1,2,3,4
RP-5	Office	3.8	2	8	2.82	1.82	1,2,3,4
RP-6	SGT office	3.4	2	8	2.50	1.61	1,2,3,4
RP-7	Work Station	3.4	2	8	2.50	1.61	1,2,3,4
RP-8	Conference Room	4.9	2	8	3.64	2.34	1,2,3,4
RP-9	Public Washroom	2.0	2	8	1.46	0.95	1,2,3,4
RP-10	Victim Service	3.4	2	8	2.50	1.61	1,2,3,4
RP-11	Interview Room	3.0	2	8	2.18	1.41	1,2,3,4

NOTES:
1. G - GLYCOL;
2. 2P - 2-WAY 2 POSITION
3. C/W INTERCONNECTORS
4. HEADER BY MECH. CONTRCTOR

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 01 35 30 – Health and Safety

.3 All specification sections prefix-numbered 26

.4 All specification sections prefix-numbered 27

.5 All specification sections prefix-numbered 28

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-09, Canadian Electrical Code, Part 1 (21st Edition), Safety Standard for Electrical Installations.

.2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

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 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.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.

.3 Language operating requirements: provide identification nameplates and labels for control items in English and French.

.4 Use one nameplate or label for each language.

1.5 SUBMITTALS

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

.2 Submit copy of electrical permit for the project to Departmental Representative prior to commencement of work. Departmental Representative will provide drawings required by Electrical Inspection Department at no cost.

.1 Pay associated fees.

.2 Notify Departmental Representative of changes required by Electrical Inspection Department prior to making changes.

.3 Furnish certificate of acceptance from Electrical Inspection Department upon completion of the work.

.3 Provide single line diagram between two sheets of plexiglass as follows:
- .1 Electrical distribution system: locate in electrical room.

.4 Shop drawings:
- .1 Submit shop drawings and product data.
- .2 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
- .3 Where applicable, include wiring, single line and schematic diagrams.
- .4 Include wiring drawings or diagrams showing interconnection with work of other Sections.
- .5 Submit 6 copies of shop drawings and product data to the Departmental Representative.

.5 Provide operation and maintenance data for incorporation into operation and maintenance manuals specified in Section 01 01 50 – General Instructions. 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 list. Advertising or sales literature not acceptable.
- .3 Wiring and schematic diagrams and performance curves.
- .4 Names and addresses of local suppliers for items included in maintenance manuals.
- .5 Copy of reviewed shop drawings.

.6 Quality Control: in accordance with Section 01 01 50 – General Instructions.
- .1 Provide CSA certified equipment and material.
- .2 Submit test results of installed electrical systems.
- .3 Permits and fees: in accordance with General Conditions of contract.
- .4 Submit, upon completion of Work, load balance report as described in PART 3.9.1 LOAD BALANCE.
- .5 Submit to Departmental Representative certificate of acceptance from authority having jurisdiction upon completion of Work.

.7 Record Drawings
- .1 Provide record drawings of the installation as specified in Section 01 01 50 – General Instructions.
- .2 Additional record drawing requirements are included under various other electrical sections.

1.6 COST BREAKDOWN

.1 Submit cost breakdown with at least the following items:
- .1 Data and telephone cable work.
- .2 Site work – underground ducts, street lighting, cables, etc.
- .3 Incoming Utility ducts and service fees
- .4 Wiring and conduit rough-in

.5 Door signal and Miscellaneous Systems – excluding data and telephone work

.6 Lighting – supply and installation of luminaires

.7 Finishing

1.7 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 01 50 – General Instructions.

.2 Qualifications: electrical Work to be carried out by qualified personnel in accordance with the requirement of authorities having jurisdiction.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.

.2 Construction/Demolition Waste Management and Disposal: where applicable separate waste materials for recycling in accordance with Section 01 01 50 – General Instructions.

1.9 SYSTEM STARTUP

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

.2 Where applicable, arrange and pay for services of manufacturer's factory service Departmental Representative to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

1.10 OPERATING INSTRUCTIONS

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 01 50 – General Instructions.

.2 Material and equipment to be CSA certified.

.3 Factory assemble control panels and component assemblies.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

.2 Control wiring and conduit: in accordance with Section 26 29 03 - Control Devices except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings. Review Equipment Schedule on electrical drawings for additional information.

2.3 WARNING SIGNS

.1 As specified and to meet requirements of Electrical Inspection Department and Departmental Representative.

.2 Use decal signs, minimum 175 x 250 mm size.

2.4 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for copper conductors.

2.5 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: lamicoid plastic engraving sheet, black face, white core, lettering accurately aligned and engraved into core attached with Loctite 414 adhesive. No pre-gummed labels are acceptable.

.2 Sizes as follows:

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

.2 Labels: plastic labels with 4mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate and label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.7 Terminal cabinets and pull boxes: indicate system and voltage.

2.6 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

.5 Label all communications cables at both ends of the cable and in major junction/pull boxes. Labels shall be self laminating with a vinyl write-on area (Thomas & Betts E-Z Code Write-On markers).

2.7 CIRCUIT IDENTIFICATION

.1 Identify every switch and receptacle cover plate indicating circuit number.

.2 Laminated clear tape label, 12 mm high, minimum 5 mm high upper case black letters, produced by electronic label maker. Brother TZ series or equivalent.

.3 Identify power junction and pull boxes with the circuit number in black indelible ink.

2.8 FINISHES

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

.1 Paint outdoor electrical equipment "equipment green" finish.

.2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

Part 3 Execution

3.1 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1, and BC Amendments, Directives and Bulletins except where specified otherwise.

.2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.

.2 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.4 ACCESS HATCHES

.1 Provide steel access hatches where required. Keyed cam lock.

3.5 FIRESTOPPING

.1 Where cables or conduits pass through floors and fire rated walls, pack space full with a ULC approved firestopping system.

.2 Firestopping is specified in Section 01 01 50 – General Instructions.

3.6 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.7 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. Install electrical equipment at following heights unless indicated otherwise.

- .1 Local switches: 1220 mm
- .2 Wall receptacles:
  - .1 General: 500 mm
  - .2 Above top of continuous baseboard heater: 200 mm
  - .3 Above top of counters or counter splash backs: 150 mm
  - .4 In mechanical rooms: 1350 mm
- .3 Panelboards: 1830 mm to top
- .4 Telephone and data outlets: 500 mm
- .5 Fire alarm annunciators: 1830 mm to top
- .6 Fire alarm stations: 1200 mm
- .7 Fire alarm bells: 75 mm down from ceiling to top of device
- .8 Television outlets: 500 mm
- .9 Doorbell pushbuttons: 1200 mm
- .10 Thermostats: 1200 mm
- .11 Emergency lighting head and exit lights: 2400 mm
- .12 Keypads: 1524 mm

3.8 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.9 FIELD QUALITY CONTROL

.1 Load Balance: Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Conduct operational tests on:

- .1 Circuits originating from branch distribution panels for correct wiring.
- .2 Lighting and its control for correct operation.
- .3 Motors, heaters and associated control equipment including sequenced operation of systems where applicable for correct operation.
- .4 Systems: fire alarm system, communications cabling systems.
- .5 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.

.3 Carry out tests in presence of Departmental Representative or his representative. Submit written test results for review.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

3.10 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

.3 At time of final cleaning, clean lighting reflectors, lenses and other lighting surfaces that have been exposed to construction dust and dirt.

3.11 PHOTOGRAPHIC RECORD

.1 The electrical contractor is to arrange to have photos taken of electrical work completed as an electronic record of construction. The pictures are to illustrate new systems installation as well as systems installation prior to concealment in construction. For example: the underground installation prior to it being covered up or concrete poured.

.2 Photos are to be made available on request.

.3 Photos will also be used to aid in assessing monthly progress claims.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 21 – Wires and Cables (0-1000V)

.3 Section 26 05 00 – Common Work Results – For Electrical

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2No.18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.2 CSA C22.2No.65, Wire Connectors.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper or copper alloy sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2No.65, with current carrying parts of copper or copper alloy sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2.

.4 Clamps or connectors as required to: CAN/CSA-C22.2No.18.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Install mechanical pressure type connectors and tighten screws or secure with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2No.65.

.2 Install fixture type connectors and tighten. Replace insulating cap.

.3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

.3 Section 26 05 00 – Common Work Results – For Electrical

1.2 REFERENCES

.1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 01 50 – General Instructions.

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors: Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 600V insulation of chemically cross-linked thermosetting polyethylene material rated RW90. Note: THHN is not acceptable.

2.2 ARMOURED CABLES

.1 Conductors: insulated, copper, minimum size 12 AWG.

.2 Armour: interlocking type fabricated from galvanized steel or aluminum strip.

.3 Type: AC90.

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

.1 Install wiring concealed as follows:

.1 In conduit systems in accordance with Section 26 05 34 where wiring is run in concrete block walls or in ceiling spaces and then from ceiling spaces down in steel stud walls to the first outlet box in the wall.

.2 In wireways and auxiliary gutters in accordance with Section 26 05 37.

.3 In underground ducts in accordance with Section 26 05 44. Do not install conduit in slab-on-grade.

3.2 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible.

.2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

.3 Conceal all wiring.

.4 Use AC90 cables for branch circuit wiring installed in steel stud walls and extended from the box in the wall to which wiring in the ceiling space is extended in EMT.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 - Common Work Results - Electrical.

Part 2 Products

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 Copper conductor: minimum 6.0 m long for each concrete encased electrode, bare, stranded, soft annealed, size as indicated.

.3 Rod electrodes: copper clad steel 19 mm dia by 3.0 m long.

.4 Plate electrodes: copper, surface area 0.2 m^2, 1.6 mm thick.

.5 Grounding conductors: bare stranded copper, soft annealed, size as required.

.6 Insulated grounding conductors: green, type TWH.

.7 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

.8 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

- .1 Grounding and bonding bushings.
- .2 Protective type clamps.
- .3 Bolted type conductor connectors.
- .4 Thermit welded type conductor connectors.
- .5 Bonding jumpers, straps.
- .6 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process or permanent mechanical connectors.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.

.7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.8 Install separate ground conductor to outdoor lighting standards and block heater receptacles.

.9 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

3.2 ELECTRODES

.1 Make ground connections to continuously conductive underground water pipe on street side of water meter.

.2 Install water meter shunt.

.3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.

.4 Install rod, electrodes and make grounding connections.

.5 Bond separate, multiple electrodes together.

.6 Use size 3/0 AWG copper conductors for connections to electrodes.

.7 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.3 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of secondary 208V system.

3.4 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, switchgear, duct systems, frames of motors, starters, control panels, building steel work, distribution panels, outdoor lighting, outdoor block heater receptacles.

3.5 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall of electrical room, room 203 and room 204.

.2 Connect main switch grounding point in electrical room to ground bus with individual bare stranded copper connections size 2/0 AWG.

3.6 COMMUNICATION SYSTEMS

.1 Install grounding connections for telephone, fire alarm, and data wiring systems as follows:

.1 Telephones: #6 AWG from main ground in room 202 to ground bar in room 203. Install #6 AWG ground from ground bar to service entrance protectors.

.2 Data: #6 AWG from main ground in room 202 to ground bar in room 204. Install #6 AWG from ground bar in room 204 to bond to equipment rack in room 204.

.3 Radio antenna: #6 AWG from main ground bar in electrical room to radio antenna support mast.

.4 53mm C for incoming radio aerial: #6 AWG from main ground bar in electrical room to radio antenna incoming conduit.

.5 Fire alarm: Install separate #12 AWG green ground conductor in with fire alarm AC circuit conductors.

.6 Room 207A: #6 AWG from main ground in electrical room to ground bar in room 207A. Install #6 AWG ground from ground bar in room 207A to each assembly of equipment for Access Control, Intruder Alarm and Video Surveillance equipment.

.7 All equipment cabinets and racks: #8 AWG from local ground busbar.

3.7 FIELD QUALITY CONTROL

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions
.2 Section 26 05 00 – Common Work Results for Electrical
.3 Section 26 05 31 – Splitters, Junctions, Pull Boxes and Cabinets
.4 Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings
.5 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings
.6 Section 26 05 37 – Wireways and Auxiliary Gutters
.7 Section 26 24 01 – Service Equipment
.8 Section 26 24 17 – Panelboards Breaker Type
.9 Section 26 27 23 – Indoor Service Poles
.10 Section 26 27 73 – Door Signal and Miscellaneous Systems
.11 Section 26 29 01 – Contactors
.12 Section 26 29 03 – Control Devices
.13 Section 26 29 10 – Motor Starters
.14 Section 26 31 02 – Multiplex Fire Alarm System
.15 Section 26 50 00 - Lighting
.16 Section 26 52 01 – Unit Equipment for Emergency Lighting
.17 Section 26 53 00 – Exit Lights
.18 Section 27 05 13 – Communications Services
.19 Section 27 05 28 – Pathways for Communications Systems
.20 Section 28 13 00 – Access Control systems
.21 Section 28 16 00 – Intrusion Alarm systems
.22 Section 28 23 00 – Video Surveillance
.23 Section 28 24 00 – Interview Rooms Audio/Video Surveillance

Part 2 Products

2.1 SUPPORT CHANNELS

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

Part 3 Execution

3.1 INSTALLATION

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

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with twist clip fasteners to inverted T-bar ceilings. Ensure that T-bars are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps 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 code required centre spacing to suit smallest conduit installed.

.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.

.13 Install fastenings and supports as required for each type of equipment, cables and conduits, and in accordance with manufacturer's installation recommendations.

.14 Provide seismic restraint of luminaires as indicated.

.15 All hangers, supports and brackets shall be provided and be installed to be consistent with the requirements of Table 4.1.8.17 of Section 4 of the British Columbia Building Code.

.16 Following installation of all equipment and fixings, retain the services of a Structural Engineer registered with the APEGBC to provide a structural review of the fixings of all devices forming part of the electrical installation. Provide, as a result of this review, a signed and sealed report indication the installation complies with the requirements of the British Columbia Building Code.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 – Common Work Results – For Electrical

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for cabinets in accordance with Section 01 01 50 – General Instructions.

Part 2 Products

2.1 SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged or screw on cover. If hinged, suitable for locking in closed position.

.2 Main and branch lugs or connection bars to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 JUNCTION AND PULL BOXES

.1 Welded steel or aluminum construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3 CABINETS

.1 Painted sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION AND PULL BOXES INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Install pull boxes so as not to exceed 30.0 m of conduit run between pull boxes.

3.3 CABINETS

.1 Install cabinets for components as indicated.

3.4 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA C22.1-2006, Canadian Electrical Code, Part 1.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.3 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

.1 Electro-glavanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

.1 Cast FS or FD aluminum or feraloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles

2.6 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 – Common Work Results – For Electrical

.3 Section 27 05 28 – Pathways for Communications Systems

.4 Section 27 10 05 – Structured Cabling for Communications.

.5 Section 28 13 00 – Access Control

.6 Section 28 16 00 – Intrusion Detection

.7 Section 28 23 00 – Video Surveillance

.8 Section 28 24 00 – Interview Rooms Audio/Video Surveillance

1.2 REFERENCES

.1 Canadian Standards Association

- .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
- .2 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .3 CSA C22.2 No. 83, Electrical Metallic Tubing.
- .4 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 01 50 – General Instructions.

Part 2 Products

2.1 CONDUITS

.1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with steel couplings.

.2 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.3 Flexible metal conduit: to CSA C22.2 No. 56, steel or aluminum liquid-tight flexible metal.

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 Beam clamps to secure conduits to exposed steel work.

.4 Channel type supports for two or more conduits.

.5 Threaded rods, 6 mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified.

.1 Coating: same as conduit.

.2 Material: Steel (Cast fittings are not acceptable).

.2 Factory "ells" where 90 degrees bends for 25 mm and larger conduits.

2.4 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 INSTALLATION

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

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

.3 Surface mount conduits in mechanical and electrical rooms and unfinished areas.

.4 Use electrical metallic tubing EMT except in cast concrete.

.5 Use rigid PVC conduit underground or in cast in place concrete in suspended slabs.

.6 Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without prewired outlet box and connection to surface or recessed fluorescent luminaires.

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

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

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

.10 Mechanically bend steel conduit over 19 mm diameter.

.11 Install fish cord in empty conduits.

.12 Run 3-27 mm spare conduits up to ceiling space from each flush mounted panelboard. Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space. In case of an exposed concrete slab, unless otherwise indicated terminate each conduit in flush concrete type box.

.13 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.14 Dry conduits out before installing wire.

.15 Unless indicated otherwise, provide conduit for all wiring and for future use as further specified or noted on the drawings.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended or surface U-channels.

.5 Do not pass conduits through structural members except as indicated. Do not locate conduits less than 75 mm parallel to hot water lines with minimum of 25 mm at crossovers.

3.3 CONCEALED CONDUITS

.1 Do not install horizontal runs in masonry walls.

.2 Do not install conduits in terrazzo or concrete toppings.

3.4 CONDUITS IN SUSPENDED CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel. Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Conduits in slabs: minimum slab thickness 4 times conduit diameter.

.5 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.6 Organize conduits in slab to minimize cross-overs.

3.5 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Do not run conduits in slab on grade. This will allow for future renovations without concern for conduits in the slab being damaged.

.2 If desired conduits may be installed below slabs-on-grade.

3.6 CONDUITS FOR TELEPHONE AND DATA CABLING

.1 Install conduit or conduit stubs as indicated to permit initial cabling and possible future installation of fibre optic cables to the outlets to suit cabling requirements of Section 27 10 05 - Structured Cabling for Communications.

.2 Bending radius of conduits sized two inches and less: 6 times internal diameter of conduit.

.3 Bending radius of conduits sized greater than two inches: 10 times internal diameter of conduit.

.4 Minimum size of conduit: 19 mm.

.5 Maximum conduit fill: 40%.

.6 Maximum 2 – 90 degree bends between pull boxes.

.7 At workstation locations provide deep outlet boxes on the ends of the conduit stubs.

.8 On the ends of all conduit stubs provide nylon insulated throat connectors.

.9 Co-ordinate with contractor under Section 27 10 05.

3.7 CONDUITS FOR INTRUSION DETECTION, ACCESS CONTROL, VIDEO SURVEILLANCE AND INTERVIEW ROOMS INSTALLATIONS

.1 Install conduit as indicated to suit cabling requirements of the systems specified under Sections 28 13 00, 28 16 00, 28 23 00 and 28 24 00.

.2 Bending radius of conduits sized two inches and less: 6 times internal diameter of conduit.

.3 Bending radius of conduits sized greater than two inches: 10 times internal diameter of conduit.

.4 Minimum size of conduit: 19 mm.

.5 Maximum conduit fill: 20%

.6 Maximum two 90° bends between pull boxes.

.7 On the ends of all conduit box-connectors provide nylon insulated throat connectors.

.8 Install pull boxes, not LB's for pulling.

.9 Locate pull boxes after every two 90° bends and at maximum 30.0 m spacing.

.10 Co-ordinate with contractors under Sections 28 13 00, 28 16 00 and 28 23 00.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 29 - Hangers and Supports for Electrical Systems

.3 Section 27 05 28 – Pathways for Communications Systems

.4 .

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.1 No.126.1-02, Metal Cable Tray Systems.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA VE 1-2002, Metal Cable Tray Systems.

.2 NEMA VE 2-2001, Cable Tray Installation Guidelines.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 01 50 – General Instructions.

.2 Shop Drawings: submit shop drawings showing materials, finish, dimensions, accessories, layout, and installation details.

.3 Identify types of cable trays used.

.4 Show actual cable tray installation details and suspension system.

Part 2 Products

2.1 CABLE TRAY

.1 Cable trays and fittings: to NEMA VE 1, CAN/CSA C22.2.

.2 Wire mesh type to CAN/CSA C22.2.

.3 Trays: galvanized steel 315 mm wide with depth 100 mm.

.4 Fittings: horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required, manufactured accessories for cable tray supplied.

.1 Radii on fittings: 600 mm minimum.

.5 Barriers where different voltage systems are in same cable tray.

.6 Ground cable trays with #2 AWG bare copper conductor attached to each tray section in accordance with CEC requirements.

.7 Provide fire stop material at firewall penetrations.

2.2 SUPPORTS

.1 Provide splices, supports for a continuously grounded system as required.

Part 3 Execution

3.1 INSTALLATION

.1 Install complete cable tray system in accordance with NEMA VE 2.

.2 Support cable tray with channel and rod hangers on both sides.

.3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

3.2 CABLES IN CABLE TRAY

.1 Install cables individually.

.2 Lay cables into cable tray. Use rollers when necessary to pull cables.

.3 Secure cables in cable tray at 6.0 m centers with nylon ties.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association.

.1 CSAC22.2No.26, Construction and Test of Wireways, Auxiliary Gutters and Associated Fittings.

1.3 PRODUCT DATA

.1 Submit product data in accordance with 01 01 50 – General Instructions.

Part 2 Products

2.1 WIREWAYS

.1 Wireways and fittings: to CSA C22.2 No.26.

.2 Sheet steel with hinged or bolted cover to give uninterrupted access.

.3 Finish: baked grey enamel if of steel, aluminum.

.4 Elbows, tees, couplings and hanger fittings manufactured as accessories to wireway supplied.

Part 3 Execution

3.1 INSTALLATION

.1 Install wireways and auxiliary gutters.

.2 Keep number of elbows, offsets, connections to minimum.

.3 Install supports, elbows, tees, connectors, fittings.

.4 Install barriers where required.

.5 Install gutter to full length of equipment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 - Common Work Results - Electrical.

.3 Section 33 65 73 – Direct Buried Underground Cable Ducts

Part 2 Products

Part 3 Execution

3.1 CABLE/CONDUCTOR INSTALLATION IN DUCTS

.1 Install conductors as indicated in ducts. Do not pull spliced conductors inside ducts.

.2 Install multiple conductors in duct simultaneously.

.3 Use CSA approved lubricants of type compatible with conductor jacket to reduce pulling tension.

.4 Before pulling cables into ducts and until cables are properly terminated, seal ends of cables with moisture seal tape.

.5 After installation of conductors, seal duct ends with duct sealing compound.

3.2 FIELD QUALITY CONTROL

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

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 – Common Work Results – For Electrical

.3 Section 26 05 28 - Grounding - Secondary.

.4 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.5 Section 26 28 23 - Disconnect Switches - Fused and Non-Fused.

Part 2 Products

2.1 EQUIPMENT

.1 Incoming Service cable wireway and pull box to suit utility requirements.

.2 Fused disconnect switch: in accordance with Section 26 28 23 - Disconnect Switches - Fused and Non-Fused, rating 400A, 208V and suitable for service entrance duty.

.3 Cabinet for utility revenue metering: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets, size as indicated.

.4 Meter base to suit utility requirements.

.5 Suitable for installation in a sprinklered room.

Part 3 Execution

3.1 INSTALLATION

.1 Install service equipment.

.2 Connect to incoming service.

.3 Connect to outgoing load circuits.

.4 Make grounding connections in accordance with Section 26 05 28 - Grounding - Secondary.

.5 Make provision for power supply authority's metering.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 - Common Work Results - Electrical.

.3 Section 26 28 21 - Moulded Case Circuit Breakers.

1.2 REFERENCES

.1 Canadian Standards Association

.1 CSA C22.2 No.29, Panelboards and enclosed Panelboards.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 01 50 – General Instructions.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

Part 2 Products

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2No.29 and product of one manufacturer.

.1 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 250 V panelboards: bus and breakers rated for 10,000 A (symmetrical) interrupting capacity or as indicated.

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Two keys for each panelboard and key panelboards alike.

.6 Copper bus with neutral of same ampere rating as mains.

.7 Mains: suitable for bolt-on breakers.

.8 Trim with flush locking door and concealed hinges.

.9 Trim and door finish: baked grey enamel.

.10 Multi-way ground bar bonded to panel steel.

.11 Surface mounted panels shall have drip-proof hood or be otherwise suitable for installation in a sprinklered room.

2.2 BREAKERS

.1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Lock-on devices on breakers for: fire alarm panel, exit sign circuits, telephone system circuits, LAN equipment circuits, doorbell system, panic alarm system, door control systems, night light circuits and other systems as indicated on the drawings.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Nameplate for each panelboard size 4 engraved.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

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 in accordance with Section 06 10 11 - Rough Carpentry. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 26 05 01 - Common Work Results - Electrical.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Indoor service pole connection.

1.2 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions.

.2 Section 26 05 00 - Common Work Results – For Electrical

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 01 50 – General Instructions.

Part 2 Products

2.1 INDOOR SERVICE POLES

.1 Supplied by Departmental Representative.

Part 3 Execution

3.1 INSTALLATION

.1 Provide power and communications connections as indicated on plans.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association

- .1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
- .2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices.
- .3 CSA-C22.2 No.55, Special Use Switches.
- .4 CSA-C22.2 No.111, General-Use Snap Switches.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.

Part 2 Products

2.1 SWITCHES

.1 15 A, 120 V, single pole, double throw, three-way to: CSA-C22.2 No.55 and CSA-C22.2 No.111.

.2 Manually-operated general purpose ac switches with following features:

- .1 Terminal holes approved for No. 10 AWG wire.
- .2 Silver alloy contacts.
- .3 Urea or melamine moulding for parts subject to carbon tracking.
- .4 Suitable for back and side wiring.
- .5 Ivory toggle.

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

.5 Acceptable materials: Cooper ‘1200’ series, Hubbell ‘HBL1200’ series, Pass & Seymour ‘PS15AC’ series.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R or 5-20 R, 125 V, 15 or 20 A, U ground, to: CSA-C22.2 No.42 with following features:

- .1 Urea moulded housing, ivory in colour except those wired to panel 'E' which shall be red in colour.
- .2 Suitable for No. 10 AWG for back and side wiring.
- .3 Break-off links for use as split receptacles.
- .4 Eight back wired entrances, four side wiring screws.
- .5 Triple wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

- .1 Ivory urea moulded housing.
- .2 Suitable for No. 10 AWG for back and side wiring.
- .3 Four back wired entrances, 2 side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

.5 Acceptable materials: Arrow Hart No. 6262, Bryant No. 5262, Hubbell No. 5262, P&S No. 5262.

2.3 DIMMER SWITCHES

.1 Dimmer switch, specification grade, 1000W, slide, separate preset switch mounted on same single gang faceplate, dimming to 5% of light output. Ensure compatibility with dimming ballast.

.2 Acceptable materials: Cooper, Lutron, Leviton

2.4 COVER PLATES

.1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.

.2 Cover plates from one manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Stainless steel, vertically brushed, cover plates, for wiring devices mounted in flush-mounted outlet box.

.5 Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.6 Weatherproof double lift spring-loaded cover plates, complete with gaskets for duplex receptacles as indicated.

- .1 Reinforced thermoplastic polyester for interior.
- .2 Cast aluminum for exterior.

.7 Vandal resistant cover plates, die formed 10 ga. CRS, baked white enamel, Fail-Safe 'SSB' series.

2.5 RECEPTACLE SWITCHES

.1 Receptacle switches to: CSA-C22.2 No.4-M91.

.2 60 A, 125/250 V AC, 3 wire, 4 pole, non-fusible switches with an interlocked receptacle and matching plug, plastic NEMA 4X enclosure.

.3 Acceptable materials: Schneider #MD360MI12 & #ME360P12W

Part 3 Execution

3.1 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height in accordance with Section 26 05 00 - Common Work Results - Electrical.

.4 Mark the circuit number in black indelible ink on the body of each switch in a location visible when the coverplate is removed, but not visible with the coverplate installed.

.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 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Mark the circuit number in black indelible ink on the body of each receptacle in a location visible when the coverplate is removed, but not visible with the coverplate installed.

.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.

.4 Provide a label on every switch and receptacle cover plate indicating circuit number.

.4 Receptacle Switches:

.1 Mount as indicated on drawings.

.2 Indicate name of power sources on size 4 nameplate.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for the following door signal and miscellaneous systems as shown on the drawings and further specified.

.1 Door signal system

.2 Panic alarm system.

.3 Radio antenna conduit system

.4 Door control system for the front public entrance doors to the facility

.5 Cell water supply cut-off system

1.2 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 - Common Work Results - Electrical.

.3 Section 26 29 03 - Control Devices

.4 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 01 50 – General Instructions.

.2 Provide shop drawings for all components of the following systems, including complete wiring diagrams:

.1 Panic alarm system.

.2 Door signal system.

.3 Door control system. Submit a single coordinated package of shop drawings showing all components of the door control system as supplied by the various Divisions.

.3 All horns, buzzers, chimes, etc. shall have distinct tones. There shall be no confusion as to which system has been activated.

Part 2 Products

.1 As required, as indicated on the drawings and as described in Part 3 – Execution.

Part 3 Execution

3.1 DOOR SIGNAL SYSTEM

.1 Provide a door signal system as shown on drawings, comprising transformer, pushbuttons, door switches, bell-buzzer combination, buzzer, and two-tone chime, to provide operation as follows:

.1 Pushbutton at secure bay entrance to cell area to sound bell in bell-buzzer combination, in guard room and in general office. Provide a disconnect

switch under the bell-buzzer in the general office; mount switch separate from light switches. Provide a lamicoid label for the disconnect switch.

.2 Pushbutton at entrance from office area to cell area to sound chime in guard room.

.3 Pushbuttons at front and side entrance doors to sound two-tone chime in general office area.

.4 Door switch on front entrance door to sound buzzer in general office area when door is opened. Loudness of buzzer to be adjustable. Provide a disconnect switch under the buzzer in general office area; mount switch separate from light switches. Provide a lamicoid label for the disconnect switch.

.5 Push button in reception to sound buzzer in general office area as well.

.2 Transformer shall be rated 120/24V sized to operate two signals at one time. Transformer shall be recessed mounted in a suitable outlet box with a perforated cover, located as shown on drawing.

.3 Buzzer, chime and combination bell-buzzer shall be rated 24V ac recessed in suitable outlet boxes with perforated covers, located as shown on drawings.

.4 Entrance chime shall be two-tone for two door operation rated 24V ac surface mounted over an outlet box, located as shown on drawings.

.5 Pushbuttons shall be momentary contact type with screw terminals rated 120V ac mounted in a brushed stainless steel cover plates. Outdoor pushbuttons shall have custom gasketted brass cover plates.

.6 Door switches shall have contact arrangement normally closed and mounted so that contacts close when door is opened. Coordinate installation of door switches with General Contractor to ensure that provision is made for installation before door frames are installed.

.7 Low voltage wiring shall be copper, minimum No. 18 AWG, run in conduit in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

3.2 SECURE DOOR CONDUIT SYSTEM

.1 Provide a system of empty conduits, boxes, pullstrings, etc. for the future installation of a security system as indicated on the drawings.

3.3 PANIC ALARM SYSTEM

.1 Supply and install a panic alarm system consisting of pushbuttons, relay and alarm horn at locations shown.

.2 Alarm pushbuttons shall be red mushroom type, momentary contact.

.3 Alarm silence pushbutton located outside the cell area shall consist of a momentary contact pushbutton mounted over an outlet box containing an electrically held relay.

.4 All alarm system wiring shall be installed in conduit and all conductors shall be No. 14 AWG.

.5 Alarm shall be horn type, heavy duty, 120V AC, flush mounted die cast housing c/w adjustment screw on the front of the horn to provide sound output adjustment

over a 20 db range from approximately 80-100, long life rated 200 hours DC, 400 hours ac at 50% duty cycle.

.6 Alarm system pushbutton stations shall be located where shown on the drawings, flush mounted at a height of 1680 mm to center. Pushbutton stations shall be complete with 1mm brushed stainless steel plate.

3.4 RADIO ANTENNA SYSTEM

.1 Provide empty conduit system complete with pullstrings, for radio antenna coaxial cable.

.2 Provide grounding accommodation for the radio antenna and entrance conduit as indicated.

.3 The coaxial cable and antenna will be installed by others under separate contract.

.4 Exact location of antenna determined by Departmental Representative.

3.5 DOOR CONTROL SYSTEM – FRONT PUBLIC ENTRANCE DOOR

.1 Provide some door control system components as indicated on the drawings. Note that some components will be supplied by other Divisions and that some components will be installed by other Divisions.

.2 Low voltage wiring shall be copper, minimum No. 18 AWG, run in conduit in accordance with Section 26 05 34.

3.6 CELL WATER SUPPLY CUT-OFF SYSTEM

.1 The solenoid valves provided by Division 23 will be used to shut off the hot and cold water supplies to the cells. Provide a switch in the guard area mounted in a separate box for this system. The solenoid valves will be 120 volts. Bond the solenoid valves. Provide a lamicoid label for the switch. Provide conduit for the wiring.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2No.248.12, Low Voltage Fuses Part 12: Class R.

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 DELIVERY AND STORAGE

.1 Ship fuses in original containers.

.2 Do not ship fuses installed in equipment.

.3 Store fuses in original containers until installed.

1.5 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 01 01 50 – General Instructions.

.2 Three spare fuses of each type and size installed up to and including 400 A.

Part 2 Products

2.1 FUSES GENERAL

.1 Fuse type references L1, L2, J1, J2, R1, etc. have been adopted for use in this specification.

.2 Fuses: Product of one manufacturer for entire project.

2.2 FUSE TYPES

.1 Class J fuses (formerly HRCI- J).

.1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type J2, fast acting.

Part 3 Execution

3.1 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit.

.2 Ensure correct fuses fitted to physically matched mounting devices.

.3 Ensure correct fuses fitted to assigned electrical circuit.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 – Common Work Results – For Electrical

1.2 REFERENCES

.1 Canadian Standards Association.

.1 CSA-C22.2 No. 5, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures.

1.3 SUBMITTALS

.1 Submit product data in accordance with Section 01 01 50 – General Instructions.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, and Ground-fault circuit-interrupters, to CSA C22.2 No. 5

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40° C ambient.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Circuit breakers to have minimum 10,000A symmetrical rms interrupting capacity rating.

.5 Minimum width 19 mm.

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.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers in components as indicated.

.2 Fire alarm breaker to be identified in red.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 - Common Work Results - Electrical.

.3 Section 26 24 01 – Service Equipment

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4, Enclosed Switches.

.2 CSA C22.2 No.39, Fuseholder Assemblies.

1.3 SUBMITTALS

.1 Submit product data in accordance with Section 01 01 50 – General Instructions.

Part 2 Products

2.1 GENERAL

.1 Fusible or non-fusible, horsepower rated disconnect switch in CSA Enclosure 1, to CAN/CSA C22.2 No.4 size as indicated.

.2 Provision for padlocking in ON-OFF switch position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated, in accordance with Section 26 28 14 - Fuses - Low Voltage.

.5 Fuseholders: to CSA C22.2 No.39, relocatable and suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action.

.7 ON-OFF switch position indication on switch enclosure cover.

.8 Double throw switch for manual transfer switch.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses as applicable or indicated.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 - Common Work Results - Electrical.

.3 Section 26 29 03 - Control Devices.

1.2 REFERENCES

.1 Canadian Standards Association

.1 CSA C22.2 No.14, Industrial Control Equipment.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 01 50 – General Instructions.

Part 2 Products

2.1 CONTACTORS

.1 Contactors: to CSA C22.2 No.14.

.2 Electrically held controlled by pilot devices as indicated and rated for type of load controlled.

.3 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.

.4 Mount in CSA Enclosure 1 unless otherwise indicated.

.5 Include following options in cover as may be further indicated:

.1 Green indicating LED.

.2 Hand-Off-Auto selector switch.

.6 Control transformer: in accordance with Section 26 29 03 - Control Devices, in contactor enclosure where further indicated.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Size 4 nameplate indicating name of load controlled.

Part 3 Execution

3.1 INSTALLATION

.1 Install contactors and connect auxiliary control devices.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 - Common Work Results - Electrical.

.3 Section 26 29 01 – Contactors

.4 Section 26 29 10 – Motor Starters to 600V

1.2 REFERENCES

.1 Canadian Standards Association.

.1 CSA C22.2 No.14, Industrial Control Equipment.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1, Industrial Control and Systems: General Requirements.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 01 50 – General Instructions.

.2 Include schematic, wiring, interconnection diagrams.

Part 2 Products

2.1 AC CONTROL RELAYS

.1 Control Relays: to CSA C22.2 No.14.

.2 Sealed contact type: plug-in electrically held with control coil voltage to suit and contact rating minimum 10 A at 120 V.

2.2 PUSHBUTTONS

.1 Heavy duty, Oil tight. Operator flush type, Green, with 1-NO and 1-NC contacts rated at 10 A AC, labelled to indicate purpose. Stop pushbuttons coloured red, labelled to indicate purpose.

2.3 SELECTOR SWITCHES

.1 Maintained, 3 position labelled Hand/Off/Auto as indicated. Heavy duty oil tight, operator, rated 250 V, 10 A, AC.

2.4 INDICATING LIGHTS

.1 LED type, lens colour: green. Supply voltage: 120 V or 208 V as indicated.

2.5 CONTROL AND RELAY PANELS

.1 CSA Type 1 sheet steel enclosure with hinged padlockable access door, accommodating relays, timers, labels, as indicated, and wired to identified terminals.

2.6 CONTROL CIRCUIT TRANSFORMERS

.1 Single phase, dry type.

.2 Primary: 208 V AC.

.3 Secondary: 120 V AC.

.4 Rating: 150 VA.

.5 Secondary fuse: 3 A.

.6 Close voltage regulation as required by magnet coils and solenoid valves.

Part 3 Execution

3.1 INSTALLATION

.1 Install control devices and interconnect as necessary.

3.2 FIELD QUALITY CONTROL

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

.2 Check out complete system for operational sequencing.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 International Electrotecqnical Commission (IEC)

.1 IEC 947-4-1, Part 4: Contactors and motor-starters.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with Section 01 01 50 - Submittal Procedures.

.2 Indicate:

.1 Mounting method and dimensions.

.2 Starter size and type.

.3 Layout of identified internal and front panel components.

.4 Enclosure types.

.5 Wiring diagram for each type of starter.

.6 Interconnection diagrams.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 01 01 50 – General Instructions.

.2 Include operation and maintenance data for each type and style of starter.

Part 2 Products

2.1 MATERIALS

.1 Starters: to IEC 947-4-1 with AC4 utilization category.

2.2 MANUAL MOTOR STARTERS

.1 Single or three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:

.1 Switching mechanism, quick make and break.

.2 One overload heater for single phase, 3 for 3-phase, manual reset, trip indicating handle.

.2 Accessories:

.1 Toggle switch: labelled to indicate purpose.

.2 Indicating light: green LED type.

.3 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 FULL VOLTAGE MAGNETIC STARTERS

.1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

- .1 Contactor solenoid operated, rapid action type.
- .2 Motor overload protective device in each phase, manually reset from outside enclosure.
- .3 Wiring and schematic diagram inside starter enclosure in visible location.
- .4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.2 Combination type starters to include fused disconnect switch, circuit breaker or motor circuit interrupter with operating lever on outside of enclosure and provision for:

- .1 Locking in ‘OFF’ position with up to 3 padlocks.
- .2 Independent locking of enclosure door.
- .3 Provision for preventing switching to ‘ON’ position while enclosure door open.

.3 Accessories:

- .1 Pushbuttons and/or Selector switches: standard, heavy duty, oil tight labelled as indicated.
- .2 Indicating lights: LED type and colour as indicated.
- .3 2-N/O and 2-N/C spare auxiliary contacts unless otherwise indicated.

2.4 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.

.2 Size control transformer for control circuit load plus 20% spare capacity.

2.5 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 00 - Common Work Results - Electrical.

2.6 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Manual starter designation label, white plate, black letters, size 1, engraved to indicate purpose.

.3 Magnetic starter designation label, white plate, black letters, size 1 engraved to indicate purpose.

Part 3 Execution

3.1 INSTALLATION

.1 Install starters, connect power and control as indicated.

.2 Ensure correct fuses and overload devices elements installed.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and manufacturer's instructions.

.2 Operate switches, starters to verify correct functioning.

.3 Perform starting and stopping sequences of starters and control relays.

.4 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 SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 - Common Work Results - Electrical.

.3 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

1.2 REFERENCES

.1 Government of Canada

.1 NBC, National Building Code of Canada.

.2 TB OSH Chapter 3-03, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-03, Standard for Fire Protection Electronic Data Processing Equipment.

.3 TB OSH Chapter 3-04, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-04, Standard for Fire Alarm Systems.

.4 International Standard ISO8201 – Acoustics – Audible Emergency Evacuation Signal

.2 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S524-2006, Installation of Fire Alarm Systems.

.2 ULC-S525, Audible Signal Appliances for Fire Alarm.

.3 CAN/ULC-S526, Visual Signal Appliances, Fire Alarm.

.4 CAN/ULC-S527, Control Units.

.5 CAN/ULC-S528, Manual Pull Stations.

.6 CAN/ULC-S529, Smoke Detectors.

.7 CAN/ULC-S536, Inspection and Testing of Fire Alarm Systems.

.8 CAN/ULC-S537, Verification of Fire Alarm Systems.

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 two-stage alarm; supervising components and wiring; actuating annunciators and auxiliary functions; initiating trouble signals and signalling to monitoring agency.

.3 Zoned, non-coded two 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 Power supplies.

.3 Initiating/input circuits.

.4 Output circuits.

.5 Auxiliary circuits.

.6 Wiring.

.7 Manual and automatic initiating devices.

.8 Audible and visual signalling devices.

.9 End-of-line resistors.

.10 Remote annunciators

.11 Ancillary devices.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

.1 System:

.1 To TB OSH Chapter 3-04.

.2 Subject to Fire Commissioner of Canada 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 Section 01 01 50 – General Instructions.

.2 Include:

.1 Detail assembly and internal wiring diagrams for control units.

.2 Overall system wiring diagram identifying control equipment initiating zones, signalling circuits; identifying terminations, terminal numbers, conductors and raceways.

.3 Details for devices.

.4 Details and performance specifications for control, annunciation and peripherals.

.5 Step-by-step operating sequence.

1.6 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for fire alarm system for incorporation into manuals specified in Section 01 01 50 – General Instructions.

.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.

.5 Provide an operators condensed and simplified list of instruction on how to react to the various alarm and trouble conditions to be expected. The list shall be on one 215.9 mm by 279.4 mm sheet only. Departmental Representative shall review the operating instructions prior to distribution.

1.7 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 01 50 - General Instructions.

.2 Include:

.1 Three spare glass rods for manual pull stations.

.2 One manual fire alarm station.

.3 One of each type of smoke detector used.

Part 2 Products

2.1 MATERIALS

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

.2 Power supply: to CAN/ULC-S524.

.3 Audible signal devices: to ULC-S524.

.4 Visual signal devices: to CAN/ULC-S526.

.5 Control unit: to CAN/ULC-S527.

.6 Manual alarm stations: to CAN/ULC-S528.

.7 Smoke detectors: to CAN/ULC-S529.

2.2 SYSTEM OPERATION: TWO STAGE - SIGNALS ONLY

.1 Actuation of any alarm initiating device on first stage to:

.1 Cause electronic latch to lock-in alarm state at central control unit.

.2 Indicate zone of alarm at central control unit and at remote annunciators.

.3 Cause audible devices throughout building to sound at 20 strokes per minute.

.4 Transmit signal to fire department via central station.

.5 Cause air conditioning and ventilation fans to shut down.

.2 Actuation of any alarm initiating device on second stage to cause audible signalling devices to sound in alarm tone throughout building.

.3 If first stage alarm is not acknowledged within 5 minutes, system to automatically go into second stage.

.4 Acknowledging alarm: indicated at central control unit.

.5 Possible to silence signals by ‘alarm silence’ switch at central control unit, after 60 s period of operation.

.6 Subsequent alarm, received after previous alarm has been silenced, to re-activate signals.

.7 Actuation of any supervisory device to:

.1 Cause electronic latch to lock-in supervisory state at central control unit.

.2 Indicate respective supervisory zone at central control unit and remote annunciators.

.3 Cause audible signal at control unit and remote annunciators to sound.

.4 Activate common supervisory sequence.

.8 Resetting alarm or supervisory device not to return system indications/functions back to normal until control unit is reset.

.9 Trouble on system to:

.1 Indicate circuit in trouble at central control unit.

.2 Activate ‘system trouble’ indication, buzzer and common trouble sequence. Acknowledging trouble condition at either control unit or remote annunciators to silence audible indication; visual indication to remain until trouble is cleared and system is back to normal.

.10 Troubles on system are suppressed during course of alarm.

.11 Trouble condition on any circuit in system not to initiate alarm conditions.

2.3 CONTROL PANEL

.1 Central control unit (CCU).

.1 Features specified are minimum requirements for microprocessor-based system with digital data control and digital multiplexing techniques for data transmission.

.2 Minimum capacity of 250 addressable monitoring and control/signal points.

.3 Minimum two line LCD type display to allow English wording on one line and French on the other.

.4 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.

.5 Integral power supply, battery charger and standby batteries.

.6 Basic life safety software: retained in non volatile 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.

.7 Circuitry to continuously monitor communications and data processing cycles of microprocessor. Upon failure, audible and visual trouble indication to activate.

.8 Equipped with software routines to provide Event-Initiated-Programs (EIP); change in status of one or more monitor points, may be programmed to operate any or all of system's control points.

.9 Software and hardware to maintain time of day, day of week, day of month, month and year.

.10 Software to operate variable sensitivity addressable smoke detectors and annunciate their status and sensitivity settings at control panel.

.11 Manufacturers: Simplex, Chubb-Edwards. Note the two manufacturers are the only two that have cell guards for smoke detectors approved by the RCMP.

2.4 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 Interface with battery charger and battery to provide uninterruptible transfer of power to standby source during primary power failure or loss.

.5 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.

.6 Standby batteries: sealed, maintenance free. Capacity of standby battery system shall be to NBC 2005 requirements for a low-rise building of occupancy type B.

.7 Continuous supervision of wiring for external initiating and alarm circuits to be maintained during power failure.

2.5 WIRING - DCL

.1 Data communication link (DCL) wiring from the panel to field devices shall be a type A link. The DCLA wiring is similar to a class A fire alarm circuit which returns to the panel. The wiring that returns to the panel shall follow a different route and not be in the same conduit per requirements of CAN/ULC S524-06. Isolator modules shall be installed in the DCLA wiring on each side of a fire separation at the entry to and exit from the space that has the fire separation. Fire separated areas on this project are the cells area, the office area and the upper floor area.

2.6 INITIATING/ INPUT CIRCUITS

.1 Receiving circuits for alarm initiating devices such as manual pull stations, smoke detectors, and water flow switches, wired to central control unit.

.2 Alarm receiving circuits (active and spare): compatible with smoke detectors and open contact devices.

.3 Receiving circuits for supervisory, N/O devices. Devices: wired to central control unit.

2.7 ALARM OUTPUT CIRCUITS

.1 Alarm output circuit: connected to signals, wired in class B configuration to central control unit.

.1 Signal circuits' operation to follow system programming; capable of sounding bells in alert and alarm conditions. Alert or first stage alarm is 20 bell strokes per minute. Alarm shall be the ISO 8201 temporal pattern. Each signal circuit: rated at 2 A, 24 V DC; fuse-protected from overcurrent.

.2 Visual signal circuit.

.3 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 or supervisory trouble on system to cause operation of programmed auxiliary output circuits.

.3 Upon resetting system, auxiliary contacts to return to normal or to operate as pre-programmed.

.4 Auxiliary circuits: rated at 2 A, 24 V DC or 30 V AC, fuse-protected.

.5 Auxiliary circuits shall control remote relays to provide shutdown functions that are required on alarm as indicated.

2.9 WIRING

.1 Twisted copper conductors: rated 300 V, listed by CSA as suitable for fire alarm duty.

.2 To initiating circuits: 18 AWG minimum, and in accordance with manufacturer's requirements.

.3 To signal circuits: 16 AWG minimum, and in accordance with manufacturer's requirements.

.4 To control circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.

2.10 MANUAL ALARM STATIONS

.1 Addressable Manual alarm stations: pull lever, wall mounted semi-flush type, general alarm key switch for two stage system bilingual signage. On board electronics for communication with control unit.

2.11 AUTOMATIC ALARM INITIATING DEVICES

.1 Smoke detector: ionization or photo-electric type. Air duct type with sampling tubes with protective housing.

.2 Addressable variable-sensitivity smoke detectors.

.1 Photo-electric type for ceiling mounted device, ionization type for air duct detectors.

.2 Electronics to communicate detector's status to addressable module.

.3 Sensitivity settings: Settings, determined and operated by control panel. No shifting in detector sensitivity due to atmospheric conditions (dust, dirt) within certain parameters.

.4 Ability to annunciate minimum of 2 levels of detector contamination automatically with trouble condition at control panel.

2.12 CELL SMOKE DETECTOR GUARDS

.1 Steel, tamper-proof smoke detector protective cage.

.2 Acceptable are: Simplex 4098-9806C and 2098-9829C, Chubb-Edwards 6255-004.

.3 There shall be no knockouts or openings since the wiring will be concealed.

.4 Guard must be ULC listed for air velocities down to three meters per minute.

.5 Guard must be ULC listed for use with the smoke detector with which it is used.

.6 Departmental Representative will provide detailed additional mounting instructions.

.7 **Minimum Fourteen gauge** cold rolled steel.

2.13 AUDIBLE SIGNAL DEVICES

.1 Bells: 250 mm diameter, 24 V DC, Minimum 85db @ 3.0 m.

2.14 VISUAL ALARM SIGNAL DEVICES

.1 Strobe type: flashing, red, 24 V DC.

.2 Designed for surface mounting on ceiling or walls.

2.15 END-OF-LINE DEVICES

.1 End-of-line devices to control supervisory current in signalling circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely at annunciators.

2.16 REMOTE ANNUNCIATORS

.1 Flush mounted LED type, with designation cards to indicate zones and with associated LCD display.

.2 Display:

- .1 Alarms and troubles for alarm initiating circuits.
- .2 Supervisory alarms and troubles for supervisory initiating circuits.
- .3 Common system trouble.
- .4 LCD display to be minimum two line type capable of English and French wording on each of the two lines. LCD readout to identify type of device in alarm and exact location.
- .5 LED display to indicate alarms and alarm-areas as indicated on the drawings.

.3 Trouble buzzer acknowledging trouble at main panel to silence trouble buzzers in system.

.4 Supervised, with LED test button and alarm and trouble acknowledge button.

2.17 SPRINKLER ALARM AND SUPERVISORY DEVICES

.1 The sprinkler sub-contractor will install alarm and supervisory switches on the sprinkler system. To allow connection of these devices to the fire alarm system provide the necessary addressable modules for connection to the sprinkler system.

2.18 AS-BUILT RISER DIAGRAM

.1 Fire alarm system riser diagram: in glazed frame minimum size 600 x 600 mm.

2.19 ANCILLARY DEVICES

.1 Remote relay unit to initiate fan shutdown as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install systems in accordance with CAN/ULC-S524 and TB OSH Chapter 3-04.

.2 Install all wiring in EMT in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

.3 Install control unit and connect to ac power supply, dc standby power.

.4 Install manual alarm stations and connect to alarm circuit wiring.

.5 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1.0 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.

.6 Connect alarm circuits to main control panel.

.7 Install bells and visual signal devices and connect to signalling circuits.

.8 Connect signalling circuits to main control panel.

.9 Install end-of-line devices at end of signalling circuits.

.10 Install remote annunciator panels and connect to annunciator circuit wiring.

.11 Install remote relay units to control fan shut down.

.12 Sprinkler system: wire alarm and supervisory switches and connect to control panel.

.13 Wiring splices are not permitted except at device locations.

.14 Provide necessary raceways, cable and wiring to make interconnections to terminal boxes, annunciator equipment and control unit, as required by equipment manufacturer.

.15 Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.

.16 Identify circuits and other related wiring at central control unit, annunciators, and terminal boxes.

.17 Install smoke detector guards in cells. Use high strength grout during installation of cell smoke detector guard to fill any space between the back of the mounting plate and the ceiling surface. Ensure no openings or knockouts are visible when installed.

.18 Wire to sprinkler system as follows:

.1 To the alarm switch on each zoned area of the sprinkler system to provide separate alarm indication for each area.

.2 To the zone valve tamper switches to provide trouble or supervisory indication. Where the tamper switches are located within the same room they may be on the one supervisory zone. Where zone valve tamper switches are in different rooms there shall be a supervisory indication for the valves in each room.

.3 System low pressure condition shall be monitored as a separate indication for each wet or dry sprinkler systems.

.4 There will be an excess pressure pump for the sprinkler system. Wire to the excess pressure pump as necessary via the pressure switch arrangement for automatic pump-up of system.

.5 To low temperature monitoring device in sprinkler room.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and CAN/ULC-S537 and CAN/ULC-S536.

.2 Tests, inspection and verification shall be performed by a specialist contractor other than the installation contractor. Provide the name of the test, inspection and verification contractor (for example – fire alarm equipment manufacturer) within 5 days after contract award.

.3 Fire alarm system:

.1 Test each device and alarm circuit to ensure manual stations, smoke detectors sprinkler system transmit alarm to control panel and actuate first stage alarm and general alarm including ancillary devices.

.1 Test of smoke detectors shall confirm that each smoke detector sensitivity value is within its rated operating range, using the manufacturer's recommended test equipment or other means. Include initial sensitivity value for each smoke detector in verification report.

.2 Check annunciator panel to ensure zones are shown correctly.

.3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of systems.

.4 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.

.5 Verification Certificate. Provide copies of the completed verification certificate to the Departmental Representative and the Office of the Fire Commissioner of Canada prior to the request of an interim inspection.

.1 Mail one copy of the verification inspection report, verification letter and certificate to the Office of the Commissioner of Canada. The interim inspection will commence only after the Office of the Fire Commissioner of Canada have these documents in their possession.

.6 Provide final PROM program of any re-burn done for the system incorporating program changes made during construction.

3.3 DEMONSTRATION AND TRAINING

.1 Provide on-site lecture and demonstration by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for interior and exterior luminaires.

.2 Provide luminaires and accessories for all outlets as listed in the Luminaire Schedule and as shown in details on drawings.

.3 Luminaires shall be well designed structurally and constructed using new parts and materials of the highest commercial grade available.

.4 Luminaires of the same or similar type shall be supplied by the same manufacturer.

1.2 RELATED SECTIONS

.1 Section 01 01 50 - General Instructions.

.2 Section 26 05 00 – Common Work Results – For Electrical

.3 Section 26 05 21 – Wires and Cables (0-1000 V)

.4 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings

1.3 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Departmental Representative.

.3 Photometric data to include: VCP Table, spacing criterion.

.4 Provide, where possible, commercially available stock luminaires which meet the requirements of the specified luminaires.

.5 Details of luminaires illustrated on drawings and listed in luminaire schedule, may include features considered exclusive to one manufacturer. It is not the intent of this specification to limit the submission of luminaires to one manufacturer and other manufacturers may submit bids on equal equipment.

Part 2 Products

2.1 LAMPS

.1 Linear fluorescent lamps:

- .1 Bi-pin T-8 design with average rated life of 20,000 hrs.
- .2 Colour rendering index of 0.85.
- .3 Colour temperature 3500° K.
- .4 Minimum 3000 initial lumens for 32 watt T-8.
- .5 Minimum 2225 initial lumens for 25 watt T-8.
- .6 Minimum 1400 initial lumens for 17 watt T-8.

.2 Compact fluorescent lamps:

- .1 Colour rendering index of 0.85.

.2 Colour temperature 3500° K.

.3 Suitable for operation by electronic ballast.

.4 Wattage as indicated.

.3 HID lamps:

.1 Lamps to be coated type.

.2 Wattage as indicated.

.3 Mogul base lamp where such lamps are an option for the luminaire into which they are to be installed.

2.2 BALLASTS

.1 Fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic, program start.

.1 Rating: 120 V, 60 Hz, for use with T-8, lamps.

.2 Totally encased and designed for 40 degrees C ambient temperature.

.3 Power factor: minimum 95 % with 95 % of rated lamp lumens.

.4 Low temperature starting of T-8 lamps down to minus 17° C.

.5 Harmonics: 10 % maximum THD and inbuilt RFI suppression.

.6 Operating frequency of electronic ballast: 40 kHz minimum.

.7 Total Circuit Power: Maximum 59 Watts for two lamp ballast.

.8 Ballast Factor: greater than 0.87.

.9 Sound rated: Class A.

.10 Mounting: Integral with luminaire.

.11 Manufacturer: Philips Optanium series or equal by GE, Osram Sylvania.

.2 Metal halide ballast:

.1 Rating: 120 V, 60 Hz, for use with lamp wattage as indicated.

.2 Totally encased and potted and designed for 40 degrees C ambient temperature.

.3 Power factor: minimum 95 % with 95 % of rated lamp lumens.

.4 Type: HPF pulse start technology.

.5 Input voltage range: plus or minus 10 % of nominal.

.6 Minimum starting temperature: minus 29° C at 90 % line voltage.

.7 Mounting: Integral with luminaire.

.3 High pressure sodium ballast: to ANSI C82.4 design.

.1 Rating: 120 V, 60Hz voltage as indicated, for use with lamp wattage as indicated.

.2 Totally encased and potted and designed for 40° C ambient temperature.

.3 Power factor: minimum 95 % with 95 % of rated lamp lumens.

.4 Input voltage range: plus 10 % to minus 10 % of nominal.

.5 Minimum starting temperature: minus 34° C at 90 % line voltage.

.6 Mounting: Outdoor integral with luminaire.

2.3 LUMINAIRES

.1 All luminaires shall comply with CSA Standard C22.2 No. 9. Accessories and components shall comply with relevant CSA standards applicable to accessory or components.

.2 Design of reflector and lamp position shall be to provide high efficiency, even brightness and lack of lamp lines.

.3 Fluorescent luminaires shall be constructed of not less than 20 ga steel. All metal parts shall be thoroughly cleaned and finished in high reflectance baked white enamel over corrosion-resistant primer. Reflecting surfaces and exposed surface shall have not less than two coats of baked white enamel with reflectance of not less than 85%.

.4 All luminaire diffusers, lens panels, lens frames, etc. shall be securely and adequately supported, and shall be removable without the use of tools for cleaning.

.5 Luminaires shall incorporate adequate gasketting, stops and barriers to form light traps and prevent light leaks.

.6 Luminaires shall be designed for adequate dissipation of ballast and lamp heat to avoid short ballast life, nuisance thermal tripping and decreased lamp output. Heat test reports by independent laboratories shall be provided where required by the Departmental Representative.

.7 Construction of all luminaires shall be such as to provide a rigid well aligned component. To accomplish this, formed or ribbed backplates, endplates, reinforcing channel, heavy gauge sockets, straps, etc. shall be used where required.

.8 The construction and performance of all fluorescent luminaires shall be subject to the strict approval of the Departmental Representative. Full photometric data from independent testing laboratories shall be provided where required by the Departmental Representative.

.9 Schedule: Refer to drawings.

2.4 OUTDOOR ILLUMINATED SIGN

.1 Outdoor sign will be supplied and set in place under other Divisions, powered by this Division.

Part 3 Execution

3.1 INSTALLATION

.1 All luminaires 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 luminaires.

.2 Locate and install as indicated.

.3 Luminaires shall not be mounted above pipes, ducts or equipment. In event of unavoidably tight locations, hangers shall be provided to clear obstructions.

.4 Luminaires and mountings shall be checked for their electrical and physical characteristics in relation to conditions due to building construction and

mechanical equipment. Necessary adjustment shall be made to location or hanging arrangements without expense to Departmental Representative.

.5 Verify all ceiling types and finishes before ordering luminaires and provide luminaires suitable for mounting in or on ceilings being installed in each area, as specified. Where luminaire types specified are not suitable for ceiling being installed, obtain written instructions from the Departmental Representative before ordering luminaires.

.6 Luminaires having low glare parabolic louver style reflectors shall not have louver installed until area is clean and free of construction dust. After removal from wrapping, reflectors shall be installed using cotton gloves to ensure reflector is kept clean. Do not install reflectors with packing dust on them. Ensure all reflectors are clean prior to installation.

3.2 WIRING

.1 Connect luminaires to lighting circuits:

.1 Directly for luminaires surface mounted on gypsum wall board ceilings.

.2 Through short flexible conduit drops for luminaires mounted in accessible suspended T-bar ceilings or by short AC cable drops.

.2 Ground all lighting equipment to grounding system as specified in Section 26 05 27.

3.3 LUMINAIRE SUPPORTS

.1 For suspended ceiling installations support luminaires from ceiling grid and provide seismic bracing as indicated for fluorescent and recessed down-light type luminaires.

.2 Wall mounted luminaires shall be secured with a minimum of four screws or fixings.

.3 Surface mounted luminaires shall be secured with a minimum of two fixings at each end. Note: Fixings to outlet box do not count as luminaire mountings. Provide 2 fixings at each end independent of outlet box screws. Where luminaires are installed surface mounted on gypsum board ceilings, arrange for the provision of rigid structural supports behind the luminaire so luminaire can be securely fixed to these supports for seismic purposes. Toggle bolts are acceptable only as a non-seismic rated support system.

.4 Provide complete and proper supports for all luminaires, luminaire hangers, etc. including headers in ceiling space, where required, for proper support of outlet boxes and luminaire hanger assemblies.

.5 Support luminaires in locations as indicated on the drawings, level, plumb and true with the structure and other equipment in a horizontal or vertical position as intended. Wall or side bracket mounted luminaire housings shall be rigidly installed and adjusted to give a neat flush fit to the surface on which they are mounted. All hangers, supports, fastenings or accessory fittings shall be protected against corrosion. Care shall be taken during the installation to assure that insulation and corrosion protection is not damaged.

.6 All recessed luminaires shall be installed so that they are removable from below to gain access to outlet box or prewired luminaire junction box. Connect all recessed luminaires to boxes with flexible conduit and approved luminaire wire.

.7 Any luminaires which are not installed properly shall be taken down and re-installed without expense to the Departmental Representative.

3.4 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line. Provide aligner clips between reflectors in continuous rows as necessary.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 OUTDOOR ILLUMINATED SIGN

.1 Provide wiring to sign and provide connection and control as indicated.

.2 Provide lamps as required.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 - General Instructions

.2 Section 26 05 21 - Wires and Cables (0-1000 V).

.3 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.2 REFERENCES

.1 Canadian Standards Association

.1 CSA C22.2 No.141, Unit Equipment for Emergency Lighting.

1.3 SUBMITTALS

.1 Submit product data in accordance with Section 01 01 50 - General Instructions.

.2 Data to indicate system components, mounting method, source of power and special attachments.

Part 2 Products

2.1 BATTERY UNITS

.1 Supply voltage: 120 VAC.

.2 Output voltage: 12 VDC.

.3 Operating time: 60 minutes.

.4 Battery: sealed, maintenance free, 10 year life expectancy.

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

.6 Solid state transfer circuit.

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

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

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

.10 Finish: Factory standard.

.11 Auxiliary equipment:

.1 Lamp disconnect switch.

.2 Test switch.

.3 AC input and DC output terminal blocks inside cabinet.

.4 Seismic fixing accommodation.

.5 Cord and plug connection for AC.

.6 RFI suppressors.

2.2 LIGHTING HEADS

.1 Integral to battery unit and/or remote, 345° horizontal and 180° vertical adjustment.

.2 Lamp type:

.1 18 watt sealed beam for garage bays.

.2 12 watt quartz for all other areas.

.3 Cell area: polycarbonate vandal resistant lens.

.4 Other areas: ceiling or wall, surface heads mounted on adjustable swivel.

2.3 RELAY UNITS

.1 Relay units to activate all emergency heads connected to battery pack, if any of the indicated lighting circuits fail.

Part 3 Execution

3.1 INSTALLATION

.1 Install unit equipment for emergency lighting. Fix to wall to suit seismic fixing requirements.

.2 Install unit equipment and remote mounted fixtures as indicated.

.3 Make DC connections with #10 AWG to exit signs.

.4 Cut and re-cap cord to remove surplus.

.5 Direct heads as indicated.

3.2 WIRING OF REMOTE HEADS

.1 Conduit: type EMT, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings where installed in ceiling spaces or walls or in armoured cable where installed concealed in walls.

.2 Conductors: RW90 type in accordance with Section 26 05 21 - Wires and Cables (0-1000 V), sized as #12 AWG for AC wiring and #10 AWG for DC wiring.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 - General Instructions.

.2 Section 26 05 21 - Wires and Cables (0-1000 V).

.3 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.2 REFERENCES

.1 Canadian Standards Association

.1 CSA C22.2 No.141, Unit Equipment for Emergency Lighting.

.2 CSA C860, Performance of Internally-Lighted Exit Signs.

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, physical size, finish and limitations.

Part 2 Products

2.1 GENERAL

.1 Exit lights: to CSA C22.2 No.141-10 and CSA C860.

.2 LED type suitable for connection to 120V AC and 12V DC.

.3 Pictogram type polycarbonate panel.

2.2 STANDARD UNITS

.1 Housing: White coloured cold rolled steel minimum 1.0 mm thick, or white extruded aluminum housing.

.2 Faceplate: die formed cold rolled steel or extruded aluminum.

2.3 CELL AREA UNITS

.1 Housing: White industrial grade PVC.

.2 Faceplate: Heavy duty vandal resistant polycarbonate.

.3 Gasketed, NEMA-4 certified.

2.4 DESIGN

.1 Universal mounting.

.2 Single or double face with face plate to remain captive for relamping.

.3 Arrows: Front, back in directions as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install exit lights in locations indicated.

.2 Connect fixtures to exit light AC circuits.

.3 Connect fixtures to emergency battery lighting DC circuits with minimum #10 AWG conductors.

.4 Ensure that exit light circuit breaker is locked in ‘on’ position.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Provision of rigid PVC duct.

1.2 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions.

.2 Section 26 05 00 – Common Work Results – For Electrical.

.3 Section 26 65 76 - Direct Buried Underground Cable Ducts.

.4 Section 26 05 44 - Installation of Cables in Trenches and in Ducts.

.5 Section 26 05 28 - Grounding - Secondary.

.6 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.3 REGULATORY REQUIREMENTS

.1 Co-ordinate and meet requirements of power supply authority. Ensure availability of power when required to suit construction schedule.

Part 2 Products

2.1 MATERIALS

.1 Underground ducts: to Section 33 65 76 - Direct Buried Underground Cable Ducts, rigid type DB2, size as indicated.

.2 Meter socket: To utility company requirements.

Part 3 Execution

3.1 INSTALLATION

.1 Install cables in trenches and in ducts in accordance with Section 26 05 44 - Installation of Cables in Trenches and in Ducts.

.2 Install meter socket and conduit.

.3 Make grounding connections in accordance with Section 26 05 28 - Grounding - Secondary.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 – Common Work Results - Electrical

.3 Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings

.4 Section 26 05 36 – Cable Trays for Electrical Systems

.5 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets

.6 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings

.7 Section 26 27 23 - Indoor Service Poles

.8 Section 26 05 29 – Hangers and Supports for Electrical Systems

.9 Section 28 13 00 – Access Control

.10 Section 28 16 00 - Intrusion Detection

.11 Section 28 23 00 - Video Surveillance

.12 Section 28 24 00 - Interview Rooms Audio/Video Surveillance

1.2 SYSTEM DESCRIPTION

.1 Empty communications raceway system consists of outlet boxes, cover plates, cabinets, conduits or conduit stubs, J-hooks, cable tray, pull boxes, sleeves and caps, fish wires, service poles, service fittings, underground ducts.

.2 Conduit and/or conduit stub system is specified to be installed under Section 26 05 34.

.3 J-hooks for open cabling in ceiling spaces shall be supplied and installed under this Section.

Part 2 Products

2.1 MATERIAL

.1 Conduits and conduit stubs: EMT type, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Underground cable ducts: DB2 type, in accordance with Section 33 65 76 - Direct Buried Underground Cable Ducts.

.3 Outlet boxes deep type, conduit boxes size, and fittings: in accordance with Section 26 05 32 – Outlet boxes, Conduit boxes and Fittings.

.4 Indoor service poles: in accordance with Section 26 27 23 - Indoor Service Poles.

.5 Fish wire: polypropylene type.

.6 J-hooks: Pre-manufactured metal type; Caddy Cablecat or similar. Pre-manufactured plastic type; listed for application in air plenum, Panduit J-Pro or similar.

Part 3 Execution

3.1 INSTALLATION

.1 Empty raceway and conduit system or conduit stubs including fish wire, outlet boxes, service poles, miscellaneous and positioning material to constitute raceway portion of the complete wiring pathway system as further detailed on the drawings or in Sections 28 13 00, 28 16 00, 28 23 00, and 28 24 00 will be installed under Section 26 05 34.

.2 Provide J-hooks as further detailed on the drawings under this section of the specification to suit open wiring installation of cables in the ceiling space.

.3 Provide mounting facility for J-hooks. Provide rod hangers or other facility. Provide independent supports for J-hooks, do not support off conduit systems, mechanical ducts or sprinkler pipes.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions.

.2 Section 26 05 00 – Common Work Results - Electrical

.3 Section 27 05 28 – Pathways for Communication Systems

1.2 REFERENCES

.1 Canadian Standards Association

.1 CSA-C22.2 No. 214, Communications Cables.

.2 Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA)

.1 ANSI/TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises.

.2 ANSI/TIA-568-C.1 Commercial Building Telecommunications Cabling standard.

.3 ANSI/TIA-568-C.2 Balanced Twisted-pair Telecommunications Cabling and Components standard.

.4 TIA-569-B, Commercial Building Standard for Telecommunications Pathways and Spaces.

.5 ANSI/TIA -606-A, Administration Standard for Commercial Telecommunications Infrastructure.

.6 ANSI/TIA-607-B Telecommunications Grounding (Earthing) and bonding for Customer Premises.

.7 National Building Code of Canada 2010.

.8 CSA C22.1-2009 Canadian Electrical Code, BC Amendments, Directives and Bulletins.

1.3 SYSTEM DESCRIPTION

.1 Structured telecommunications wiring system consists of unshielded-twisted-pair cables, terminations, connectors, cross-connection hardware and related equipment installed inside building for occupant's telecommunications systems, including voice and data.

.1 Data cabling terminations and equipment located in room 204.

.2 Voice cabling terminations and equipment located in room 203.

.2 Generally, equip each workstation outlet faceplate with three cables as follows unless indicated otherwise:

.1 Cables 1, 2: data

.2 Cable 3: voice

.3 Telephone and data wiring is to be installed as per details on drawing.

.4 Provide manufacturer’s warranty per clause 3.9.2.

1.4 SUBMITTALS

.1 Provide submittals in accordance with Section 01 01 50 – General Instructions.

.2 Submittals to include shop drawings of all components and equipment.

.3 As-built Records and Drawings:

.1 On clean set of drawings mark clearly and neatly in coloured ink, the exact locations of devices and the wiring system and wiring route for the devices as installed. Mark the drawings as work proceeds to avoid errors.

.2 Provide electronic drawings in AutoCAD format depicting all construction as indicated on the marked up hard copy drawing and including all labelling and numbering associated with the cable drops. Provide two hard copies and two CDs or DVDs with electronic files. Also include on all CDs/DVDs copies of tel/data wiring test results.

.3 Provide two (2) bound complete hard-copy sets of as-built records to the Consultant.

.1 Provide and place one hard copy of as-built records for each telecommunications room in plan holder in each telecommunications room.

1.5 CONTRACTOR QUALIFICATIONS

.1 Upon request by Departmental Representative, provide certified documentation of qualifications described below. Failure to meet or provide such documentation will be the basis for rejection of sub-contractor proposed for work under this Section.

.2 The cabling Contractor under this Section shall be a certified system vendor of the manufacturer's components and/or cable being bid, and use only technicians fully trained and qualified on installation and testing of the components to be installed.

.3 All staff performing any type of work contained in this Section shall be certified in the installation, termination and testing of all aspects of UTP Cable systems by:

.1 A recognized education institution or,

.2 A major cable manufacturer or,

.3 Being the holder of the designation of Registered Communications Distribution Designer (RCDD).

.4 Contractor shall hold appropriate and valid licenses and/or BC Provincial permits to install low voltage cabling.

.5 Contractor must be certified by the component supplier/s as acceptable installers so the warranty is provided that is specified in clause 3.9 of this section.

Part 2 Products

2.1 HORIZONTAL CABLE

.1 Four (4) pair, unshielded, twisted, solid copper core, 100 ohm, 24 AWG, Category 6A, FT4 rated.

.2 Transmission requirements shall conform to or exceed all applicable sections of the TIA/EIA 568-C.1, C.2 current specifications for Category 6A cable and components.

.3 Electromagnetic radiation: cables shall comply with Class A limits of FCC Part 15, Subpart J for computing devices.

.4 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.

.5 Category 6A cable for both voice (white) and data (blue) horizontal cabling.

.6 Cable manufacturer: To suit provision of warranty per clause 3.9.2.

2.2 HORIZONTAL CABLE CONNECTORS

.1 Applies to both voice and data terminations.

.2 All UTP connectors at each horizontal cable run and each patch cord shall meet the following specifications:

- .1 Category 6A, 110 punch down, individually snap-in and modular, non-keyed
- .2 Data horizontal cable runs shall use 8P/8W female RJ45 components at both ends. T568A pin configuration.
- .3 Voice horizontal cable runs shall use 8P/8W female RJ45 components at the faceplate end, T568B pin configuration, direct IDC termination in the telephone room.
- .4 Patch cords shall use male RJ45 connectors on both ends for data.
- .5 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.
- .6 Components:
  - .1 Configured to support 8 position EIA/TIA, ISDN cabling.
  - .2 Insulation Displacement Type (IDC), modular, non-keyed, utilizing CAT 6A BIX block type connectors.
- .7 Use the same connector type at both ends of cables.
- .8 Connectors at outlet end: install in appropriate wall plate.

2.3 CABLE MANAGEMENT

.1 Data:

- .1 Black metal suitable for mounting in 483 mm racks.
- .2 Frontside horizontal cable management, 5 metal finger style, minimum 57 mm deep.
- .3 Must not take up more than 1 unit of rack space.
- .4 Install as specified and/or directed by Departmental Representative.
- .5 Provide one 10.0 m roll of 13 mm wide Velcro to supplement cable management. Give to Departmental representative.
- .6 Manufacturer: Hammond #PCMBS19001BK1 or #PCMBS19003BK1

.2 Voice:

- .1 Ring type cable management, wall mounted.

2.4 RACK UNIT – CABINET

.1 Standard complete EIA ventilated enclosed rack cabinet suitable for 483mm standard rack-mount equipment.

.2 One in number floor mounted cabinet

.3 Size: Approx. 2134 mm (H) x 800 mm (W) x 1016 mm (D) with minimum 44U vertical space for equipment. Minimum 150 mm x 150 mm vertical wiring side channels both sides.

.4 Top mounted fan unit: 250 CFM.

.5 Two vertically mounted 20A, 120V input power bars, equipped with ten 5-20R outlets, a 12 foot shielded cord, with reset breaker but no on off switch. Power bars mounted at the rack side rails facing the rear. Quantity: 2 per rack.

.6 Louvered steel sides

.7 Painted black

.8 Four adjustable rails

.9 Locking steel doors with mechanical latches. Magnetic latches not acceptable. Provide two keys. Doors shall be capable of being interchanged to create opposite door swing as may be required.

.10 Two rail mounted vented shelf units. Shelves shall be 2U high, 483 mm rack mountable, minimum 406 mm deep, front or flush mounting type – not center mount.

.11 Cable management panels installed between each pair of 24 port patch panels. Panels shall be 1 U space, all metal and have five metal fingers minimum 57 mm deep.

.12 Vertical cable management, 200 mm wide, 150 mm deep.

2.5 PATCH PANELS

.1 Modular patch panel, Category 6A, black in colour.

.2 24 port 1U, high density, female 8P/8W

.3 Suitable for mounting on 483 mm rack unit

.4 Must not take up more than 1 unit of rack space

.5 Provide number of patch panels as indicated. Mount starting at the top of the rack. Use the top 24 port patch panel to terminate the six Cat 6A cables from the telephone and PTSS rooms.

.6 Patch panels for data horizontal cabling except as indicated.

.7 Manufacturer: To suit provision of warranty per clause 3.9.2.

2.6 FLUSH FACEPLATES FOR WALL-MOUNTED OUTLETS

.1 Angle down style for use on all flush mounted voice and data wall outlets.

.2 Supply 4 port face plate. Install blanks on all unused ports.

.3 Single gang, flush mounted – white colour

.4 Telephone and data icons

.5 Label to identify jacks

2.7 MODULAR VOICE AND DATA JACKS

.1 For installation in face plates

.2 Non-keyed, 4 pair, 8P/8W modular jacks, Category 6A.

.3 Snap-in type connectors.

.4 Colour coded:

.1 Cable 1, 2: data – black

.2 Cable 3: voice - white

.5 Arrange jacks in identical sequence at every outlet, with data jacks on top and voice on the bottom.

.6 Manufacturer: To suit provision of warranty per clause 3.9.2.

2.8 VOICE HORIZONTAL CABLE TERMINATIONS

.1 Patch panel: 48 position, rack mountable c/w Cat.6 RJ-45 jacks, Panduit.

.2 Wall mounted rack: 483mm (w) x 978mm (h) x 635 (d), black finish, Anixter #267489.

.3 Ensure that if termination tools are supplied with the jacks, that they be stored in a box in the LAN room upon completion of project.

2.9 BUILDING ENTRANCE PROTECTORS

.1 Provided by communication service provider.

Part 3 Execution

3.1 RACK INSTALLATION

.1 Install the rack in the room 204. Equipment in the room 203 shall be wall mounted.

.2 Provide patch panels and power bar in the rack.

.3 Cables connected to the rear of the patch panels shall be dressed horizontally.

.4 Cables terminating on each row of connectors shall be collected together with Velcro straps.

.5 Hardwire UTP cables directly to the patch panel connectors.

.6 Label all equipment as specified.

.7 Ground rack to the ground bar in room 204.

.8 Install RJ45 patch panels and horizontal cable management panels mounted between patch panels. No gaps between any panels.

.9 Orient rack to allow access to both front and back.

.10 Fasten rack at four points to floor. Provide seismic bracing at top to wall as indicated.

3.2 HORIZONTAL CABLE INSTALLATION

.1 Install each cable in one continuous run from the rooms 203 and 204 to the faceplate. Breaks or splices not allowed.

.2 No single cable run shall exceed 90.0 metres in length, measured from the terminations in the rooms 203 and 204 to each RJ45 faceplate jack. Ensure this 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 130 mm from fluorescent luminares.

.5 At least 300 mm from electric motors and transformers.

.4 Cable terminations:

.1 Terminate data cables with female RJ45 components at both ends.

.2 Terminate voice cables with female RJ45 components at the faceplate end, direct IDC termination in room 203.

.5 Cables connected to each row of patch panel jacks shall be dressed horizontally, collected together, and tie-wrapped as a group. Each group of cables shall be routed to the side in a straight line parallel to the floor, and not allowed to hang loosely.

.6 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.

.7 In spaces with UTP terminations, cable bend radii shall not be less than 8 times the cable diameter.

.8 Cables shall be installed perpendicular or parallel to building lines. ‘Shortest routes’ are unacceptable.

.9 Label cables as further specified.

.10 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.

.11 Should the Contractor encounter cable runs that cannot be installed to meet required clearance specifications, then the Contractor shall install fully satisfactory shielding.

.12 Install all cables in conduit stubs and on J-hooks as indicated in details on the drawing. Provide no more than 4 cables in a 21 mm conduit and 7 cables in a 27 mm conduit. Each conduit to have a woven nylon pull string installed in with the cables. Tie off pull string at each end.

.13 Make allowance to return to site following the project being substantially completed and after the Departmental Representative’s furniture arrives. Install voice and data cabling in furniture raceway if the furniture has a raceway. If there is no raceway install the cabling on the surface to surface mounted outlets. Use Panduit-style plastic raceway for mechanical protection of the cable on the furniture. Install cables hidden from normal view at the furniture.

3.3 UTP CABLE TERMINATIONS

.1 All terminations to the UTP cable shall be properly connected using industry-standard Insulation Displacement Connection conventions and

procedures to 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.

3.4 CABLE SLACK FOR TERMINATED CABLES

.1 For each cable run terminated, there shall be a minimum cable slack of 4.0 m at the originating end (rooms 203 & 204). At the workstation/desk outlet, provide 1.0 metre slack, and provide 3.0 m cable slack in the ceiling space immediately above.

.2 Place cable slack in the ceiling or as deemed appropriate by the Departmental Representative, on condition that storage of slack is neat.

3.5 TIE CABLES BETWEEN ROOM 204 AND 203

.1 Install 6 Cat. 6A cables from room 204 to room 203.

.2 Install a patch panel labelled as 'Tie Panel' as the first and top most patch panel.

.3 It is common for a fibre termination enclosure to be rack mounted above, with this specialty purpose tie panel located directly beneath.

.4 Terminate using positions "←----- #1 – 6---→".

.5 Terminate in room 203 on a high density patch panel fixed to a 4-U hinged wall mount bracket, 150 mm deep, in first 6 jack positions, labelled as "←-----Ties to LAN room #1 – 6----->".

3.6 TIE CABLES BETWEEN ROOM 204 AND ROOM 207A

.1 Run 6 Cat. 6A cables from room 204 to the room 207A.

.2 Use same patch panel labelled as 'Tie Panel' described above.

.3 Terminate using positions #7-12. Label as "←-----Ties to PTSS Room #7-12----->".

.4 Terminate in room 207A on a high density patch panel fixed to a 4-U hinged wall mount bracket, 150 mm deep, in first 6 jack positions, labelled as "←-----Ties to LAN Room #1-6----->".

3.7 VOICE HORIZONTAL CABLE TERMINATIONS

.1 Terminate all four horizontal cable pairs.

3.8 BUILDING ENTRANCE PROTECTORS

.1 Ground connection as specified in Section 26 05 28.

3.9 GROUNDING

.1 Ground all racks with minimum #8 insulated copper ground wire.

.2 Ensure metal-to-metal contact is established when installing ground to painted surfaces.

3.10 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 this specification.

.5 Provide printouts of all test results, including a record of the length of each drop and soft records of the testing results on two CDs.

.6 Test all cables.

.7 All testing shall be performed in both directions.

.2 Test all cables with a Level III tester for conformance with basic link performance as described in EIA/TIA-568-C series standards.

.3 Documentation of tests will be given in report form and will, at minimum, contain the following data:

DATE	IMPEDANCE
OPERATOR	WIRE MAP
LOCATION	NEXT (PAIR-TO-PAIR)
CABLE #	PSNEXT
CABLE TYPE	RETURN LOSS
TESTER, MAKE AND MODEL	ELFEXT (PAIR-TO-PAIR)
TEST RESULTS (PAIRS)	PSELFEXT
ATTENUATION	PROPAGATION DELAY
LENGTH	DELAY SKEW
PINS 1, 2 / PINS 3,6 / PINS 4, 5 / PINS 7,8	

.4 Testing shall be done in the presence of the Departmental Representative.

.5 No marginal pass or conditional pass will be accepted.

3.11 UTP CABLE DOCUMENTATION AND CERTIFICATION

.1 Provide record drawings upon completion.

.1 Indicate all changes.

.2 Indicate cable IDs adjacent to outlets.

.3 Indicate conduit runs, pull boxes and conduit sizes on record drawings.

.2 Provide a Category 6A certificate document issued by the cable/component manufacturer guaranteeing transmission capabilities of the cabling system to support Category 6A applications for a period of minimum 15 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 Manufacturer shall guarantee that:

.1 All material and labour is covered for the full certification period.

.2 In the event that the Contractor is no longer in business, the full certification remains valid and will be covered by the manufacturer.

.5 The installed structured cabling system shall be covered by a warranty which includes, as a minimum:

.1 15 year coverage.

.2 Warranty against defects in material and workmanship from the date of 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 and at no additional cost to Departmental Representative, provide a manufacturer's technical representative to conduct an on-site visit to ensure complete technical compliance.

3.12 LABELLING

.1 General:

.1 Bold face laser quality printed labels, black print on white background.

.2 Handwritten labels of any kind are not acceptable.

.2 Cable Labels:

.1 Cable ID format black mechanically printed on white background: label cables with x-Dzzz format where:

x indicates floor level either 1 or 2

D indicates Data, V - Voice

zzz drop number and position on patch panel.

Example

1D-101 – 'D' indicates data cable, '101' indicates 101st port position on the data patch panel

.2 Label both ends of all cables with cable ID identical to patch panels. Place labels minimum 300 mm from each jack or connector and secured with shrink wrap or wrap around mylar.

.3 Label each 8P/8W, jack with the cable ID.

.4 Label patch panel port positions starting in sequence from the top patch panel.

3.13 NEW TELEPHONE SERVICE

.1 Arrange to have communication service provider to install new service cables from the utility service pole and demarcation in room 203. Pull into the same conduit a CATV cable, where a CATV service cable is available.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions. Applicable requirements govern this section.

.2 Section 26 05 00 – Common Work Results – Electrical. Applicable requirements govern this section.

.3 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

1.2 SECTION INCLUDES

.1 Wiring and infrastructure.

1.3 REFERENCE STANDARDS

.1 The installation shall, as minimum, meet all national, provincial, and municipal, including, but not limited to:

.1 Building, fire, electrical and labour codes and standards.

.2 Workmanship shall meet or exceed nationally accepted workmanship standard.

1.4 SUBMITTALS

.1 Drawings

.1 The contractor shall submit to the Departmental Representative:

.1 One (1) set of shop drawings showing conduit route and size, pull box locations and installation locations of all field components. Drawings shall be submitted before starting of any work. Do not start any work until the shop drawings have been reviewed and approved by the Departmental Representative.

.2 Two (2) sets of as-built drawings shall be submitted to the Departmental Representative within four (4) weeks after completion and Departmental Representative final inspection.

.2 Operation and Maintenance Manual

.1 All operation, maintenance, installation, programming manuals and password lists shall be submitted to Departmental Representative within four (4) weeks after completion.

.2 Provide operation and maintenance data for incorporation into operation and maintenance manuals specified in Section 01 01 50 General Instructions and in compliance with Section 26 05 00.

.3 Product Data: Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions.

.1 Submit manufacture's literature for cables.

Part 2 Products

2.1 SYSTEM COMPONENTS

.1 Contractor to supply complete raceway and conduit system, including device, pull & wiring distribution boxes, and cables as indicated on the drawings.

.2 The Departmental Representative shall supply and install all equipment components necessary to complete the system.

2.2 CABLES

.1 All cables shall be CSA approved.

.2 All cables shall be FT4 for non-plenum and FT6 for plenum areas.

.3 .

Part 3 Execution

3.1 INSTALLATION

.1 Install raceway and conduit system, including device, pull & wiring distribution boxes, and cables as indicated on the drawings.

.2 The contractor under this section is responsible for installing cable from device boxes to wiring distribution box in room 207A.

.3 Each cable from component to component shall be continuous without any joint or splice.

.4 No low voltage cables are permitted to share the same conduits or ducts with line voltage electrical cables.

.5 All cables shall be protected by EMT conduit.

.6 Install a woven nylon pull string in with cables as cables are pulled into conduits.

.7 A wiring list identifying all cables shall be submitted to the Departmental Representative upon rough-in completion.

.8 All cables shall be permanently marked at room 207A. Hand written marking will not be acceptable.

3.2 VERIFICATION

.1 Departmental Representative (DR) Inspection

- .1 DR personnel will perform inspection of the contractors' work during the installation.
- .2 The contractor shall inform DR ten days before interior boarding starts.
- .3 The DR will perform a final acceptance inspection after all the works are completed by the contractor.

.2 Visual verification: Objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual inspection to include:

- .1 Sturdiness of equipment fastening.
- .2 Non-existence of installation related damages.
- .3 Compliance of device locations with reviewed shop drawings.

.4 Compatibility of equipment installation with physical environment.

.5 Inclusion of all accessories.

.6 Device and cabling identification.

.3 Technical verification: Purpose to ensure that all systems and devices are properly installed and free of defects and damage. Technical verification includes:

.1 Measurements of reader coverage patterns

.2 Connecting joints and equipment fastenings.

.3 Compliance with manufacturer's specification, product literature and installation instructions.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions. Applicable requirements govern this section.

.2 Section 26 05 00 – Common Work Results – Electrical. Applicable requirements govern this section.

.3 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

1.2 SECTION INCLUDES

.1 Wiring and infrastructure.

1.3 REFERENCE STANDARDS

.1 The installation shall, as minimum, meet all national, provincial, and municipal, including, but not limited to:

.1 Building, fire, electrical and labour codes and standards.

.2 Workmanship shall meet or exceed nationally accepted workmanship standard.

1.4 SUBMITTALS

.1 Drawings

.1 The contractor shall submit to the Departmental Representative:

.1 One (1) set of shop drawings showing conduit route and size, pull box locations and installation locations of all field components. Drawings shall be submitted before starting of any work. Do not start any work until the shop drawings have been reviewed and approved by the Departmental Representative.

.2 Two (2) sets of as-built drawings shall be submitted to the Departmental Representative within four (4) weeks after completion and Departmental Representative final inspection.

.2 Operation and Maintenance Manual

.1 All operation, maintenance, installation, programming manuals and password lists shall be submitted to Departmental Representative within four (4) weeks after completion.

.2 Provide operation and maintenance data for incorporation into operation and maintenance manuals specified in Section 01 01 50 General Instructions and in compliance with Section 26 05 00.

.3 Product Data: Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions.

.1 Submit manufacture's literature for cables.

Part 2 Products

2.1 SYSTEM COMPONENTS

.1 Contractor to supply complete raceway and conduit system, including device, pull & wiring distribution boxes, and cables as indicated on the drawings.

.2 The Departmental Representative shall supply and install all equipment components necessary to complete the system.

2.2 CABLES

.1 All cables shall be CSA approved.

.2 All cables shall be FT4 for non-plenum and FT6 for plenum areas.

.3 .

Part 3 Execution

3.1 INSTALLATION

.1 Install raceway and conduit system, including device, pull & wiring distribution boxes, and cables as indicated on the drawings.

.2 The contractor under this section is responsible for installing cable from device boxes to wiring distribution box in room 207A.

.3 Each cable from component to component shall be continuous without any joint or splice.

.4 No low voltage cables are permitted to share the same conduits or ducts with line voltage electrical cables.

.5 All cables shall be protected by EMT conduit.

.6 Install a woven nylon pull string in with cables as cables are pulled into conduits.

.7 A wiring list identifying all cables shall be submitted to the Departmental Representative upon rough-in completion.

.8 All cables shall be permanently marked at room 207A. Hand written marking will not be acceptable.

3.2 VERIFICATION

.1 Departmental Representative (DR) Inspection

- .1 DR personnel will perform inspection of the contractors' work during the installation.
- .2 The contractor shall inform DR ten days before interior boarding starts.
- .3 The DR will perform a final acceptance inspection after all the works are completed by the contractor.

.2 Visual verification: Objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual inspection to include:

- .1 Sturdiness of equipment fastening.
- .2 Non-existence of installation related damages.
- .3 Compliance of device locations with reviewed shop drawings.

.4 Compatibility of equipment installation with physical environment.

.5 Inclusion of all accessories.

.6 Device and cabling identification.

.3 Technical verification: Purpose to ensure that all systems and devices are properly installed and free of defects and damage. Technical verification includes:

.1 Measurements of reader coverage patterns

.2 Connecting joints and equipment fastenings.

.3 Compliance with manufacturer's specification, product literature and installation instructions.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions. Applicable requirements govern this section.

.2 Section 26 05 00 – Common Work Results – Electrical. Applicable requirements govern this section.

.3 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

1.2 SECTION INCLUDES

.1 Wiring and infrastructure.

1.3 REFERENCE STANDARDS

.1 The installation shall, as minimum, meet all national, provincial, and municipal, including, but not limited to:

.1 Building, fire, electrical and labour codes and standards.

.2 Workmanship shall meet or exceed nationally accepted workmanship standard.

1.4 SUBMITTALS

.1 Drawings

.1 The contractor shall submit to the Departmental Representative:

.1 One (1) set of shop drawings showing conduit route and size, pull box locations and installation locations of all field components. Drawings shall be submitted before starting of any work. Do not start any work until the shop drawings have been reviewed and approved by the Departmental Representative.

.2 Two (2) sets of as-built drawings shall be submitted to the Departmental Representative within four (4) weeks after completion and Departmental Representative final inspection.

.2 Operation and Maintenance Manual

.1 All operation, maintenance, installation, programming manuals and password lists shall be submitted to Departmental Representative within four (4) weeks after completion.

.2 Provide operation and maintenance data for incorporation into operation and maintenance manuals specified in Section 01 01 50 General Instructions and in compliance with Section 26 05 00.

.3 Product Data: Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions.

.1 Submit manufacture's literature for cables.

Part 2 Products

2.1 SYSTEM COMPONENTS

.1 Contractor to supply complete raceway and conduit system, including device, pull & wiring distribution boxes, and cables as indicated on the drawings.

.2 The Departmental Representative shall supply and install all equipment components necessary to complete the system.

2.2 SIGNAL CABLE

.1 Four (4) pair, unshielded, twisted, solid copper core, 100 ohm, 24 AWG, Category 6, FT4 rated.

.2 Transmission requirements shall conform to or exceed all applicable sections of the TIA/EIA 568-C.1, C.2 current specifications for Category 6A cable and components.

.3 Electromagnetic radiation: cables shall comply with Class A limits of FCC Part 15, Subpart J for computing devices.

.4 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.

.5 Terminate cables with male RJ45 Category 6 components at both ends.

2.3 POWER CABLES

.1 Low voltage power cables shall be 2/18 AWG, stranded copper, FT4 rated, CSA approved.

Part 3 Execution

3.1 INSTALLATION

.1 Install raceway and conduit system, including device, pull & wiring distribution boxes, and cables as indicated on the drawings.

.2 The contractor under this section is responsible for installing cables from device boxes to wiring distribution box in room 207A. Provide sufficient length in room 207A to connect to rack indicated on plans. Confirm with Departmental Representative.

.3 Individual camera cable quantities:

.1 Two signal and one LVT power cables for interior and exterior building.

.2 Two signal and two LVT power cables for exterior pole.

.4 Each cable from component to component shall be continuous without any joint or splice.

.5 No low voltage cables are permitted to share the same conduits or ducts with line voltage electrical cables.

.6 All cables shall be installed in EMT conduit. Maintain fill ratio of 40%.

.7 Install a woven nylon pull string in with cables as cables are pulled into conduits.

.8 All cables shall be permanently marked at both ends. Hand written marking will not be acceptable.

3.2 VERIFICATION

.1 A wiring list identifying all cables shall be submitted to the Departmental Representative (DR) upon rough-in completion.

.2 Departmental Representative Inspection:

.1 DR personnel will perform inspection of the contractors' work during the installation.

.2 The contractor shall inform DR ten days before interior boarding starts.

.3 The DR will perform a final acceptance inspection after all the works are completed by the contractor.

.3 Visual verification: Objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual inspection to include:

.1 Sturdiness of equipment fastening.

.2 Non-existence of installation related damages.

.3 Compliance of device locations with reviewed shop drawings.

.4 Compatibility of equipment installation with physical environment.

.5 Inclusion of all accessories.

.6 Device and cabling identification.

.4 Technical verification: Purpose to ensure that all systems and devices are properly installed and free of defects and damage. Technical verification includes:

.1 Test cables to industry standards.

.2 Connecting joints and equipment fastenings.

.3 Compliance with manufacturer's specification, product literature and installation instructions.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions. Applicable requirements govern this section.

.2 Section 26 05 00 – Common Work Results – Electrical. Applicable requirements govern this section.

.3 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

1.2 SECTION INCLUDES

.1 Wiring and infrastructure.

1.3 REFERENCE STANDARDS

.1 The installation shall, as minimum, meet all national, provincial, and municipal, including, but not limited to:

.1 Building, fire, electrical and labour codes and standards.

.2 Workmanship shall meet or exceed nationally accepted workmanship standard.

1.4 SUBMITTALS

.1 Drawings

.1 The contractor shall submit to the Departmental Representative:

.1 One (1) set of shop drawings showing conduit route and size, pull box locations and installation locations of all field components. Drawings shall be submitted before starting of any work. Do not start any work until the shop drawings have been reviewed and approved by the Departmental Representative.

.2 Two (2) sets of as-built drawings shall be submitted to the Departmental Representative within four (4) weeks after completion and Departmental Representative final inspection.

.2 Operation and Maintenance Manual

.1 All operation, maintenance, installation, programming manuals and password lists shall be submitted to Departmental Representative within four (4) weeks after completion.

.2 Provide operation and maintenance data for incorporation into operation and maintenance manuals specified in Section 01 01 50 General Instructions and in compliance with Section 26 05 00.

.3 Product Data: Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions.

.1 Submit manufacture's literature for cables.

Part 2 Products

2.1 SYSTEM COMPONENTS

.1 Contractor to supply complete raceway and conduit system, including device, pull & wiring distribution boxes, and cables as indicated on the drawings.

.2 The Departmental Representative shall supply and install all equipment components necessary to complete the system.

2.2 CABLES

.1 All cables shall be CSA approved.

.2 All cables shall be FT4 for non-plenum and FT6 for plenum areas.

.3 .

Part 3 Execution

3.1 INSTALLATION

.1 Install raceway and conduit system, including device, pull boxes, and cables as indicated on the drawings.

.2 The contractor under this section is responsible for installing cable from device boxes to room 128 and wiring distribution box in room 207A.

.3 Each cable from component to component shall be continuous without any joint or splice.

.4 No low voltage cables are permitted to share the same conduits or ducts with line voltage electrical cables.

.5 All cables shall be protected by EMT conduit.

.6 Install a woven nylon pull string in with cables as cables are pulled into conduits.

.7 A wiring list identifying all cables shall be submitted to the Departmental Representative upon rough-in completion.

.8 All cables shall be permanently marked at rooms 128 and 207A. Hand written marking will not be acceptable.

3.2 VERIFICATION

.1 Departmental Representative (DR) Inspection

- .1 DR personnel will perform inspection of the contractors' work during the installation.
- .2 The contractor shall inform DR ten days before interior boarding starts.
- .3 The DR will perform a final acceptance inspection after all the works are completed by the contractor.

.2 Visual verification: Objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual inspection to include:

- .1 Sturdiness of equipment fastening.
- .2 Non-existence of installation related damages.
- .3 Compliance of device locations with reviewed shop drawings.

.4 Compatibility of equipment installation with physical environment.

.5 Inclusion of all accessories.

.6 Device and cabling identification.

.3 Technical verification: Purpose to ensure that all systems and devices are properly installed and free of defects and damage. Technical verification includes:

.1 Measurements of reader coverage patterns

.2 Connecting joints and equipment fastenings.

.3 Compliance with manufacturer's specification, product literature and installation instructions.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions for Submittal Procedures.

.2 Section 32 11 16 - Granular Sub-base

.3 Section 32 11 23 – Aggregate Base Courses

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

1.3 SAMPLES

.1 Submit samples in accordance with Section 01 01 50 - General Instructions for Submittal Procedures.

.2 Allow continual sampling by Departmental Representative during production.

.3 Provide Departmental Representative with access to source and processed material for sampling.

.4 Pay cost of sampling and testing of aggregates to determine if the material meet specified requirements. All testing results to be provided to the Departmental Representative.

Part 2 Products

2.1 MATERIALS

.1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.

.2 Flat and elongated particles of coarse aggregate: to ASTM D4791.

.1 Greatest dimension to exceed five times least dimension.

.3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:

.1 Natural sand.

.2 Manufactured sand.

.3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.

.4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:

.1 Crushed rock.

.2 Gravel and crushed gravel composed of naturally formed particles of stone.

.3 Light weight aggregate, including slag and expanded shale.

2.2 SOURCE QUALITY CONTROL

.1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing production.

.2 If, in opinion of Departmental Representative materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.

.3 Advise Departmental Representative 4 weeks in advance of proposed change of material source.

.4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

Part 3 Execution

3.1 PREPARATION

.1 Topsoil stripping

.1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.

.2 Begin topsoil stripping of areas as directed by Departmental Representative after area has been cleared of brush,weeds and grasses and removed from site.

.3 Strip topsoil to depths as directed by Departmental Representative. Avoid mixing topsoil with subsoil.

.4 Stockpile in locations as directed by Departmental Representative. Stockpile height not to exceed 2 m.

.5 Dispose of topsoil as directed by Departmental Representative to be incorporated into the works. Dispose off site all excess topsoil material.

.2 Aggregate source preparation

.1 Prior to excavating materials for aggregate production, clear and grub area to be worked, and strip unsuitable surface materials. Dispose of cleared, grubbed and unsuitable materials as directed by Departmental Representative.

.2 Where clearing is required, leave screen of trees between cleared area and roadways as directed.

.3 Clear, grub and strip area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials.

.4 When excavation is completed dress sides of excavation to nominal 1.5:1 slope, and provide drains or ditches as required to prevent surface standing water.

.5 Trim off and dress slopes of waste material piles and leave site in neat condition.

.3 Processing

.1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.

.2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified. Use methods and equipment approved by Departmental Representative.

.3 Wash aggregates, if required to meet specifications. Use only equipment approved by Departmental Representative

.4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate.

.4 Handling

.1 Handle and transport aggregates to avoid segregation, contamination and degradation.

.5 Stockpiling

.1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Departmental Representative. Do not stockpile on completed pavement surfaces.

.2 Stockpile aggregates in sufficient quantities to meet Project schedules.

.3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.

.4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into Work.

.5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.

.6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Departmental Representative within 48 h of rejection.

.7 Stockpile materials in uniform layers of thickness as follows:

.1 Max 1.5 m for coarse aggregate and base course materials.

.2 Max 1.5 m for fine aggregate and sub-base materials.

.3 Max 1.5 m for other materials.

.8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

.9 Do not cone piles or spill material over edges of piles.

.10 Do not use conveying stackers.

.11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.2 CLEANING

.1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.

.2 Leave any unused aggregates in neat compact stockpiles as directed by Departmental Representative.

.3 For temporary or permanent abandonment of aggregate source, restore source to condition meeting requirements of authority having jurisdiction.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 31 23 33 - Excavation, Trenching and Backfilling.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m3).

1.3 EXISTING CONDITIONS

.1 Examine subsurface investigation report which is bound in following Section .

.2 Known underground and surface utility lines and buried objects are as indicated on site plan.

.3 Refer to dewatering in Section 31 23 33 - Excavating Trenching and Backfilling.

1.4 PROTECTION

.1 Protect and/or transplant existing bench marks, pavement, surface or underground utility lines which are to remain as directed by Departmental Representative. If damaged, restore to original or better condition unless directed otherwise.

.2 Maintain access roads to prevent accumulation of construction related debris on roads.

Part 2 Products

2.1 MATERIALS

.1 Fill material: Type 2 in accordance with of Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Excavated or graded material existing on site may be suitable to use as fill for grading work if approved by Departmental Representative.

Part 3 Execution

3.1 STRIPPING OF TOPSOIL

.1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected as determined by Departmental Representative.

.2 Commence topsoil stripping of areas as directed by Departmental Representative after area has been cleared of brush, weeds and grasses and removed from site.

.3 Strip topsoil to depths as directed by Departmental Representative. Rototill weeds and grasses and retain as topsoil on site. . Avoid mixing topsoil with subsoil.

.4 Stockpile in locations as directed by Departmental Representative. Stockpile height not to exceed 2 m.

.5 Dispose of unused topsoil off site.

3.2 GRADING

.1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.

.2 Rough grade to following depths below finish grades:

.1 450 mm for grassed areas.

.2 475 mm for asphalt paving.

.3 550 mm for concrete paving and precast paving units.

.3 Slope rough grade away from building 1:50 minimum.

.4 Prior to placing fill over existing ground, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.

.5 Compact filled and disturbed areas to standard Proctor corrected maximum dry density to ASTM D698, as follows:

.1 85% under landscaped areas.

.2 95 % under paved and walk areas.

.6 Do not disturb soil within branch spread of trees or shrubs to remain.

3.3 TESTING

.1 Inspection and testing of soil compaction and bearing capacity will be carried out by approved geotechnical engineering firm as directed by Departmental Representative.

.2 Pay costs for tests.

.3 When directed by Departmental Representative, contact designated geotechnical engineering firm to perform tests on site for:

.1 Gradation analysis of Type 1 and Type 2 fill

.2 Field density tests for existing soil subgrade under new building and parking lot.

3.4 SURPLUS MATERIAL

.1 Remove surplus material and material unsuitable for fill, grading or landscaping off site in accordance to local authority having jurisdiction.

END OF SECTION

Part 1 General

1.1 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 C136-05, 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 D698-00ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ;) (600 kN-m/m ;).

1.2 DEFINITIONS

.1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.

.1 Rock : solid material in excess of 0.75 m ; and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15m^3 bucket. Frozen material not classified as rock.

.2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.

.2 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.

.3 Waste material: excavated material unsuitable for use in Work or surplus to requirements.

.4 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

.5 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.

.6 Unsuitable materials:

.1 Weak, chemically unstable, and compressible materials.

.2 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to

ASTM D422 and ASTM C136 : Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.

.2 Table:

Sieve Designation	**% Passing**
2.00 mm	100
0.10 mm	45 - 100
0.02 mm	10 - 80
0.005 mm	0 - 45

.3 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.

1.3 EXISTING CONDITIONS

.1 Examine geotechnical report available from Departmental Representative. The contractor shall use the geotechnical report based on their sole interpretation of the report.

.2 Buried services:

.1 Before commencing work verify location of buried services on and adjacent to site.

.2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.

.3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.

.4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.5 Prior to beginning excavation Work, notify applicable authorities having jurisdiction establish location and state of use of buried utilities and structures. Authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.

.6 Confirm locations of buried utilities by careful test excavations

.7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated on drawings.

.8 Record location of maintained, re-routed and abandoned underground lines.

.9 Confirm locations of recent excavations adjacent to area of excavation.

Part 2 Products

2.1 MATERIALS

.1 Type 1 and Type 2 fill:

.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-8.1 CAN/CGSB-8.2.

.3 Table:

Sieve Designation	% Passing	
	Type 1	Type 2

Sieve Designation	% Passing	
	Type 1	Type 2
75 mm	-	100
50 mm	-	-
37.5 mm	-	-
25 mm	100	-
19 mm	75-100	-
12.5 mm	-	-
9.5 mm	50-100	-
4.75 mm	30-70	22-85
2.00 mm	20-45	-
0.425 mm	10-25	5-30
0.180 mm	-	-
0.075 mm	3-8	0-10

.2 Type 3 fill: selected material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

.3 Backfill material size gradations as specified in the geotechnical report are also acceptable.

.4 Use MMCD gradations for granular material for work occurring on 100 Mile House property.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

.2 Cut pavement neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.3 PREPARATION/PROTECTION

.1 Protect existing features in accordance with applicable local regulations.

.2 Keep excavations clean, free of standing water, and loose soil.

.3 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.

.4 Protect buried services that are required to remain undisturbed.

.5 Contractor to implement all recommendations outlined in the Geotechnical Site Assesment Report in regards to subgrade protection due to frost action and construction.

3.4 STRIPPING OF TOPSOIL

.1 Begin topsoil stripping of areas as indicated as directed by Departmental Representative after area has been cleared of brush weeds and grasses and removed from site.

.2 Strip topsoil to depths as indicated as directed by Departmental Representative.

.1 Do not mix topsoil with subsoil.

.3 Stockpile top soil to be incorporated into the works in locations as directed by Departmental Representative.

.1 Stockpile height not to exceed 2 m and should be protected from erosion.

.2 Dispose off site all excess topsoil material.

3.5 STOCKPILING

.1 Stockpile fill materials in areas designated by Departmental Representative.

.1 Stockpile granular materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

.3 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 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Worker's Compensation Board of British Columbia.

.2 Obtain permit from authority having jurisdiction for temporary diversion of water course.

.3 During backfill operation:

.1 Unless otherwise indicated or directed by 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 500mm above toe of sheeting.

.4 When sheeting is required to remain in place, cut off tops at elevations as indicated.

.5 Upon completion of substructure construction:

.1 Remove cofferdams, shoring and bracing.

.2 Remove excess materials from site and restore watercourses as indicated and as directed by Departmental Representative.

3.7 DEWATERING AND HEAVE PREVENTION

.1 Keep excavations free of water while Work is in progress.

.2 Provide for the Departmental Representative review details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.

.3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.

.1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.

.4 Protect open excavations against flooding and damage due to surface run-off.

.5 Dispose of water in 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.

.6 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 Advise Departmental Representative at least 7 days in advance of excavation operations for initial cross sections to be taken.

.2 Excavate to lines, grades, elevations and dimensions as directed by Departmental Representative.

.3 Excavation must not interfere with bearing capacity of adjacent foundations.

.4 Do not disturb soil within branch spread of trees or shrubs that are to remain.

.1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.

.5 All excavations are to adhere to WorkSafe BC requirements for excavations.

.6 Refer to geotechnical report following this section for recommendations with respect to safe excavations.

.7 For trench excavation, unless otherwise authorized by 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.

.8 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.

.9 Restrict vehicle operations directly adjacent to open trenches.

.10 Dispose of surplus and unsuitable excavated material in approved location.

.11 Do not obstruct flow of surface drainage or natural watercourses.

.12 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.13 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.

.14 Correct unauthorized over-excavation as follows:

.1 Fill under bearing surfaces and footings with Type 2 fill compacted to not less than 100% of corrected Standard Proctor maximum dry density.

.2 Fill under other areas with Type 2 fill compacted to not less than 95 % of corrected Standard Proctor maximum dry density.

.15 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.

3.9 ROCK REMOVAL

.1 Rock is to be removed by use of hydraulic breaker only. Under no circumstances shall shale, hardpan, frozen material, or soft or disintegrated rock material be classified as "rock" that can be removed by heavy excavating equipment having a minimum operating weight of 30 tonnes.

3.10 BEDDING AND SURROUND OF UNDERGROUND SERVICES

.1 Place and compact granular material for bedding and surround of underground services as indicated and as specified in Section 33 11 16 – Incoming Site Water Utility Piping and Section 33 31 13 – Public Sanitary Utility Sewerage and Drain Piping.

.2 Place bedding and surround material in unfrozen condition.

3.11 BACKFILLING

.1 Do not proceed with backfilling operations until completion of following:

.1 Departmental Representative has inspected and approved installations.

.2 Inspection, testing, approval, and recording location of underground utilities.

.3 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 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.5 Provide geotechnical testing for verification of compaction and backfill density in all trenches and submit test results to Departmental Representative.

3.12 RESTORATION

.1 Upon completion of Work, remove waste materials and debris, trim slopes, and correct defects as directed by Departmental Representative.

.2 Replace topsoil as indicated as directed by Departmental Representative.

.3 Reinstate lawns to elevation which existed before excavation.

.4 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.

.5 Clean and reinstate areas affected by Work as directed by Departmental Representative.

.6 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions for Submittal Procedures.

.2 Section 31 05 16 - Aggregate Materials.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C117, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.2 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D422, Standard Test Method for Particle-Size Analysis of Soils.

.5 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft^3) (600kN-m/m^3).

.6 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft^3) (2,700kN-m/m^3).

.7 ASTM D1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

.8 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

Part 2 Products

.1 Granular sub-base material: in accordance with Section 31 05 16 - Aggregate Materials and 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-8.1 and CAN/CGSB-8.2.

.3 Table

Sieve Designation	**% Passing**
100 mm	-
75 mm	100
50 mm	-
37.5 mm	60-100
25 mm	-
19 mm	35-80
12.5 mm	-

Sieve Designation	% Passing
9.5 mm	26-60
4.75 mm	20-40
2.36 mm	15-30
1.18 mm	10-20
0.3 mm	3-10
0.075 mm	0-5

.4 Other Properties as follows:

.1 Liquid Limit: to ASTM D4318, Maximum 25.

.2 Plasticity Index: to ASTM D4318, Maximum 6.

.3 Los Angeles degradation: to ASTM C131. Max% Loss by mass: 40.

.4 Particles smaller than 0.02 mm: to ASTM D422, Maximum 3%.

.5 Soaked CBR: to ASTM D1883, Min 40 when compacted to 100% of ASTM D1557.

Part 3 Execution

3.1 PLACING

.1 Place granular sub-base after subgrade is inspected and approved by Departmental Representative.

.2 Construct granular sub-base to depth and grade in areas indicated.

.3 Ensure no frozen material is placed.

.4 Place material only on clean unfrozen surface, free from snow or ice.

.5 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.

.6 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.

.7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.8 Remove and replace portion of layer in which material has become segregated during spreading.

3.2 COMPACTION

.1 Compaction equipment to be capable of obtaining required material densities.

.2 Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from Departmental Representative before use.

.3 Equipped with device that records hours of actual work, not motor running hours.

.4 Compact to density of not less than 100% standard proctor maximum dry density in accordance with ASTM D698.

.5 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.

.6 Apply water as necessary during compaction to obtain specified density.

.7 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.

.8 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.3 PROOF ROLLING

.1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm maximum.

.2 Obtain approval from Departmental Representative to use non standard proof rolling equipment.

.3 Proof roll at level in sub-base as indicated. If non standard proof rolling equipment is approved, Departmental Representative to determine level of proof rolling.

.4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.

.5 Where proof rolling reveals areas of defective subgrade:

- .1 Remove sub-base and subgrade material to depth and extent as directed by Departmental Representative.
- .2 Backfill excavated subgrade with sub-base material and compact in accordance with this section.
- .3 Replace sub-base material and compact.

.6 Where proof rolling reveals areas of defective sub-base, remove and replace in accordance with this section at no extra cost.

3.4 SITE TOLERANCES

.1 Finished sub-base surface to be within 15 mm of elevation as indicated but not uniformly high or low.

3.5 PROTECTION

.1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 31 05 16 - Aggregate Materials.

.2 Section 32 11 16 - Granular Sub-base.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C117, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.2 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600kN-m/m^3).

.5 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700kN-m/m^3).

.6 ASTM D1883Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

.7 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver and stockpile aggregates in accordance with Section 31 05 16 - Aggregate Materials. Stockpile minimum 50% of total aggregate required prior to beginning operation.

Part 2 Products

2.1 MATERIALS

.1 Granular base: material in accordance with Section 31 05 16 - Aggregate Materials and following requirements:

.1 Crushed stone or gravel.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1 and CAN/CGSB-8.2.

.1 Gradation to:

Sieve Designation	**% Passing**
37.5 mm	-

Sieve Designation	% Passing
25 mm	-
19 mm	100
12.5 mm	75-100
9.5 mm	60-90
4.75 mm	40-70
2.36 mm	27-55
1.18 mm	16-42
0.600 mm	8-30
0.300mm	5-20
0.075 mm	2-8

.2 Material to level surface depressions to meet gradation (2) limits in accordance with Method #1.

.3 Liquid limit: to ASTM D4318, maximum 25

.4 Plasticity index: to ASTM D4318, maximum 6

.5 Los Angeles degradation: to ASTM C131. Max. % loss by weight: 45

Part 3 Execution

3.1 SEQUENCE OF OPERATION

.1 Place granular base after sub-base surface is inspected and approved by Departmental Representative.

.2 Placing

.1 Construct granular base to depth and grade in areas indicated.

.2 Ensure no frozen material is placed.

.3 Place material only on clean unfrozen surface, free from snow and ice.

.4 Begin spreading base material on crown line or on high side of one-way slope.

.5 Place material using methods which do not lead to segregation or degradation of aggregate.

.6 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.

.7 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. The Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.

.8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.9 Remove and replace that portion of layer in which material becomes segregated during spreading.

.3 Compaction Equipment

.1 Compaction equipment to be capable of obtaining required material densities.

.4 Compacting

.1 Compact to density not less than 100% standard proctor maximum dry density [maximum dry density in accordance with ASTM D698.

.2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.

.3 Apply water as necessary during compacting to obtain specified density.

.4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative

.5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

.5 Proof rolling

.1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm.

.2 Obtain approval from Departmental Representative to use non standard proof rolling equipment.

.3 Proof roll at level in granular base as indicated. If use of non standard proof rolling equipment is approved, Departmental Representative to determine level of proof rolling.

.4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.

.5 Where proof rolling reveals areas of defective subgrade:

.1 Remove base, sub-base and subgrade material to depth and extent as directed by Departmental Representative.

.2 Backfill excavated subgrade with sub-base material and compact in accordance with Section 32 11 16 - Granular Sub-Base.

.3 Replace sub-base material and compact in accordance with Section 32 11 16- Granular Sub-base.

.4 Replace base material and compact in accordance with this Section.

.6 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by Departmental Representative and replace with new materials in accordance with Section 32 11 16 - Granular Sub-base and this section at no extra cost.

3.2 SITE TOLERANCES

.1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

3.3 PROTECTION

.1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by Departmental Representative

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for asphalt concrete pavement for car park areas, driveways to buildings, bikeways and walks or play areas.

1.2 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions for Submittal Procedures

1.3 REFERENCES

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

- .1 ASTM C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
- .2 ASTM C117, Standard Test Method for Material Finer Than 0.075 (No. 200) mm Sieve in Mineral Aggregates by Washing.
- .3 ASTM C123, Standard Test Method for Lightweight Particles in Aggregate.
- .4 ASTM C127, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
- .5 ASTM C128, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
- .6 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .7 ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
- .8 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (600 kN-m/m^3).
- .9 ASTM D995, Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
- .10 ASTM D1557, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3) (2,700 kN-m/m^3).
- .11 ASTM D1559, Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus, was withdrawn in 1998 with no replacement.
- .12 ASTM D2419, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
- .13 ASTM D3203, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
- .14 ASTM D4318, Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .15 ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

.2 Asphalt Institute (AI)

- .1 AI MS-2, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1, Sieves Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2, Sieves Testing, Woven Wire, Metric.

.3 CAN/CGSB-16.1, Cutback Asphalts for Road Purposes.

.4 CAN/CGSB-16.2, Emulsified Asphalts, Anionic Type, for Road Purposes.

.5 CAN/CGSB-16.3, Asphalt Cements for Road Purposes.

1.4 SUBMITTALS

.1 Submit product data in accordance with Section 01 01 50 – General Instructions for Submittal Procedures.

.2 Submit asphalt concrete mix design to Departmental Representative for approval.

.3 Materials to be tested by independent testing laboratory.

.4 Submit test certificates showing suitability of materials at least 4 weeks prior to commencing work.

.1 Submit samples in accordance with Section 01 01 50 – General Instructions for Submittal Procedures.

.2 Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing work.

.3 Submit samples of following materials proposed for use at least [4] weeks prior to commencing work:

.1 One 5 L container of asphalt cement.

Part 2 Products

2.1 MATERIALS

.1 Granular base and sub-base material: to Section 31 05 16 - Aggregate Materials and Section 32 11 19 Granular Sub-Base and Section 32 11 23 Aggregate Base Courses.:

.2 Asphalt concrete aggregates:

.1 Coarse aggregate is aggregate retained on 4.75 mm sieve and fine aggregate is aggregate passing 4.75 mm sieve when tested to ASTM C117.

.2 When dryer drum plant or plant without hot screening is used, process fine aggregate through 4.75 mm sieve and stockpile separately from coarse aggregate.

.3 Separate stock piles for coarse and fine aggregate are not required for sheet asphalt.

.4 Do not use aggregates having known polishing characteristics in mixes for surface courses.

.5 Aggregate: material to Section 31 05 16 - Aggregate Materials and following requirements:

.1 Crushed stone or gravel.

.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**
200 mm	-
75 mm	-
50 mm	-
38.1 mm	-
25 mm	-
19 mm	100
12.5 mm	84-95
9.5 mm	73-90
4.75 mm	50-75
2.36 mm	35-57
1.18.mm	26-45
0.600 mm	18-34
0.300	10-26
0.150	6-17
0.075 mm	3-7

.3

.1 Sand equivalent: to ASTM D2419, Minimum 50.

.2 Magnesium Sulphate soundness: to ASTM C88. Max % loss by weight: coarse aggregate 15, fine aggregate 18.

.3 Los Angeles Degradation: to ASTM C131. Max % loss by weight: coarse aggregate, 35.

.4 Absorption: to ASTM C127 Max % by weight: coarse aggregate, 1.75.

.5 Lightweight particles: to ASTM C123. Max % by mass, with less than 1.95. Relative density (formally Specific Gravity): 1.5.

.6 Flat and elongated particles: to ASTM D4791, (with length to thickness ratio greater than 5): Max % by weight: coarse aggregate, 15.

.7 Crushed particles: at least 60 % of particles by mass within each of following sieve designation ranges to have at least 1 freshly fractured face. Material to be divided into ranges using methods of ASTM C136 and ASTM C137.

.8 Table

Passing		Retained on
25 mm	to	12.5 mm
12.5 mm	to	4.75 mm

.9 Regardless of compliance with specified physical requirements, fine aggregates may be accepted or rejected on basis of past field performance.

.4 Mineral filler for asphalt concrete:

.1 Finely ground particles of limestone, hydrated lime, Portland cement or other approved non-plastic mineral matter, thoroughly dry and free from lumps.

.2 Add mineral filler when necessary to meet job mix aggregate gradation or as directed by Departmental Representative.

.1 Refer to environmental limitations on vehicle activities in front end documents.

.2 Pavers: mechanical grade controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated

.3 Vibratory rollers:

.1 Minimum drum diameter: 750 mm.

.2 Maximum amplitude of vibration (machine setting): 0.5mm for lifts less than 40 mm thick.

.4 Haul trucks: sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:

.1 Boxes with tight metal bottoms.

.2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.

.3 In cool weather or for long hauls, insulate entire contact area of each truck box.

.4 Use only trucks which can be weighed in single operation on scales supplied.

.5 Hand tools:

.1 Lutes or rakes with covered teeth for spreading and finishing operations.

.2 Tamping irons having mass not less than 12 kg and bearing area not exceeding 310 cm^2 for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by Departmental Representative, may be used instead of tamping irons.

.3 Straight edges, 4.5 m in length, to test finished surface.

2.2 MIX DESIGN

.1 Mix design to be approved by Departmental Representative.

.2 Mix design to be developed by testing laboratory approved by Departmental Representative.

.3 Design of mix: by Marshall method to requirements below.

.1 Compaction blows on each face of test specimens: 50.

.2 Mix physical requirements:

Property	
Marshall Stability at 60EC kN min	5.5 surface course
Flow Value mm	2-4
Air Voids in Mixture, %	3-5
Voids in Mineral Aggregate, % min	15 surface course
Index of Retained Stability % minimum	75

.3 Measure physical requirements as follows:

.1 Marshall load and flow value: to AASHTO T245 .

.2 Compute void properties on basis of bulk specific gravity of aggregate to ASTM C127 and ASTM C128 . Make allowance for volume of asphalt absorbed into pores of aggregate.

.3 Air voids: to ASTM D3203 .

.4 Voids in mineral aggregates: to AI MS2, chapter 4.

.5 Index of Retained Stability: measure in accordance with Section 32 12 10 - Marshall Immersion Test for Bitumen .

.4 Do not change job-mix without prior approval of Departmental Representative. When change in material source proposed, new job-mix formula will be provided to be approved to be reviewed by Departmental Representative.

.5 Return plant dust collected during processing to mix in quantities acceptable to Departmental Representative.

Part 3 Execution

3.1 ASPHALT PRIME

.1 Cutback asphalt:

.1 Heat asphalt prime for pumping and spraying in accordance with CAN/CGSB-16.1.

.2 Apply cutback asphalt prime to granular base, at rate directed by Departmental Representative, but do not exceed 2.2 L/m^2.

.3 Apply on dry surface, unless otherwise directed by Departmental Representative.

.2 Emulsified asphalt:

.1 Dilute asphalt emulsion with clean water at 1:1 ratio for application. Mix thoroughly by pumping or other method approved by Departmental Representative.

.2 Apply diluted asphalt emulsion at rate directed by Departmental Representative but do not exceed 5 L/m^2.

.3 Apply on damp surface unless otherwise directed by Departmental Representative.

.3 Do not apply prime when air temperature is less than 5 degrees C or when rain is forecast within 2 hours.

.4 If asphalt prime fails to cure within 24 hours, spread sand blotter material in amounts required to absorb excess material. Sweep and remove excess blotter material.

3.2 PLANT AND MIXING REQUIREMENTS

.1 In accordance with ASTM D995.

3.3 ASPHALT CONCRETE PAVING

.1 Obtain approval of tack coat base and primer from Departmental Representative before placing asphalt mix.

.2 Place asphalt mix only when base or previous course is dry and air temperature is above 5]degrees C.

.3 Place asphalt concrete as indicated on the drawings.

.4 Minimum 135 degrees C mix temperature required when spreading.

.5 Maximum 160 degrees C mix temperature permitted at any time.

.6 Compact each course with roller as soon as it can support roller weight without undue cracking or displacement.

.7 Compact [parking lot and driveway asphalt concrete] to density not less than 95 % of density obtained with Marshall specimens prepared in accordance with ASTM D1559 from samples of mix being used. Roll until roller marks are eliminated.

.8 Keep roller speed slow enough to avoid mix displacement and do not stop roller on fresh pavement.

.9 Moisten roller wheels with water to prevent pick up of material.

.10 Compact mix with hot tampers or other equipment approved by Departmental Representative in areas inaccessible to roller.

.11 Finish surface to be within 10 mm of design elevation and with no irregularities greater than 10 mm in 4.5 m.

.12 Repair areas showing checking, rippling or segregation as directed by Departmental Representative.

3.4 JOINTS

.1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip.

.2 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.

.3 For cold joints, cut back to full depth vertical face and tack face with hot asphalt.

.4 For longitudinal joints, overlap previously laid strip with spreader by 25 to 50 mm.

3.5 ASPHALTIC CURBS

.1 Form asphalt curbs by machine to profiles as indicated. Curve curbs uniformly.

3.6 SPEED BUMPS

.1 Form speed-limiting bumps as indicated. Stop bumps 300 mm short of curb.

3.7 PROTECTIVE COATING

.1 Apply 2 coats of protective coating to completed paved areas and asphalt curbs in accordance with manufacturers instructions.

3.8 TESTING

.1 Inspection and testing of asphalt pavement will be carried out by designated testing laboratory in accordance with 100 Mile House, By-Law No.1198, 2010.

.2 Pay for costs of tests.

3.9 PROTECTION

.1 Keep vehicular traffic off newly paved areas until paving surface temperature has cooled below 38 degrees C. Do not permit stationary loads on pavement until 24 hours after placement.

.2 Provide access to buildings as required. Arrange paving schedule so as not to interfere with normal use of premises.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 32 12 16 Asphaltic Paving.

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International):
- .1 CAN/CSA A3001-09 - Cementitious materials for use in concrete.
- .2 CAN/CSA-A23.1/A23.2-M2009, Concrete materials and methods of concrete construction/Test methods and standard practices for concrete
- .3 CSA G30.5-M1983(R1991), Welded Steel Wire Fabric for Concrete Reinforcement.
- .4 CSA G30.18-M92, Billet Steel Bars for Concrete Reinforcement.
- .5 CSA A23.4-09 Precast concrete - Materials and construction.

2 Products

2.1 MATERIALS

.1 Cement: CAN/CSA A3001-09 - Cementitious materials for use in concrete.

.2 Water and aggregates: to CAN/CSA-A23.1. Coarse aggregate to be normal density.

.3 Air entraining admixture: to CAN/CSA-A23.1.

.4 Reinforcing steel: to CSA G30.18 deformed, Grade 300, unless indicated otherwise, 10 M bars.

.5 Concrete: proportion normal density concrete to CAN/CSA-A23.1, Alternative 1, minimum 30 MPa compressive strength at 28 days, for C1 exposure.

.6 Curb anchors: reinforcing steel dowels or galvanized steel pins to CSA G30.18, minimum M15 x 500 mm length.

2.2 FABRICATION

.1 Fabricate to CAN/CSA-A23.4, precast reinforced concrete wheel stops width, height and length as indicated with battered sides and square cut ends.

.2 Fabricate minimum 2 holes per unit to permit securing with curb anchors.

.3 Finish to be commercial grade.

3 Execution

3.1 INSTALLATION

.1 Install curbs as indicated or directed by Departmental Representative.

.2 Secure curbs in position by driving curb anchors into pavement through holes provided in wheel stops.

.3 Replace damaged or defective units with sound units.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 32 12 16 - Asphalt Paving.

1.2 REFERENCE STANDARDS

.1 CGSB Standards:
.1 CAN/CGSB-1.5-M91, Low Flash Petroleum Spirits Thinner.
.2 CGSB 1-GP-12c-68, Standard Paint Colours.
.3 CGSB 1.219-2001-CAN/CGSB AMD 1 Lead and Chromate-Free Waterborne Traffic Paint.

2 Products

2.1 MATERIALS

.1 Pavement markings:
.1 Paint: to CAN/CGSB 1.219-2001 Lead and Chromate-Free Waterborne Traffic Paint, fast drying, flat finish, 60% volume solids with less than 90 g/ℓ of VOC.
.2 Colour: to CGSB 1-GP-12C, yellow 505-308, white 513-301and blue symbols.

3 Execution

3.1 EQUIPMENT REQUIREMENTS

.1 Paint applicator to be an approved pressure type mobile distributor capable of applying paint in single lines. Applicator to be capable of applying marking components uniformly, at rates specified, and to dimensions as indicated, and to have positive shut-off.

3.2 PREPARATION OF SURFACES

.1 Pavement surfaces to be free of water, frost, ice, dust, oil, grease and other foreign materials.

3.3 APPLICATION

.1 Layout pavement markings and graphics accurately as indicated.

.2 Apply paint when air temperature is above 10°C and no rain is forecast.

.3 Prepare for, and apply pavement markings in accordance with material manufacturer's instructions.

.4 Apply paint evenly at a rate of 25 m²/ℓ to meet dry film thickness of minimum 25 microns. Do not thin paint unless approved by Departmental Representative.

.5 Paint lines to be of uniform colour and density with sharp edges.

.6 Symbols and letters to conform to provincial standards for dimensions.

.7 Paint lines to delineate parking stalls: white.

.8 Paint curbs and warning stripes in non parking areas: yellow.

.9 Paint Barrier Free symbols: blue.

.10 Paint lettering: white.

3.4 TOLERANCE

.1 Paint markings to be within plus or minus 10 mm of dimensions indicated.

3.5 PROTECTION OF COMPLETED WORK

.1 Protect pavement markings until dry.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDE

.1 Materials and installation for chain link fences and gates.

1.2 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete

.2 Section 01 01 50 – General Instructions for Submittal Procedures.

1.3 REFERENCE STANDARDS

.1 CAN/CSA A3001-09 – Cementitious materials for use on concrete.

.1 CAN/CSA-A23.1/A23.2-M2009, Concrete materials and methods of concrete construction/Test methods and standard practices for concrete.

.2 CAN/CGSB-138.1-96, Fence, Chain Link, Fabric.

.3 CAN/CGSB-138.2-96, Fence, Chain Link, Framework, Zinc-Coated, Steel.

.4 CAN/CGSB-138.3-96, Fence, Chain Link – Installation.

.5 CAN/CGSB-138.4-96, Fence, Chain Link, Gates.

.6 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.7 ASTM A 53/A53M-10, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.8 ASTM A90/A90M-09 – Standard Test Method for Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.

.9 ASTM A123/A123M – 09 Standard Spcification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.10 ASTM A 121-07 – Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.

.11 ASTM A392-07 – Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.

.12 ASTM F900-05 Standard Specification for Industrial and Commercial Swing Gates.

.13 ASTM F1043-10 Standard Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework.

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 01 50 – General Instructions for Submittal Procedures.

.2 Shop drawings to indicate: line post spacing, location and construction details of gates, manufacturers standard post and gate hardware type, class and style of chain link fences, gate range of travel, all electrical and mechanical connections for the automatic gate, size and location of the automatic gate concrete mounting pad, and other appurtenances as specified in this section.

Part 2 Products

2.1 MATERIALS

.1 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.1 Nominal coarse aggregate size: 20-5 .

.2 Compressive strength: 20 MPa minimum at 28 days.

.2 .Chain link Fence Fabric: to CAN/CGSB-138.1.

.1 Electro-galvanised steel, 50mm x 50mm, 3.8mm (Gauge 9) thickness with PVC coating.

.2 Height of fabric: as indicated

.3 Posts, braces and rails: to CAN/CGSB-138.2, galvanized steel pipe. Schedule 40 hot dipped galvanized stell pipe and the following, except as noted otherwise:

.1 Line posts: 65mm O.D
.2 Gate and corner posts:89mm O.D.
.3 Rails (brace and top rail):42mm O.D
4. Roof Rails: To suit span and deadloads

.

.4 Bottom tension wire: to CAN/CGSB-138.2, single strand, galvanized steel wire.

.5 Tie wire fasteners: single strand, galvanised steel wire conforming to requirements of fence fabric, 3mm diameter.

.6 Tension bar: to ASTM A653/A653M, 5 x 20 mm minimum galvanized steel.

2.2 GATES

.1 Gate frames: to ASTM A53 or galvanized steel pipe, 45 mm outside diameter pipe, for outside frame and 35 mm outside diameter for interior bracing. Conform to CGSB 138.4.

.2 Man Gates:

.1 Fabricate single and double gates to ASTM F900, of 914 mm wide each leaf x height to match fence with electronically welded joints and Galvacon finish.

.2 Fasten fence fabric on outside of gate with twisted selvage at top.

.3 Furnish gate with galvanized malleable iron hinges, latch and latch catch with provision for padlock which can be attached and operated from either side of installed gate.

.4 Padlock: Section 08 71 10 – Finishing Hardware.

2.3 SLIDING SECURITY GATE

.1 Gate Operators:

.1 HySecurity gate operator model SlideDriver 40-C (222 CE ST) complete with controller and two input stands, or approved equivalent.

.2 Operation:

.1 Operation shall be by means of a metal rail passing between a pair of solid metal wheels with polyurethane treads. Operator motors shall be hydraulic, geroller type, and system shall not include belts, gears, pulleys, roller chains or sprockets to transfer power from operator to gate panel. The operator shall generate a minimum horizontal pull of 136 kg (300 pounds) without the drive wheels slipping and without distortion of supporting arms. Operator shall be capable of handling gates weighing up to 1,814 kg (4000 pounds). Gate panel velocity shall not be less than 0.30 m per second and shall be stopped gradually to prevent shock loads to the gate and operator assembly.

.2 Additional control devices shall radio control.

.3 Standard mechanical components shall include as a minimum:

.1 Supporting arms: Cast aluminum channel. Arms shall incorporate a fully bushed, 38 mm (1-1/2") bronze bearing surface, acting on arm pivot pins. (item 2 below)

.2 Arm pivot pins: 19 mm (3/4") diameter, stainless steel, with integral tabs for ease of removal.

.3 Tension spring: 63.5 mm (2-1/2") heavy duty, 363 kg (800 pound) capacity.

.4 Tension adjustment: Finger tightened nut, not requiring the use of tools.

.5 Drive release: Must instantly release tension on both drive wheels, and disengage them from contact with drive rail in a single motion, for manual operation.

.6 Limit switches: Fully adjustable, toggle types, with plug connection to control panel.

.7 Electrical enclosure: Oversized, metal, with hinged lid gasketed for protection from intrusion of foreign objects, and providing ample space for the addition of accessories.

.8 Chassis: 6.35 mm (1/4") steel base plate, and 12 Ga. (2.66 mm) sides and back welded and ground smooth.

.9 Cover: 10 Ga. (3.42 mm) zinc plated steel with textured TGIC polyester powder coat finish. All joints welded. Cover shall have padlock hasp assembly installed.

.10 Finish: Zinc plated steel with textured TGIC polyester powder coat finish, proven to withstand 1000-hour salt spray test.

.11 Drive rail: Shall be extruded 6061 T6, not less than 3.175 mm (1/8") thick. Drive rail shall incorporate alignment pins for ease of replacement or splicing. Pins shall enable a perfect butt splice.

.12 Hydraulic hose: Shall be 6.35 mm (1/4") synthetic, rated to 19 MPa (2750 PSI).

.13 Hydraulic valves: Shall be individually replaceable cartridge type, in an integrated hydraulic manifold.

.14 Hose fittings: At manifold shall be quick-disconnect type, others shall be swivel type.

.15 Hydraulic fluid: High performance type with a viscosity index greater than 375 and temperature range -40C to 75C degrees (-40F to 167F).

.16 A zero to 13.79 MPa (2000 PSI) pressure gauge, mounted on the manifold for diagnostics, shall be a standard component.

.17 The hydraulic fluid reservoir shall be formed from a single piece of metal, non-welded, and shall be powder painted on the inside and outside, to prevent fluid contamination.

2.4 FINISHES

.1 Galvanizing:

.1 For chain link fabric: to CAN/CGSB-138.1 Grade 2

.2 For pipe: 550g/m^2minimum to ASTM A90.

.3 For barbed wire: to ASTM A121, Class 2, CAN/CGSB-138.2.

.4 For other fittings: to CAN/CSA-G164.

Part 3 Execution

3.1 GRADING

.1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts.

.1 Provide clearance between bottom of fence and ground surface of 30mm to 50 mm.

3.2 ERECTION OF FENCE

.1 Erect fence along lines as indicated and in accordance with CAN/CGSB-1-138.3.

.2 Excavate post holes to dimensions indicated by methods approved by Departmental Representative. Bulb bottom of holes for corner, terminal and gate posts and for corner posts:

1. Fenced enclosures:
    1. Line posts: 250 mm dia x 760 deep
    2. Gate and corner posts: 300 mm dia x 900 deep

.3 Brace to hold posts in plumb position and true to alignment and elevation before and during placement of concrete and until concrete has set.

.4 Space line posts maximum 3 metres apart except as noted otherwise, measured parallel to ground surface, except as indicated otherwise.

.5 Install corner post where change in alignment exceeds 10°.

.6 Install gate posts on both sides of gate openings.

.7 Place concrete in post holes then embed posts into concrete to 100 mm from bottom of hole. Extend concrete 50 mm above ground level and slope to drain away from posts. Do not install fence fabric until concrete has cured a minimum of 5 days.

.8 Install brace between gate posts and nearest line post, placed in centre of panel and parallel to ground surface. Install braces on both sides of corner posts in similar manner.

.9 Install top rail between posts and fasten securely to terminal posts and secure waterproof caps.

.10 Install roof rails to top rails or posts and fasten securely (weld or bolt). Space roof rails to support liveloads and deadloads.

.11 Install bottom tension wire, stretch tightly and fasten securely to end, corner and gate posts with turnbuckles and tension bar bands.

.12 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end corner and gate posts with tension bar bands spaced at 300mm intervals. Knuckeld selvedge at bottom. Twisted selvedge at top.

.13 Join rolls of fabric by weaving a single strand of fabric into the ends of the rolls to form a continuous mesh.

.14 Secure fabric to outside fence line top rails, roof rails, line posts and bottom tension wire with tie wires at 300 mm intervals. Give tie wires minimum two twists.

3.3 INSTALLATION OF GATE

.1 Install gates in locations as indicated and as per Manufacturer recommendation.

.2 Level ground between gate posts and set gate bottom approximately 40 mm above ground surface.

.3 Install gate stops where indicated.

3.4 TOUCH UP

.1 Repair damaged galvanized surfaces. Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of approved zinc pigmented (Galvalcon) paint to damaged areas.

3.5 CLEANING

.1 Clean and trim areas disturbed by operations.

.1 Dispose of surplus material and replace damaged turf with sod as directed by Departmental Representative.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Topsoil Placement and Grading; Section 32 91 21.
.2 Trees, Shrubs and Groundcover Planting; Section 32 93 10.
.3 Irrigation; Section 32 93 11.

1.2 EXAMINATION

.1 In all cases where rough grading and the establishment of the subgrade has been carried out by others, the Contractor shall verify such subgrade on the site and report all discrepancies in writing to the Departmental Representative before commencement of work.

.2 Failure to do so will imply acceptance by the Contractor of surfaces and conditions and no claim made thereafter for damages for extras resulting from such surfaces and conditions will be accepted.

.3 Generally, subgrades by others are established to a depth of fifteen (l5 cm) below finished grades, unless specified otherwise.

.4 Such subgrade will constitute a rough, machine-finished surface. Where such subgrade averages five (5) cm plus or minus the specified subgrade, all work required to adjust the subgrade shall be the responsibility of the Contractor.

1.3 INSPECTION

.1 The Contractor shall give timely notice, in writing, that all work has been completed.

.2 Inspection for acceptance will be conducted within fifteen (l5) days after completion.

.3 Inspection for partial acceptance will be conducted only where partial acceptance applies.

.4 Where the Contractor requests inspection for partial acceptance of seeding work, he shall notify the Departmental Representative in writing.

.5 Partial acceptance will be given when seeding work has been delayed due to circumstances beyond the control of the Contractor or when further work would conflict with good horticultural practice and jeopardize the performance of work and materials.

.6 At time of inspection for acceptance, grass shall be well established and in a vigorous growing condition.

1.4 GUARANTEE

.1 All seeded areas shall be guaranteed for a period of one (l) year from date of substantial completion. All areas which show deterioration, bare spots, or are thin due to faulty materials and/or workmanship, shall be reseeded at the Contractor's expense.

1.5 ESTABLISHMENT MAINTENANCE AND POST CONSTRUCTION MAINTENANCE

.1 The Contractor is responsible for providing hand watering for establishment of the seeded grass areas.

.2 The maintenance of seeded areas shall continue until 30 days after substantial completion.

.3 Such maintenance shall include all measures necessary to establish and maintain grass in a vigorous growing condition, including, but not limited to:

.1 Mowing: At regular intervals as required to maintain grass at a maximum height of six (6) cm. No more than one-third (l/3) of blade shall be cut at any one mowing. Edges of grass areas shall be neatly trimmed and hand clipped where necessary. Heavy clipping shall be removed immediately after mowing and trimming.

.2 Hand Watering: When required, and with sufficient amounts to ensure germination and prevent grass and underlying soil from drying out.

.3 Fertilizing: Including all required supplementary fertilizer applications as necessary to establish a vigorous growing stand of grass.

.4 Weed Control: Shall be carried out when required to keep seeded areas reasonably free of weeds. When herbicides are used, they shall be applied in accordance with manufacturer's recommendations and local regulations. Any damage resulting from Contractor's use of herbicides shall be remedied at his own expense.

.5 Erosion: Eroded areas resulting from Contractor's faulty workmanship and/or materials, heavy rainfall or overwatering shall be repaired and reseeded at the Contractor's expense.

.6 Reseeding: Repair areas which show root growth failure, deterioration, bare or thin spots, or which have been damaged by any means, including replacement operations.

.7 Immediately after seeding, erect barricades and warning signs to protect seeded areas from traffic until grass is established, unless otherwise specified.

1.6 HANDLING / STORAGE

.1 Grass Seed: All grass seed, where specified, shall be stored in a dry, weatherproof storage place and shall be protected from damage by heat, moisture, rodents or other causes until time of seeding. Care shall be taken that labels or other identification are not removed or defaced.

.2 Fertilizers:

.1 Fertilizer shall be packed in standard containers, clearly marked with the name of the manufacturer, weight and analysis.

.2 All fertilizer shall be stored in a weatherproof storage place and in such a manner that it will stay dry and its effectiveness is not impaired.

.3 The Contractor shall supply all necessary fertilizers to eliminate any chemical deficiencies of topsoil.

.3 Topsoil: See Section 32 91 21 Topsoil Placement and Grading, for topsoil requirements.

.1 Topsoil shall not be fine graded, or otherwise handled while in a frozen or muddy condition.

1.7 TESTING

.1 See specification section 32 91 21 Topsoil Placement and Grading for topsoil testing requirements.

PART 2 - PRODUCTS

2.1 FERTILIZER

.1 The Contractor shall provide all necessary fertilizers to eliminate any chemical deficiencies of the topsoil as determined by the topsoil analysis.

2.2 TOPSOIL

.1 See Section 32 91 21 Topsoil Placement and Grading, for topsoil requirements.

2.3 WATER

.1 Water used in this work shall be furnished by the Departmental Representative and will be suitable for irrigation and free from ingredients harmful to plant life. Watering equipment required for the work shall be furnished by the Contractor.

2.4 GRASS SEED

.1 Grass seed shall be certified seed, meeting the requirements of the Seeds Act for Canada No. I Seed, and mixed as specified hereinafter.

.2 Seed Mixture for grass areas to consist of a drought resistant blend of grass species.
Seed mix:
- 5% Kentucky Bluegrass
- 25% Perennial Ryegrass
- 10% Chewings Fescue
- 30% Hard Fescue
- 30% Creeping Red Fescue
- seeding rate as per supplier recommendations.

PART 3 - EXECUTION

3.1 FINISH GRADING

.1 Sub-grade shall be scarified to a minimum depth of ten (l0) cm to provide an even, loose textured surface.

.2 Fine grade subgrade, eliminating uneven areas and low spots. Remove debris and stones in excess of 2.5 cm. Remove subsoil that has been contaminated with oil, gasoline or building materials.

.3 Fine grade topsoil to finish grades conforming to the contours, elevations, and pitches indicated on the Engineering Consultants drawings, eliminating rough and low areas to ensure positive drainage.

.4 No fill shall be placed over debris, organic matter, snow, ice, or frozen ground.

.5 Roll topsoil with 50 kg roller to compact and retain finish surface grades flush with adjacent curbs and walks.

.6 The Contractor shall be responsible for maintaining finish grades in all planting areas and for executing any grading as designed or necessary to achieve surface drainage.

.7 Fine grading of each area shall be executed with care. All reasonable precautions, such as wetting down, covering, or other effective measures must be taken to prevent dust from becoming airborne.

.8 The topsoil under all seeded areas shall be spread evenly over the approved subgrade to the specified depth, and compacted to 80-85% Standard Proctor Density. The minimum depth of topsoil under seeded areas shall be fifteen (15) cm.

3.2 INSPECTION

.1 Finish grades shall be inspected and approved prior to any seeding.

3.3 WORKMANSHIP

.1 Keep site well drained.

.2 Clean up immediately soil or debris spilled onto pavement or concrete and dispose of deleterious materials.

.3 Leave site in neat and acceptable condition. Remove all excess materials from site.

3.4 SEEDING OPERATION

.1 The specified fertilizer shall be applied to and well worked into the topsoil by disking, raking or harrowing at the rate required to eliminate chemical deficiencies of the topsoil. This shall be done within 48 hours prior to seeding.

.2 The fertilizers shall be well worked into the upper seven (7) cm of soil prior to seeding.

.3 Immediately before any seed is to be sown, the ground shall be scarified as necessary and shall be raked until the surface is smooth, friable and of uniformly fine texture. Lawn areas shall be seeded evenly with a mechanical spreader at the rate of 2.25 kg/l00 square metres, lightly raked, rolled with a 9 to l2 kg per linear metre roller, and watered with a fine spray. The method of seeding may be varied at the discretion of the Contractor on his own responsibility to establish a smooth, uniformly grassed lawn. All the lawn areas showing germination failure shall be reseeded at intervals of l0 days, until a good growth of grass is established over the entire seeded areas.

3.5 GENERAL REQUIREMENTS

.1 All seeding shall be done on ground which is free of frost, snow or standing water.

.2 The Contractor is responsible for providing hand watering to ensure germination of the seeded areas. Hand watering to continue for 30 days after substantial completion.

.3 The Contractor shall be responsible for providing and maintaining warning signs for all seeded areas until the acceptance unless specified otherwise. Remove protection after grass areas are accepted.

.4 Seeding grass areas shall be carried out during periods which are most favourable for the establishment of a healthy stand of grass.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Trees, Shrubs and Ground Cover Planting; Section 32 93 10.
.2 Seeding; Section 32 92 20.
.3 Irrigation; Section 32 93 11.

1.2 TESTING

.1 Obtain Departmental Representative initial approval of topsoil at source.

.2 Test growing medium from source for the following as outlined in section 6.2.6 Growing Medium Properties and Table 6-3: Properties of Growing Medium for Level 2 “Groomed Areas” (2L) & (2P) in the British Columbia Landscape Standard – 7 th. Edition:
.1 Fertility (N,P,K)
.2 Salinity
.3 Boron
.4 Sodium
.5 Total Nitrogen
.6 Available Phosphorus
.7 Available Potassium
.8 Carbon to Nitrogen Ratio
.9 Acidity (Ph)
.10 Texture -% dryweight of sand, silt and clay.
.11 Organic Matter

.3 Submit 0.5 kg sample of each growing medium type (planting beds and grass areas) to testing laboratory and indicate intended use, type of mulches to be applied, type of subsoil and quality of drainage. Prepare and ship sample according to provincial regulations.

.4 Growing medium shall be tested and **recommendations for corrections** provided to bring properties to levels indicated in Section 6.2.6 and Table 6-3, of the British Columbia Landscape Standard – Seventh Edition, for Planting areas (2P) and Low Traffic Lawn Areas (2L).

.5 Submit one copy of growing medium analysis and **recommendations for corrections** to Departmental Representative.

.6 Inspection and testing of topsoil will be carried out by a reputable testing laboratory at the Contractors expense.

1.3 DELIVERY AND STORAGE

.1 Deliver and store fertilizer, lime, sulphur, in waterproof bags showing bulk accompanied in writing by weight, analysis and name of manufacturer.

1.4 EXAMINATION

.1 In all cases where rough grading and the establishment of the subgrade has been carried out by others, the Contractor shall verify such subgrade on the site and report all discrepancies in writing to the Departmental Representative before commencement of work.

.2 Failure to do so will imply acceptance by the Contractor of surfaces and conditions and no claim made thereafter for damages for extras resulting from such surfaces and conditions will be accepted.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 All topsoil stripped during excavation to be removed from the site.

.2 Growing medium for grass and planting areas to consist of imported topsoil and shall meet requirements identified outlined in section 6.2.6 Growing Medium Properties and Table 6-3: Properties of Growing Medium for Level 2 “Groomed Areas” (2L) & (2P) in the British Columbia Landscape Standard – 7 th. Edition. Topsoil shall be free from subsoil, roots, grass, weeds, toxic materials, stones, and foreign objects. Growing medium containing crabgrass, couch grass, equisetum, noxious weeds or seeds or parts thereof is unacceptable.

.3 Peatmoss:

.1 Decomposed plant material, fairly elastic and homogenous, free of decomposed colloidal residue, wood, sulphur and iron containing minimum 60% organic matter by weight and moisture content not exceeding l5%. Shredded particles may not exceed 6 mm in size. Minimum pH value of peat 5.0, maximum 7.0.

.4 Fertilizer

.1 Complete commercial synthetic slow release fertilizer with maximum 35% water soluble nitrogen.

.2 Formulation ratio: l:4:4 Seeding and l:4:2 Trees & Shrubs

.5 Lime:

.1 Ground agricultural limestone containing minimum 85% of total carbonates.

.2 Gradation requirements: percentage passing by weight, 90% passing l.0 mm sieve, 50% passing l25 micrometre sieve.

.3 Use lime as indicated by acidity analysis of topsoil to bring pH to required level.

.6 Bonemeal:

.1 Raw steamed bonemeal, finely ground with a minimum analysis of 4% nitrogen and 20% phosphoric acid.

.7 Sand:

.1 Hard, granular sharp sand to CSA A82.56-Ml976, well washed and free of impurities, chemical or organic matter.

.8 Sulphur:

.1 Finely crushed agricultural elemental sulphur, free of impurities.

2.2 SOIL MIXTURES FOR PLANTING

.1 Planting soil: For planting of trees, shrubs and groundcover, incorporate organic matter into the growing medium at a rate as recommended by the soil analysis.

.2 Incorporate bonemeal into the growing medium as recommended by the soil analysis.

.3 Incorporate fertilizer as recommended by the soil analysis.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Grade subgrade, eliminating uneven areas and low spots, ensuring positive drainage. Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials. Remove subsoil that has been contaminated with oil, gasoline or calcium chloride. Dispose of removed materials as directed.

.2 Cultivate entire area which is to receive topsoil to depth of l00 mm. Repeat cultivation in those areas where equipment used for hauling and spreading has compacted subgrade.

3.2 SPREADING OF TOPSOIL

.1 Spread topsoil with adequate moisture in uniform layers during dry weather over approved, dry, unfrozen subgrade, where seeding and planting is indicated. No topsoil or fill shall be placed over debris, organic matter, snow, ice or frozen ground.

.2 Install topsoil in areas as indicated on Landscape Plan. Finished surfaces of planting areas to be level with top of curbs.

.3 Apply topsoil to the following minimum depths:
450 mm for shrub beds.
300 mm for ornamental grass.
150 mm for seeded grass areas.
See Section 32 93 10 Trees, Shrubs and Groundcover Planting, 3.1 for tree planting pit requirements.

.4 Remove stones, roots, grass, weeds, construction materials, debris and foreign non-organic objects from topsoil.

.5 Manually spread topsoil around trees and plants.

3.3 SOIL AMENDMENTS

.1 Apply lime, sulphur or other soil amendment at rate determined from soil analysis.

.2 Mix soil amendment well into the full depth of topsoil by cultivating or roto-tilling prior to application of fertilizer.

3.4 APPLICATION OF FERTILIZER

.1 Apply fertilizer at least one week after lime application and at least 6 days before seeding.

.2 Spread fertilizer with mechanical spreaders over entire area of topsoil at manufacturer's recommended rate of application rate and as determined by the soil analysis.

.3 Mix fertilizer thoroughly into upper 50 mm of topsoil.

3.5 FINISH GRADING

.1 Fine grade subgrade, eliminating uneven areas and low spots. Remove debris and stones in excess of 2.5 cm. Remove subsoil that has been contaminated with oil, gasoline or building materials.

.2 Fine grade topsoil in planting areas indicated on the Landscape Plan, eliminating rough and low areas to ensure positive drainage.

.3 Fine grade and loosen topsoil prior to seeding. Eliminate rough spots and low areas to ensure positive drainage. Prepare loose friable sod bed by means of disking and subsequent raking. Roll lightly and rake wherever topsoil is too loose.

.4 Roll topsoil with 50 kg roller, minimum 900 mm wide, to compact and retain surface.

.5 Leave surface smooth, uniform, firm against deep foot printing, with a fine loose texture.

.6 Be responsible for maintaining finish grades in all planting areas and for executing any grading as designed or necessary to achieve surface drainage.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Topsoil Placement and Grading; Section 32 91 21
.2 Seeding; Section 32 92 20.
.3 Irrigation; Section 32 93 11.

1.2 EXAMINATION

.1 Report to the Departmental Representative, in writing, of any conditions or defects encountered on the site during or before construction upon which the work of this section depends and which may adversely affect its performance.

.2 Do not commence work until such conditions or defects have been investigated and corrected.

.3 Commencement of work shall imply acceptance of surfaces and conditions and no claim for damages for extras resulting from such conditions or defects will be accepted thereafter, except in cases where such conditions cannot be known prior to or during the course of construction.

1.3 QUALIFICATIONS AND SUPERVISION

.1 All planting work described in this section shall be executed by experienced personnel under the direction of a skilled foreman.

.2 The Contractor shall be responsible for insuring that all plants to be supplied conform with all Provincial and Federal laws, rules, regulations and inspections.

1.4 SUBSTITUTIONS

.1 All plants shall be supplied as specified on the plant list. Substitution will be permitted only upon submission of proof that any plant as specified is not obtainable. All proposed substitutions must be approved in writing by the Departmental Representative, prior to commencement of work, and must be made at no additional cost to the Owner. Unauthorized substitutions will be corrected at the Contractor's expense using the specified plants or other substitute plants authorized by the Departmental Representative.

1.5 INSPECTION

.1 Within ten (l0) days following acceptance of the bid, the Departmental Representative shall be notified of the source of the materials required.

.2 All materials may be subject to inspection and approval before they are installed. Inspection and approval by the Departmental Representative of plants at the place of growth shall be for quality, size and varieties only, and shall not in any way impair the right of rejection for failure to meet other requirements during progress of the work.

.3 The Contractor shall give timely notice to the Departmental Representative when such materials are available for inspection.

1.6 ACCEPTANCE DATE

.1 Inspection for acceptance shall be completed by the Departmental Representative within l5 days of receipt of written notification from the Contractor that the work is complete.

.2 Any work not satisfactory as specified shall be rectified by the Contractor. This process of inspection and correction shall continue until the Departmental Representative is satisfied that the work is l00% complete.

.3 The date of the written acceptance report by the Departmental Representative shall be the acceptance date.

.4 In the case of partial acceptance, the acceptance date shall apply only to those portions of the work for which partial acceptance have been given.

.5 Where the Contractor requests partial acceptance, he shall give timely notice in writing to the Departmental Representative.

.6 Partial acceptance will only be given when planting work has been delayed due to circumstances beyond the control of the Contractor or when further work would conflict with good horticultural practices and would jeopardize the performance of the work and the plants.

.7 Final inspection of all planting will be made at the end of the specified guarantee period.

.8 At the time of inspection, all plants shall be alive and in a healthy, satisfactory, growing condition.

1.7 GUARANTEE

.1 All plant materials shall be guaranteed for a period of one (l) year after the date of substantial completion.

1.8 REPLACEMENTS

.1 During the guarantee period and during the normal planting season, any plant required under this contract that is dead or not in satisfactory growth, as determined by the Departmental Representative, shall be removed from the site and replaced immediately; these and any plants missing due to the Contractor's negligence, and any plant materials which do not meet the requirements of the specifications, shall be replaced as soon as conditions permit, but during the normal planting season. At the end of the guarantee period, inspection will be made by the Departmental Representative together with the Contractor. All costs of replacements shall be borne by the Contractor.

.2 All replacements shall be plants of the same kind as specified in the plant list and they shall be furnished and planted in accordance with the drawings and specifications.

.3 Any damage to plant materials from any source whatsoever shall be reported in writing to the Departmental Representative.

.4 The cost of replacements resulting from theft, vandalism, carelessness or neglect on the part of others, or any causes due to circumstances beyond the control of the Contractor, shall be borne by the Departmental Representative.

1.9 MAINTENANCE

.1 The Contractor is responsible for maintenance to immediately follow, and coincide with, and be continuous with the planting operations, and shall continue until 30 days after substantial completion.

.2 Such maintenance shall include all measures necessary to establish and maintain all plants in an acceptable, vigorous and healthy growing condition, including, but not limited to:

.1 Cultivating and weeding of planting beds and tree pits: When herbicides are used for weed control, they shall be applied in accordance with manufacturer's recommendations. Damage resulting from Contractor's use of herbicides shall be remedied at his own expense.

.2 Watering: When required and in sufficient quantities to saturate the root system. All plant material should be watered in thoroughly prior to winter season.

.3 Pruning: Including the removal of dead, or broken branches and treatment of pruning wounds.

.4 Disease and insect control when required: When chemicals are used for such control, they shall be used in accordance with manufacturer's recommendations and government regulations.

.5 Maintain in good condition all tree stakes and tree ties and replace all accessories when required.

.3 At time of inspection for acceptance all planting beds and tree pits shall be freshly cultivated, free of weeds, leaves, broken branches and rubbish and shall be in a neat and tidy condition.

.4 Notwithstanding any provisions in the contract documents, the Contractor shall be responsible for making bimonthly inspections of all plantings during the guarantee period and submit a written report of each inspection to the Departmental Representative.

.5 The Contractor shall advise the Departmental Representative in writing of any corrective or preventative measures necessary to ensure healthy plant growth.

1.10 DELIVERY OF MATERIALS

.1 All manufactured materials, such as fertilizers, bonemeal, mulches, etc., shall be delivered to and stored on the site in standard containers clearly indicating contents, weight, analysis and the name of the manufacturer.

.2 Where such materials are supplied in bulk, written statements shall be submitted to the Departmental Representative, indicating the same information as if supplied in standard containers.

.3 All plant material shall be delivered in an enclosed truck or truck covered with a heavy duty plastic tarp securely enveloping all plants. Failure to do so may result in rejection of some or all delivered plants due to wind stress and damage.

1.11 STORAGE OF MATERIALS

.1 All materials which are subject to deterioration resulting from weather or any other causes, shall be stored on the site in a dry, weatherproof place in such a manner that their effectiveness will not be impaired.

.2 All plant materials which cannot be planted immediately upon arrival on site, shall be well protected with soil or similar material to prevent drying out and shall be kept moist until commencement of planting. Plants shall not remain unplanted for longer than three days after delivery.

1.12 DIGGING OF PLANTS

.1 All plants shall be dug and delivered to the site as specified on the Plant List.

.2 Immediately after digging, the root system shall be kept moist to prevent drying out until planted on the site.

.3 All plants specified 'B&B' shall be moved with solid balls firmly wrapped in burlap or any other acceptable material, and bound with twine, cord, or wire mesh.

.4 The sizes of root balls for deciduous and coniferous trees shall be as per British Columbia Landscape Standard – Seventh Edition, table 9-1 and 9-2.

.5 All root balls less than 45 cm in diameter shall be burlapped with l40 g Hessian burlap or approved equal. Balls from 45 to 75 cm in diameter shall be double burlapped and drum laced with 6.0 mm rope at 20 cm spacing.

.6 Plants moved with frozen ball shall be moved only when balls are complete, and root systems intact. Such plants shall be planted as soon as possible after digging.

.7 No plants shall be used when the root ball of earth surrounding the roots has been cracked or broken preparatory to or during the process of planting, or when the steel mesh and ropes required in connection with their transplanting, have been removed.

1.13 HANDLING OF PLANTS

.1 All plants shall be well protected against damage and drying out from the time of digging until they are planted on the site.

.2 All plant material which cannot be planted immediately upon arrival on the site shall be protected with soil or similar materials to prevent drying out and shall be kept moist until commencement of planting.

.3 Plants with broken or abraded trunks or branches are not acceptable.

.4 Root balls, trunks, branches and leaves shall be protected from sun and wind desiccation.

PART 2 - PRODUCTS

2.1 TOPSOIL FOR PLANTING SOIL

.1 See specification section 32 91 21 Topsoil Placement and Grading for topsoil requirements.

.2 Topsoil Depths
- 450 mm. in shrub planting areas.
- 300 mm for ornamental grass planting.
- 150 mm. in grass areas.
- See section 3.1 for tree planting pit requirements.

2.2 PEAT MOSS

.1 See specification section 32 91 21 Topsoil Placement and Grading - 2.1.3.

2.3 FERTILIZER

.1 See specification section 32 91 21 Topsoil Placement and Grading for fertilizer requirements. The Contractor shall provide all necessary fertilizers to eliminate any chemical deficiencies of the topsoil as specified in the soil analysis report .

2.4 BONEMEAL

.1 See specification section 32 91 21 Topsoil Placement and Grading - 2.1.6.

2.5 BARK MULCH

.1 Submit sample to Departmental Representative prior to shipping to site.

.2 Mulch shall be of Douglas Fir / Hemlock bark and shall be free from small branches, leaves, stones, dirt, vegetative material and must pass l00% a 2.5 cm screen.

.3 Mulch to be installed to standards indicated in the British Columbia Landscape Standard – 7 th. Edition, section 10.

2.6 WATER

.1 Water used in this work shall be furnished by the Departmental Representative and will be suitable for irrigation and free from ingredients harmful to plant life. Hose and other watering equipment required for the work shall be furnished by the Contractor.

2.7 PLANT MATERIALS

.1 All plant materials shall meet the horticultural standards of the Canadian Nursery Trades Association with respect to grading and quality.

.2 They shall be nursery grown under proper cultural practices as recommended by the Canadian Nursery Trades Association.

.3 Nomenclature of specified plants shall conform to the International Code of Nomenclature of Cultivated Plants and shall be in accordance with the approved scientific names given in the latest edition of Standardised Plant Names. The names of varieties not named therein are generally in conformity with the names accepted in the nursery trade.

.4 Plants shall be true to type and have a growth habit which is normal for the species. They shall be structurally sound; well-branched, healthy, vigorous, and free of disease, insect infestations, rodent damage, sun scald, frost cracks, and other abrasions or scars to the bark. Standard trees shall have straight trunks and full, symmetrical well branched heads. Plants shall be densely foliated when in leaf and have a healthy, well developed root system. Pruning wounds shall vigorous bark on all edges and all parts shall be moist and show live, green cambium tissue when cut. Where more than one plant of the same species or cultivar is specified, they shall be uniform in appearance.

.5 All plant materials shall conform to the measurements specified in the plant list except that plants larger than specified may be used only upon approval from the Landscape Architect. The use of such plants shall not increase the contract price. If larger plants are used, the ball of earth shall be increased in proportion to the size of the plant.

.6 All plants shall be measured when the branches are in their normal position. Height and spread dimensions specified refer to the main body of the plant and not from branch tip to root base or from branch tip to branch tip. Where trees are measured by caliper (cal.) reference is made to the diameter of the trunk measured l5 cm above ground as tree stands in the nursery.

2.8 ACCESORIES

.1 Hardware such as tree ties for supporting trees shall be required as per drawing details. The contractor shall submit samples of such products to the Departmental Representative prior to installation.

PART 3 - EXECUTION

3.1 PLANTING PITS

.1 Planting pits for trees shall be excavated to a minimum of 3.0 m. diameter and .60 m. depth minimum. When a 3.0 m. diameter cannot be achieved, tree pits to be extended laterally to provide a 10 sq. meter area. Tree pit locations to be staked out on site and approval obtained from the General Contractor prior to excavation to avoid conflicts with underground services.

.2 Pits shall be deep enough to allow a minimum depth of fifteen (l5) cm of compacted planting soil mixture under the root ball.

.3 The transition of the tree planting area to shallower growing medium of the surrounding planting bed or grass areas shall have a shallow angle.

.4 All tree pits to drain freely.

3.2 PLANT INSTALLATION

.1 Planting shall be done during periods suitable with respect to weather conditions and locally accepted practice. Plants shall be set plumb in the centre of the pits and at the same relation to grade as originally grown, after settlement has taken place.

.2 Trees and other plant materials shall be faced to give the best appearance.

.3 Plants shall be set on a layer of loose, unfrozen, prepared soil, at least l5 cm deep. Soil shall be firmly tamped in place in such a manner that the plant retains its vertical position. Particular care shall be taken to ensure that no air pockets remain under or around the roots. The planting soil shall be thoroughly watered immediately after tamping. All non-porous or non-biodegradable containers shall be removed.

3.3 PLANT SUPPORT

.1 Trees shall be braced upright in position by stakes and tree ties as noted on the drawings.

3.4 PRUNING

.1 Plants shall be pruned after planting. The amount of pruning shall be limited to the minimum necessary to remove dead or injured branches and to compensate for the loss of roots as a result of transplanting operations. Pruning shall be done in such a manner as to preserve the natural character of the plants. Leaders shall not be removed. Only clean, sharp tools shall be used. All cuts shall be clean and flush, leaving no stubs. Cuts, bruises or scars on the bark shall be traced back to living tissue and removed. The affected areas shall be shaped so as not to retain water.

3.5 BARK MULCH

.1 Bark mulch shall be installed in all shrub beds, planters and in all plant saucers to a depth of 7.5 cm.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Trees , Shrubs and Ground Cover Planting; Section 32 93 10.
.2 Topsoil Placement and Grading; Section 32 91 21.
.3 Seeding, Section 32 92 20.

1.2 IRRIGATION SYSTEM CRITERIA

.1 Irrigation Contractor to review Landscape drawings to familiarize themselves with the scope of irrigation required.
.2 Irrigation Contractor to provide a shop drawing of the proposed irrigation system for review and approval by the Departmental Representative prior to commencement of work. Irrigation system to be designed in accordance with Irrigation Industry Association of British Columbia Standards, 2008 Edition. Irrigation shop drawing to be computer drawn and submitted for review in .dwg and .pdf formats.
.3 The intent of the irrigation system is to provide a water efficient drip irrigation system for planting beds, ornamental grass, vine planting and trees. Grass boulevard areas and lane edges are not to be irrigated with a permanent irrigation system.
.4 Irrigation system to meet all municipal and provincial codes.
.5 Irrigation to be provided from a potable water source. The irrigation point of connection is located in the planting island on the north side of the driveway access as indicated on the Landscape Plan. Irrigation contractor to provide backflow prevention and obtain permits, testing and certificates to meet all code requirements.
.6 Sleeves for irrigation lines to be provided by the General Contractor under all paved areas and through retaining walls to access all shrub beds. Location of sleeves to be co-ordinated between Landscape Contractor, Irrigation Contractor, and General Contractor. Sleeves to consist of 100 mm. class 160 PVC.
.7 All main and lateral lines to be installed at a minimum 400 mm. depth below finished grade.
.8 Irrigation controller to be located in the sprinkler room as indicated on the Landscape Plan. General Contractor to co-ordinate the 110 volt power source and conduit to an exterior planting area for zone valve wires.
.9 Manuals of instructions and an “as built” plan to be provided by the Irrigation Contractor upon completion of the irrigation installation as per IIABC Standards 2008 Edition. Irrigation “as built” to be computer drawn and submitted for review in .dwg and .pdf formats. Upon approval of the as built drawings, digital and hard copies to be provided to the Departmental Representative.
.10 Irrigation Contractor to provide the following documentation to the Departmental Representative: a). Backflow prevention test certificate. b). Mainline pressure test verification.
.11 Irrigation Contractor to demonstrate operation of the Irrigation Controller with Maintenance Personnel and monitor the irrigation operation and co-ordinate the irrigation requirements of the planting with the Maintenance Personnel during the 1 year warranty period..
.12 Irrigation Contractor to provide a one year warranty, from the date of Substantial Completion, on all parts and labour.

END OF SECTION

Part 1 General

1.1 REFERENCES

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

- .1 ASTM A48/A48M-00, Standard Specification for Gray Iron Castings.
- .2 ASTM C139-05, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
- .3 ASTM C478M-06, Standard Specification for Precast Reinforced Concrete Manhole Sections Metric.

.2 Canadian Standards Association (CSA International)

- .1 CAN/CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .2 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-A3002-03, Masonry and Mortar Cement.
- .3 CAN/CSA-A165 Series-04, CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3).

Part 2 Products

2.1 MATERIALS

.1 Precast manhole units: to ASTM C478M, circular or oval.

- .1 Top sections eccentric cone or flat slab top type with opening offset for vertical ladder installation.
- .2 Monolithic bases to be approved by Engineer and set on concrete slabs cast in place .

.2 Precast catch basin sections: to ASTM C139.

.3 Joints: made watertight using rubber rings , bituminous compound, epoxy resin cement or cement mortar .

.4 Ladder rungs: to CAN/CSA-G30.18, No.25M billet steel deformed bars, hot dipped galvanized to CAN/CSA-G164.

- .1 Rungs to be safety pattern (drop step type).

.5 Adjusting rings: to ASTM C478M.

.6 Concrete Brick: to CAN3-A165 Series.

.7 Frames, gratings, covers to dimensions as indicated and following requirements:

- .1 Gray iron castings: to ASTM A48/A48M, strength class 30B .

.2 Manhole frames and covers: heavy duty municipal type for road service.

.1 Cover cast without perforations and complete with two 25 mm square lifting holes .

.8 Granular bedding and backfill: in accordance with the following requirements:

.1 Crushed screed stone, gravel sand.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

.3 Table:

Sieve Designation	% Passing	
	Stone/Gravel	Gravel/Sand
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	100	-
19 mm	-	-
12.5 mm	65-90	100
9.5 mm	-	-
4.75 mm	35-55	50-100
2.00 mm	-	30-90
0.425 mm	10-25	10-50
0.180 mm	-	-
0.075 mm	0-8	0-10

.4 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete .

.5 Backfill material size gradations as specified in the geotechnical report are also acceptable.

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 EXCAVATION AND BACKFILL

.1 Excavate and backfill in accordance with Section 31 23 33 - Excavating Trenching and Backfilling and as indicated.

.2 Obtain approval of Departmental Representative before installing outfall structures, manholes or catch basins.

3.3 CONCRETE WORK

.1 Do concrete work in accordance with Section 03 05 10- Cast-in-Place Concrete .

.2 Place concrete reinforcement in accordance with Section 03 05 10- Cast-in-Place Concrete.

.3 Position metal inserts in accordance with dimensions and details as indicated.

3.4 INSTALLATION

.1 Construct units in accordance with details indicated, plumb and true to alignment and grade.

.2 Complete units as pipe laying progresses.

.1 Maximum of three units behind point of pipe laying will be allowed.

.3 Dewater excavation to approval of Engineer and remove soft and foreign material before placing concrete base. Refer to Erosion and Sediment Control Plan.

.4 Cast bottom slabs directly on undisturbed ground.

.5 Set precast concrete base on 150 mm minimum of granular bedding compacted to 100 % corrected maximum dry density maximum density to ASTM D698.

.6 Precast units:

.1 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base.

.2 Make each successive joint watertight with Engineer's Engineer's Consultant's approved rubber ring gaskets , bituminous compound, cement mortar, epoxy resin cement, or combination of these materials.

.3 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.

.4 Plug lifting holes with precast concrete plugs set in cement mortar or mastic compound.

.7 For sewers:

.1 Place stub outlets and bulkheads at elevations and in positions indicated.

.2 Bench to provide smooth U-shaped channel.

.1 Side height of channel to be 0.75 times full diameter of sewer.

.2 Slope adjacent floor at 1 in 20 .

.3 Curve channels smoothly.

.4 Slope invert to establish sewer grade.

.8 Compact granular backfill to 95 % corrected maximum dry density maximum density to ASTM D698.

.9 Set frame and cover to required elevation on no more than four courses of brick.

.1 Make brick joints and join brick to frame with cement mortar.

.2 Parge and make smooth and watertight.

.10 Place frame and cover on top section to elevation as indicated.

.1 If adjustment required use concrete ring.

.11 Clean units of debris and foreign materials.

.1 Remove fins and sharp projections.

.2 Prevent debris from entering system.

.12 Install safety platforms in manholes having depth of 5 m or greater, as indicated.

3.5 ADJUSTING TOPS OF EXISTING UNITS

.1 Remove existing gratings and frames and store for re-use at locations designated by Engineer.

.2 Sectional units:

.1 Raise or lower straight walled sectional units by adding or removing precast sections as required.

.2 Raise or lower tapered units by removing cone section, adding, removing, or substituting riser sections to obtain required elevation, then replace cone section.

.1 When amount of raise is less than 600 mm use standard manhole brick, moduloc or grade rings.

.3 Monolithic units:

.1 Raise monolithic units by roughening existing top to ensure proper bond and extend to required elevation with mortared brick course for 150 mm or less alteration cast-in-place concrete.

.2 Lower monolithic units with straight wall by removing concrete to elevation indicated for rebuilding.

.3 When monolithic units with tapered upper section are lowered more than 150 mm, remove concrete for entire depth of taper plus as much straight wall as necessary, then rebuild upper section to required elevation with cast-in-place concrete.

.4 Install additional manhole ladder rungs in adjusted portion of units as required.

.5 Re-use existing gratings and frames.

.6 Re-set gratings and frames to required elevation on not more than 4 courses of brick.

.1 Make brick joints and join brick to frame with cement mortar, parge and trowel smooth.

.2 Re-set gratings and frames to required elevation on full bed of cement mortar, parge and trowel smooth.

3.6 SEALING OVER EXISTING UNITS

.1 Cut galvanized iron sheet to extend 50 mm beyond opening of existing manhole or catch basin grating.

.1 Center iron sheet over existing grating and spot or stitch weld to grating.

.2 Fill with cast-in-place concrete material approved by Departmental Representative.

3.7 FIELD QUALITY CONTROL

.1 Leakage Test: Install watertight plugs or seals on inlets and outlets of each new sanitary sewer manhole and fill manhole with water.

.2 Leakage not to exceed 0.3% per hour of volume of manhole.

.3 If permissible leakage is exceeded, correct defects.

.4 Repeat until approved by Departmental Representative.

.5 Engineer will issue Test Certificate for each manhole passing test.

3.8 CLEANING

.1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for service connections.

1.2 RELATED SECTIONS

.1 Section 31 23 33 - Excavating, Trenching and Backfilling.

1.3 REFERENCES

.1 American National Standards Institute/American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA C651-99, Disinfecting Water Mains.

.2 ANSI/AWWA C900-97, Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Distribution.

.2 Canadian Standards Association (CSA International)

.1 CSA B137 Series-02, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).

.1 CSA B137.3-02, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.

1.4 SUBMITTALS

.1 Inform Departmental Representative of proposed source of bedding materials and provide access for sampling at least 4 weeks prior to commencing work.

.2 Pipe certification to be on pipe.

1.5 CLOSEOUT SUBMITTALS

.1 Provide data to produce record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, maintenance and operating instructions.

1.6 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services.

.2 Submit schedule of expected interruptions to Departmental Representative for approval and adhere to interruption schedule as approved by Departmental Representative.

.3 Notify Departmental Representative and building occupants superintendent minimum of 72 h in advance of interruption in service.

.4 Do not interrupt water service for more than 3 h and confine this period between 10:00 and 16:00 h local time unless otherwise authorized.

.5 Notify fire department of any planned or accidental interruption of water supply to hydrants.

.6 Advise local police department of anticipated interference with movement of traffic.

Part 2 Products

2.1 PIPE, JOINTS AND FITTINGS

.1 Polyvinyl chloride pressure pipe: to ANSI/AWWA C900, pressure class 150, DR 18, 1 MPa gasket bell end, cast iron outside diameter.

.1 Acceptable material: IPEX or approved equivalent.

.2 CSA-B137.3, PVC series 160, 1.1 MPa elastomeric gasket.

.3 Composite epoxy impregnated fibreglass PVC pipe to ASTM D2996, class H. Unplasticized PVC core over wrapped with bonded fibreglass reinforced epoxy resin. Pressure class 300, 2.4 MPa with cast iron outside diameter and integral bell gasketted joints to ANSI/ASTM D2992. Material to ASTM D2310, classification RTRP-11HZ-5001-PVC-13223.

.4 Cast iron fittings: to ANSI/AWWA C110/A21.10, and for pipe diameters larger than NPS4 cement mortar lined to ANSI/AWWA C104/A21.4.

2.2 SERVICE CONNECTIONS

.1 Copper tubing: to ASTM B88M type K, annealed.

.2 Brass corporation stops: compression type having threads to ANSI/AWWA C800.

.3 Service connections for PVC pipe:

.1 Service connections less than 100 mm: Corporation stop, tapped to main using AWWA threads, complete with stainless service saddle. Service saddle to consist of circumferential band type complete with side bars and fingers, keeper bar, stud bolts, nuts, washers and gaskets.

.2 Service connections 100 mm and over: Use tee fitting or tapping valve and sleeve.

2.3 VALVES AND VALVE BOXES

.1 Valves to open counter clockwise.

.2 Gate valves: to ANSI/AWWA C500, standard iron body, bronze mounted wedge or double disc valves with non-rising stems, suitable for 1 Pa with flanged or hub joints as shown on drawings.

.3 Underground type indicator valve where indicated. Indicator post to accurately indicate valve open or closed.

2.4 PIPE BEDDING AND SURROUND MATERIAL

.1 Granular material to: following requirements:

.1 Crushed 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-8.1 CAN/CGSB-8.2.

.3 Table

Sieve Designation	% Passing Stone/Gravel	Gravel/Sand
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	100	-
19 mm	-	-
12.5 mm	65-90	100
9.5 mm	-	-
4.75 mm	35-55	80-100
2.00 mm	-	50- 90
0.425 mm	10-25	10- 50
0.180 mm	-	-
0.075 mm	0- 8	0- 10

.2 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks: to Section 03 05 10 - Cast-in-Place Concrete.

2.5 BACKFILL MATERIAL

.1 As indicated. Type 3, in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.

.2 Backfill material size gradations as specified in the geotechnical report are also acceptable.

Part 3 Execution

3.1 PREPARATION

.1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.

.1 Inspect materials for defects to approval of Departmental Representative.

.2 Remove defective materials from site as directed by Departmental Representative.

3.2 TRENCHING

.1 Do trenching work in accordance with Section 31 23 33 - Excavating Trenching and Backfilling.

.2 Trench depth to provide cover over pipe of not less than 1 m from finished grade or as indicated.

.3 Trench alignment and depth require Engineer's Consultant's approval prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

.1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth of 75mm below bottom of pipe to depth as indicated.

.2 Do not place material in frozen condition.

.3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.

.4 Shape transverse depressions in bedding as required to suit joints.

.5 Compact each layer full width of bed to at least 95% Modified Proctor Density of to ASTM D1557.

.6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33 - Excavating Trenching and Backfilling with compacted bedding material.

3.4 PIPE INSTALLATION

.1 Terminate building water service 1m outside building wall opposite point of connection to main. Install coupling necessary for connection to building plumbing. If plumbing is already installed, make connection; otherwise cap or seal end of pipe and place temporary marker to locate pipe end.

.2 Lay pipes to manufacturer's standard instructions and specifications. Do not use blocks except as specified.

.3 Join pipes in accordance with manufacturer's recommendations.

.4 Bevel or taper ends of PVC pipe to match fittings.

.5 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.6 Lay pipes on prepared bed, true to line and grade.

.1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.2 Take up and replace defective pipe.

.3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.

.7 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.

.8 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

.9 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.

.1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.10 Position and join pipes with equipment and methods approved by Departmental Representative.

.11 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.12 Align pipes before jointing.

.13 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.14 Avoid displacing gasket or contaminating with dirt or other foreign material.

.1 Remove disturbed or contaminated gaskets.

.2 Clean, lubricate and replace before jointing is attempted again.

.15 Complete each joint before laying next length of pipe.

.16 Minimize deflection after joint has been made.

.17 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

.18 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Departmental Representative.

.19 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.20 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.

.21 Do not lay pipe on frozen bedding.

.22 Do hydrostatic and leakage test and have results approved by Departmental Representative before surrounding and covering joints and fittings with granular material.

.23 Backfill remainder of trench.

3.5 VALVE INSTALLATION

.1 Install valves to manufacturer's recommendations at locations as indicated.

.2 Support valves located in valve by means of bedding same as adjacent pipe. Maximum length of pipe on each end of valve shall be 1 m. Valves not to be supported by pipe.

.3 Install underground post-type indicator valves as indicated.

3.6 SERVICE CONNECTIONS

.1 Install building water service perpendicularly opposite point of connection to main.

.1 Install coupling necessary for connection to building plumbing.

.2 If building plumbing is already installed, make connection, otherwise cap or seal end of pipe and place temporary marker to locate pipe end.

.2 Do not make final connection of service connections until satisfactory completion of hydrostatic and leakage tests of water main.

.3 Construct service connections at right angles to water main unless otherwise directed. Locate curb stops 300 mm inside roadway allowance.

.4 Tappings on PVC pipe to be either PVC valve tees or bronze type service clamps, strap type with "O" ring seal cemented in place.

.5 Employ only competent workmen equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.

.6 Install single and multiple tap service connections on top half of main, between 45 degrees and 90 degrees measured from apex of pipe.

.7 Install multiple corporation stops, 30 degrees apart around circumference of pipe and minimum of 300 mm apart along pipe.

.8 Tap main at 2:00 o'clock or 10:00 o'clock position only; not closer to joint nor closer to adjacent service connections than recommended by manufacturer, or 1 m, whichever is greater.

.9 Leave corporation stop valves fully open.

.10 In order to relieve strain on connections, install service pipe in "Goose Neck" form "laid over" into horizontal position.

.11 Install rigid stainless steel liners in small diameter plastic pipes with compression fittings.

.12 Install curb stop with corporation box on services NPS 2 or less in diameter.

.1 Equip larger services with gate valve and cast iron box.

.2 Set box plumb over stop and adjust top flush with final grade elevation.

.3 Leave curb stop valves fully closed.

.13 Place temporary location marker at ends of plugged or capped unconnected water lines.

.1 Each marker to consist of 38 x 89 mm stake extending from pipe end at pipe level to 600 mm above grade.

.2 Paint exposed portion of stake red with designation "WATER SERVICE LINE" in black.

3.7 BACKFILL

.1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.

.2 Do not place backfill in frozen condition.

.3 Place backfill to at least 98% Modified Proctor Density to ASTM D1557.

3.8 TESTING, FLUSHING AND DISINFECTING

.1 Perform tests, flushing and disinfection in presence of Departmental Representative

.2 Notify Departmental Representative 72 hours in advance of proposed tests.

.3 As per MMCD except paragragh 3.17.4 to be replaced with the following:

.1 Chlorinated water flushed from the mains shall be treated in such manner that it does not pose a threat to the aquatic life in the receiving water for fish bearing streams. If there is a possibility that the chlorinated discharge will cause damage to the environment, a neutralizing chemical shall be applied to the water to be wasted to thoroughly neutralize the residual chlorine. Disposal of chlorinated water into the sanitary sewer must be by slow release only and is subject to prior approval by the *100 Mile House*, *Director of Community Services*.

3.9 SURFACE RESTORATION

.1 After installing and backfilling over water mains, restore surface to original condition as directed by Departmental Representative.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for storm and sanitary sewer.

1.2 RELATED SECTIONS

.1 Section 31 23 33 - Excavating, Trenching and Backfilling.

1.3 REFERENCES

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

.1 ASTM C136-01, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

.2 ASTM D3034-00, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.2 Canadian Standards Association (CSA International)

.1 CSA B1800-02, Plastic Non-pressure Pipe Compendium:

.1 CSA B182.2-02, PVC Sewer Pipe and Fittings (PSM Type).

.2 CSA B182.4-02, Profile PVC Sewer Pipe and Fittings.

.3 CSA B182.11-02, Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.

1.4 SCHEDULING

.1 Schedule Work to minimize interruptions to existing services and to maintain existing flow during construction.

.2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

Part 2 Products

2.1 PLASTIC PIPE

.1 Type PSM Poly Vinyl Chloride (PVC): to CSA-B182.2.

.1 Standard Dimensional Ratio (SDR): 35

.2 Separate gasket and integral bell system.

.3 Nominal lengths: 4 m.

2.2 PIPE BEDDING AND SURROUND MATERIAL

.1 Granular material in accordance with following requirements:

.1 Crushed or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C136

.2 Table

Sieve Designation (mm)	% Passing Stone/Gravel	Gravel/Sand
200	-	-
75	-	-
50	-	-
38.1	-	-
25	100	-
19	-	-
12.5	65-90	100
9.5	-	-
4.75	35-55	50-100
2.00		30-90
0.425	10-25	10-50
0.180	-	-
0.075	0-8	0-10

.3 Backfill material size gradations as specified in the geotechnical report are also acceptable.

2.3 BACKFILL MATERIAL

.1 As indicated.

.2 Type 3 to Section 31 23 33 - Excavating Trenching and Backfilling.

Part 3 Execution

3.1 PREPARATION

.1 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Departmental Representative.

3.2 TRENCHING

.1 Do trenching Work in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.

.2 Do not allow contents of sewer or sewer connection to flow into trench.

.3 Trench alignment and depth to approval of Departmental Representative prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

.1 Place bedding in unfrozen condition.

.2 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness.

.3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe. Do not use blocks when bedding pipes.

.4 Compact each layer full width of bed to at least 95 % corrected maximum dry density maximum density to ASTM D698.

.5 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with compacted bedding material .

3.4 INSTALLATION

.1 Lay and join pipes in accordance with manufacturer's recommendations and to approval of Departmental Representative.

.2 Handle pipe using methods approved by Departmental Representative

.1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

.3 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points.

.1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.4 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.5 Do not exceed maximum joint deflection recommended by pipe manufacturer.

.6 Do not allow water to flow through pipe during construction, except as may be permitted by Departmental Representative.

.7 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.8 Install plastic pipe and fittings in accordance with CSA B182.11.

.9 Pipe jointing:

.1 Install gaskets in accordance with manufacturer's recommendations.

.2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.3 Align pipes before joining.

.4 Maintain pipe joints free from mud, silt, gravel and other foreign material.

.5 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted.

.6 Complete each joint before laying next length of pipe.

.7 Minimize joint deflection after joint has been made to avoid joint damage.

.8 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

.10 When stoppage of Work occurs, block pipes as directed by Departmental Representative to prevent creep during down time.

.11 Plug lifting holes with pre-fabricated plugs approved by Departmental Representative, set in shrinkage compensating grout.

.12 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.13 Make watertight connections to manholes.

.1 Use shrinkage compensating grout when suitable gaskets are not available.

.14 Use prefabricated saddles or field connections approved by Departmental Representative, for connecting pipes to existing sewer pipes.

.1 Joints to be structurally sound and watertight.

3.5 PIPE SURROUND

.1 Place surround material in unfrozen condition.

.2 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.

.3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.

.4 Place layers uniformly and simultaneously on each side of pipe.

.5 Compact each layer from pipe invert to mid height of pipe to at least 98 % corrected maximum dry density.

.6 Compact each layer from mid height of pipe to underside of backfill to at least 98 % corrected maximum dry density.

.7 Provide geotechnical testing for verification of compaction and backfill density in all trenches and submit test results to Departmental Representative.

.8 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

3.6 BACKFILL

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.

.3 Place unshrinkable backfill in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.

3.7 PRESSURE TESTING

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 When directed by Departmental Representative draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.

.3 Remove foreign material from sewers and related appurtenances by flushing with water.

.4 Provide labour, equipment and materials required to perform air pressure test.

.5 Perform air pressure test as soon as practicable after jointing and bedding are complete, and service connections have been installed.

.6 Do air pressure test testing as specified herein and as directed by Departmental Representative.

.1 Perform tests in presence of Departmental Representative

.2 Notify Departmental Representative 72 hours in advance of proposed tests.

.3 Increase pressure in test section to 24 kPa above average ground water pressure and observe rate of pressure drop.

.4 Maintain 25kPa above average ground water pressure for at least 5.0minutes before commencing internal air pressure test. Regulate air pressure to prevent pressure inside test section from exceeding 35 kPa above average ground water pressure.

.5 Commence test period when pressure decreases to 24 kPa above average groundwater pressure and end when pressure decreases to 20.5 kpa above average groundwater pressure. Do not add air to test section during test period. If test period is less than:

Pipe Size	Minimum test Success Time
150mm	3 min. 50 sec.
200mm	5 min. 6 sec.
250mm	6 min. 22 sec.

.6 Repair and retest sewer line as required, until test results are within limits specified.

.7 Departmental Representative reserves right to withdraw permission to use this test procedure at any time and to require contractor to carry out exfiltration test utilizing water.

.7 Repair visible leaks regardless of test results.

3.8 VIDEO INSPECTION

.1 Provide video inspection of drain and sanitary sewers as per MMCD.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Excavation, Trenching and Backfilling - Section 31 23 33.

1.2 REFERENCES

.1 CSA B1800 SERIES-06, B182.1-06: Perforated Plastic Pipe and Fittings.

1.3 MATERIAL CERTIFICATION

.1 At least 2 weeks prior to commencing work, submit manufacturer's test data and certification that drain pipe materials meet requirements of this section.

2 Products

2.1 MATERIALS

.1 Perforated and non-perforated rigid drainage pipe:
.1 Plastic pipe and fittings: plastic drain pipe and plastic pipe fittings with minimum pipe stiffness of 275 kPa, single-wall, non-corrugated, non-perforated plastic pipe and plastic pipe fittings, to B182.1, nominal pipe size 100 mm φ.

.2 Sand bedding and cover: to Section 31 23 33 - Excavation, Trenching and Backfilling.

3 Execution

3.1 EXCAVATING

.1 Do excavating and backfilling in accordance with Section 31 23 33 - Excavating Trenching and Backfilling.

3.2 BEDDING AND PROTECTIVE COVER

.1 Non-perforated pipe: lay pipe on bedding of 150 mm thickness of sand (Type 4 Fill), cover with minimum 300 mm of Type 4 Fill and compact to Density specified.

3.3 INSTALLATION OF PIPE

.1 Lay pipe drains on prepared bed, true to line and grade with inverts smooth and free of sags or high points. Ensure barrel of each pipe is in contact with bed throughout full length.

.2 Commence laying pipe at outfall and proceed in upstream direction. Connect drainage line to all RWL drains at finish grade using special fittings.

.3 Make joints tight in accordance with manufacturer's instructions. Cement all joints.

.4 Provide vertical drain pipe to finish grade level at all cleanouts.

.1 Cleanouts required at all RWLs. Provide 100 mm 45° wye at grade level with screw type cleanout cap.

.2 All cleanouts accessible at grade level with concrete pads installed in landscape areas and at sidewalks areas. Note: cut off RWL cleanout pipes at 150 mm above rough grade and flush with concrete pads and sidewalk.

.3 Provide purpose made 75/100 increaser for 75 mm φ RWL drains at finish grade to accommodate underground 100 mm drainage piping.

.5 Protect open upstream ends of pipes during installation to prevent ingress of backfill material.

.6 Do not allow water to flow through pipes during construction except as approved.

END OF SECTION

1 GENERAL

1.1 CO-ORDINATION OF DOCUMENTS

.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 WORK INCLUDED

.1 Buried natural gas service piping from point of connection to gas utility supply to the point of building entry all in accordance with the Canadian Gas Association, CGA B149.1-M95, Natural Gas Installation Code.

.2 Coordinate with the general contractor and owner for the provision of a natural gas meter, pressure reducing valves station, and valve train as necessary for a complete installation.

.3 Coordinate with the general contractor for the provision of a gas meter slab and fenced compound as necessary.

1.3 RELATED SECTIONS

.1 Division 2 -Trenching and Backfilling

.2 [Section 31] Earthwork

.3 Section 02700 - Piped Utilities -

.4 Section [33 05 00] -Common Work Results for Utilities

.5 Section [3] - Cast-in-Place Concrete

.6 Section [01 32 17 - Construction Progress Schedule - Critical Path Method (CPM)].

.7 Section [01 32 18 - Construction Progress Schedules - Bar (GANTT) Chart].

.8 Section [01 33 00 - Submittal Procedures].

.9 Section [01 45 00 - Quality Control].

.10 Section [01 47 15 - Sustainable Requirements: Construction].

.11 Section [01 47 17 - Sustainable Requirements: Contractor's Verification].

.12 Section [01 74 19 - Construction/Demolition Waste Management and Disposal].

.13 Section [01 78 00 - Closeout Submittals].

.14 Section [02 61 33 - Hazardous Materials].

.15 Section [23 05 00 - Common Work Results - Mechanical].

.16 Section [23 05 16 - Expansion Fittings and Loops for HVAC Piping].

.17 Section [23 05 17 - Pipe Welding].

.18 Section [23 08 01 - Performance Verification of Mechanical Piping Systems].

.19 Section [23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems].

.20 Section [33 05 00]Common Work Results for Utilities].

1.4 MEASUREMENT PROCEDURES

.1 Excavation and backfill will be measured under Section [31 23 10 - Excavating Trenching and Backfilling].

.2 Supply of Natural gas pipe will be measured in metres, of each type and size indicated and in authorized quantities delivered to designated storage area.

.3 [Bedding] [and] [backfill material] will be measured in [tonnes] [cubic metres] of material incorporated into Work. [No deduction to be made for volume normally occupied by pipe.]

.4 Horizontal measurement will be made from point of entry to the ground from the storage tank to the entry point to the building over the surface after work has been completed.

1.5 REFERENCE

.1 Canadian Gas Association (CGA Standards, Recommended :Practices and Codes are now published by CSA).

.1 CGA, -1.8-M96/ANSI Z83.11-1996 Gas Food Services Equipment.

.2 CGA -6.10-M97/ANSI Z21.24-1997 Connectors for Gas Appliances

.3 CAN/CGA -8.1-M86 Elastomeric Composite Hose and Hose Couplings for Conducting Propane and Natural Gas

.4 CAN -8.3-M77 (R1983) Thermoplastic Hose and Hose Couplings for Conducting Propane and Natural Gas

1.6 SUBMITTALS

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

.2 Inform Consultant of proposed source of bedding and backfill materials and provide access for sampling at least [4] weeks prior to commencing work.

.3 Product Data:

.4 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.

.5 Shop Drawings:

.6 Submit shop drawings to indicate project layout including layout, dimensions and extent of piping system.

.7 Vertical and horizontal piping locations and elevations and connections details.

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

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

.10 Instructions: submit manufacturer's installation instructions.

1.7 CONNECTION FEE

.1 Refer to the plans for the general arrangement of connections to the Natural Gas utility service system.

.2 Arrange and pay for all applicable fees and/or charges including connection fees and inspection fees levied by the gas utility authority for the right of connecting to their system.

.3 Determine the extent of work provided by the utility for the above referenced fees and provide all necessary additional work to effect a complete and fully functional connection to their system.

.4 Coordinate with the general contractor for the provision of a gas meter slab and fenced compound as necessary.

2 PRODUCTS

2.1 PIPE AND FITTINGS

.1 Schedule 40 carbon steel to CSA B63 complete with factory extruded polyethylene jacket as manufactured by Shaw Pipe Protection.

.2 Type L Copper pipe to ASTM B 88-96/B88M-96 complete with factory extruded polyethylene jacket as manufactured by Kamco Products (http://kamcoproducts.com/) or Shaw Pipe Protection.

.3 Fittings for steel pipe shall be malleable iron to ANSI/ASME B16.3.

2.2 VALVES

.1 High pressure isolation valves shall be of the plug, ball or eccentric type.

.2 Pressure regulator valves sized for required flow at the extremes of inlet pressures.

.3 All valves to the Canadian Gas Association, CGA B149, Natural Gas Installation Code.

2.3 VALVES AND VALVE BOXES

.1 The specified valve is available in all the different resins from which the pipe may be manufactured. It is mandatory that the resin type for the valves be identical to that of the pipe selected.

2.4 TRACER WIRE

.1 No. 14 gauge stranded copper wire.

2.5 WARNING TAPE

.1 Underground warning tape (plain tape only). - Acceptable Products: Brady Idenoline

2.6 GAS METER

.1 Natural gas meter suitable for a maximum capacity reading at least equal to the total connected gas load, reading in cubic meters per hour at a maximum pressure of 70 kPa and possessing 4-20 mA output signal to remote reading module suitable for input to the building management system. Provide strainer to all turbine meters. Coordinate with the building management system trade for the appropriate selection.

.2 Acceptable Products:

.1 Less than 85 cubic metres per hour [3,000 cfh]: American / Canadian Meter Co. displacement (bellows) type meter.

.2 Greater than 85 cubic metres per hour [3,000 cfh]: Rockwell turbine meter.

2.7 MAIN REGULATOR

.1 Regulator suitable to lower pressure from incoming service pressure from meter to service pressure within the building. - Acceptable Products: Rockwell, Neptune

3 EXECUTION

3.1 PIPE INSTALLATION

.1 Weld steel pipe or join polyethylene pipe in accordance with manufacturer's recommendations.

.2 Align pipes carefully before jointing. Maintain a minimum of 900 mm separation between propane gas line and any adjacent buried services.

.3 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Engineer.

.4 Upon completion of pipe laying and after Engineer has inspected work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated or directed.

.5 Hand place granular material in uniform layers not exceeding 150 mm thick to minimum 600 mm over top of pipe. Dumping of material directly on top of pipe is not permitted. Bury a plastic tracer tape marked "Natural Gas" 150 mm above the natural gas line.

.6 Place layers uniformly and simultaneously on each side of pipe to prevent lateral displacement of pipe.

.7 Compact each layer to at least 95% maximum density ASTM D698-78.

.8 Backfill of piping shall not be commenced until tests have been accepted by the Engineer.

.9 Heat shrink factory extruded polyethylene sleeves over bare metallic pipe at weld.

.10 Employ an independent testing agency to test the continuity of the polyethylene jacket, when metallic piping is installed in the pipe trench, using a 12,000 volt Holiday Detector. Repair any breaks in polyethylene jacket with two layers of polyken tape. Submit report from testing agency certifying continuity of polyethylene jacket.

.11 Do not paint dielectric isolating couplings used for cathodic protection.

3.2 VALVE INSTALLATION

.1 Install valves to manufacturer's recommendations at locations indicated.

3.3 TRACER WIRE INSTALLATION

.1 Provide tracer wire to all underground plastic natural gas piping.

.2 Mount on the top surface of the pipe and secure with plastic straps at two meter intervals.

.3 Bond to steel supply main at connection with plastic run.

.4 Bring tracer wire to grade in a Terminal City Iron Works no corrode service box adjacent to the shut-off valve as shown on UBC Standard Detail G-1. Wire shall be coiled loosely in box, not cut off.

.5 Wire shall be run up the transition riser and taped to the steel pipe.

.6 Check the continuity of the tracer wire and provide a confirmation report.

3.4 WARNING TAPE

.1 Provide warning tape to all underground plastic propane gas piping

.2 Underground warning tape is to be placed the full length of the pipe trench at a depth of 2 feet (600 mm) below the finished grade.

3.5 SAFETY PROCEDURE

.1 Whenever the Contractor metallically separates piping components for any reason, the corrosion protection system must be shut off at the breaker before separation and re-engerized after metallic continuity is restored. Failure to do this could lead to severe arcing.

3.6 METALLIC GAS PIPING CATHODIC PROTECTION

.1 D.W. Lemon and Associates shall be retained by the Contractor to inspect and confirm by actual measurement that the effectiveness of the cathodic protection system has not been compromised. Implement corrective measures as may be necessary and as ordered by D.W.Lemon and Associates. A report upon completion of the testing program shall be included in the Operating and Maintenance manuals.

.2 Cathodically protect all buried metallic gas piping downstream of gas meter as required and approved by the B.C. Safety Authority.

.3 An approved testing agency shall be retained within the contract and under this section of the work to confirm by actual measurement the effectiveness of the cathodic protection system installed. Submit a report to Owner upon completion of testing program.

.4 Acceptable Testing Agencies: B.H.Levelton & Associates, West Coast Corrosion Prevention Ltd., D.W.Lemon and Associates

.5 When buried piping exceeds 100 mm in size or exceeds 153 m in length, the B.C. Safety Authority shall be consulted regarding cathodic protection at the cathodic protection design stage.

3.7 BUILDING CONNECTIONS

.1 Building service shall terminate at building wall opposite point of connection to interior piping. If interior piping is already installed, make connection with dielectric coupling otherwise cap or seal end of pipes.

.2 Do not install building connections until satisfactory completion of tests.

3.8 TESTING

.1 Provide labour, equipment and materials required to perform tests hereinafter described.

.2 Notify Engineer at least 48 h in advance of all proposed tests. Perform tests in presence of Engineer, his representative or the authority having jurisdiction.

.3 Perform tests required and in accordance with the Canadian Standards Association, CSA B149.1, Natural Gas and Propane Installation Code.

.4 Examine piping for leaks and remake all leaking connections and joints.

END OF SECTION

AMEC Earth & Environmental
A division of AMEC Americas Limited
31899 Mercantile Way
Abbotsford, British Columbia
Canada, V2T 4C3
Tel +1 (604) 864-9971
Fax: +1 (604) 864-4276

Geotechnical Site Assessment
RCMP Detachment Building
Alder Avenue, 100 Mile House, BC

Submitted to:

Public Works & Government Services Canada
641 – 800 Burrard Street
Vancouver, BC V6Z 2V6

Submitted by:

AMEC Earth and Environmental
A Division of AMEC Americas Limited
Abbotsford, BC

21 December 2010

AMEC File: KA21008-100

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Appendix A – Testpit Logs

1.0 INTRODUCTION

AMEC Earth and Environmental (AMEC) presents herein our geotechnical site assessment report for the proposed new RCMP detachment centre in 100 Mile House, BC. The terms of reference for the project were described in AMEC's proposal KAP10282 dated 11 August 2010. AMEC received email authorization to proceed with the proposed scope of work on 17 August 2010. The site location is shown in Figure 1.

The purpose of this report is to provide appropriate geotechnical comments and recommendations regarding subsurface soil and groundwater conditions, site preparation, frost protection, surface water drainage, foundation design recommendations, seismic design considerations, structural fill, including potential reuse of existing site soils, and pavement structure for design, site preparation and construction of the proposed facility.

2.0 BACKGROUND INFORMATION AND SITE DESCRIPTION

The subject property is located east of Highway 97 and consists of an undeveloped rectangular two lot parcel of land approximately 76m long by 62m wide, bounded by Alder Avenue to the west, and an unnamed municipal lane to the east. To the north, the site is bounded by a car dealership, and to the south, by a parking area. The topography of the site slopes gently down to the northeast at an average gradient of about 6% such that there is about 2.5 to 3.5 metres of elevation difference across most of the property going from south to north. The slope steepens to about 17% in the northeast corner of the site, dropping another 2.5m in elevation over 15m to the northeast corner of the site. The ground surface at the site includes a vegetation cover of grass, small shrubs, and several clumps of trees.

We understand that the proposed development includes a single story building with no below grade spaces or basement. It is understood that the proposed building foundation system is slab on grade with conventional spread/strip footings. Fill placement and a retaining wall(s) are planned to create a level site. The location of the proposed building is shown in Figure 2.

3.0 FIELD WORK

A field reconnaissance and subsurface exploration program was completed by AMEC on September 14, 2010.

Subsurface soil conditions were exposed at selected locations within the site by advancing eleven test pits (TP10-01 through TP10-11) to depths ranging between 2.4m and 3.8m below the ground surface using a backhoe excavator owned and operated by Kingsgate Excavating of 100 Mile House. After observation and sampling of the soil materials exposed, the test pits were backfilled with site material which was loosely tamped using the backhoe bucket.

The field program was coordinated and monitored by a representative of AMEC who located the test pits, made detailed observations of the subsurface conditions encountered including groundwater seepage and other pertinent site features. Test pit locations were measured using a tape relative to a fire hydrant on the southwest part of the site shown on the site plan. Disturbed soil samples obtained from the test pits were retrieved for classification.

Representative disturbed soil samples were collected and transported to AMEC's Abbotsford soil laboratory to confirm field classifications and to determine moisture content.

4.0 SITE CONDITIONS

4.1 Subsurface Conditions

The subsurface conditions encountered in the testpits are described in detail on the testpit logs presented in Appendix A, and are summarized in the following paragraph.

Surficial top soil comprising organic silt with some sand, roots and woody debris was encountered in each testpit except TP10-09 where fill was encountered to a depth of 1.2m. Generally test pits were excavated to refusal at depths ranging from 2.4m to 3.8m. The dominant soil type present was compact to dense silty. Weathered volcanic rock (fine-grained mafic basalt) was encountered beneath the till in all test pits. Backhoe refusal occurred in the upper part of the bedrock. Volcanic boulders interlain with silt were encountered in TP10-01 from 1.9m to refusal at a depth of 2.8m.

Materials encountered in the test pits were as follows:

4.1.1 Top Soil

A 0.3m to 0.6m thick layer of topsoil was encountered in all test pits except TP10-09 where fill was encountered. The topsoil layer was underlain by native silt till.

4.1.2 Fill

Fill, comprised of silt with sand and logs, was encountered in TP10-09. The fill was about 1.2m thick and was underlain by compact to dense silt till.

4.1.3 Silt Till

Glacial till, comprised of compact to dense silt with trace sand was encountered in each test pit up to the termination depth. Moisture content ranged from 10 to 34%. This till deposit was underlain by bedrock at the depths noted in the borehole logs.

4.1.4 Bedrock

Bedrock was encountered in all test pits beneath the silt till. As well, angular bedrock fragments were common in the lower part of the silt.

4.2 Groundwater Conditions

No ground water seepage was observed during test pit excavation on September 14, 2010. Moisture content in excess of 30%, which could be indicative of periodic/intermittent groundwater seepage, was measured in samples retrieved from a depth of 1m in TP10-01, 0.6m in TP10-02 and 2.6m in TP10-08.

5.0 DISCUSSION AND RECOMMENDATIONS

Results from the site investigation indicate the presence of a blanket of compact to dense silt till, deposit, beneath the entire site. We consider this material to be suitable for foundation support of the proposed building on spread footings.

A major geotechnical design item is related to site topography. The site slopes down from southwest to northeast such that there is an approximate 3.5m elevation difference on the proposed building site and another 2m drop on elevation at the northeast corner of the site. We understand that the present plan involves fill placement such that the design floor level will be close to existing grade at the southwest part of the site. A retaining wall or walls in the order of 5m high will be constructed on the northeastern part of the site.

The client may consider a lower building floor elevation with a cut and fill to be attractive economically. In this case, we have included recommendations for the re-use of native silty till materials as fill material in a balanced cut and fill configuration across the site. The placement of cohesive structural fills requires contractors experienced in such work with experienced personnel and appropriate equipment. The till materials may require moisture conditioning to optimize the level of compactive effort required, and it should be noted that such materials can be problematic if too much moisture is added during placement.

5.1 Site Preparation and Structural Fill

Site preparation should consist of removal of existing topsoil and fill, exposing undisturbed native silt. The subexcavation should be completed below the entire footprint of the building footprint and parking area to reduce the risk of unacceptable settlement. Based on the observations made in the test pit exposures, depth of subexcavation required is anticipated to vary from 0.5m to 1.2m. The subexcavation depths should be confirmed by the geotechnical engineer during the site preparation works. The exposed subgrade should be reviewed in the field by the geotechnical engineer prior to placement of engineered fill, foundations, driveways, sidewalks and roadway pavement structures.

The dense native silt tills may be susceptible to disturbance after excavation, so areas of disturbance caused by frost action or construction activity should be removed prior to placing footing concrete. It may be advantageous to place a 150 mm thick layer of granular structural fill or cover of lean mix concrete immediately after exposing the foundation layer to create a clean, dry working surface for subsequent footing construction and formwork placement.

Structural fill is defined as fill material used to develop site grades beneath foundations, floor slabs, pavements, sidewalks, and other hard surfaced areas. The structural fill and granular materials for pavement structures for roadways should consist of clean granular fill containing less than 5% silt and clay sizes.

Structural fill should be placed in loose lifts not exceeding 200 mm in thickness and compacted to a minimum 100% of the Standard Proctor Maximum Dry Density (SPMDD). Compaction of the structural fill should be confirmed by field density testing during construction.

Surface water and groundwater if encountered during excavation should not be allowed to collect on the subgrade. It is anticipated that any accumulated water in excavations can be controlled with conventional filtered sump and pump systems. Sediment laden water should not be discharged into the municipal storm drainage system.

5.1.1 Re-use of native silt as structural fill

Because of the sloping nature of the site, it may be attractive to lower the building and finished site grade such that there is a balanced cut and fill with an approximate 1.75m deep cut at the high side and fill of similar magnitude on the low side. In this case a cut and fill operation could be carried out. Such a cut may encounter intermittent bedrock above the desired floor elevation and rock removal by mechanical excavation or blasting may be required.

It is possible to re-use the native silty tills as structural fill as follows:

- The excavation/earthworks contractor should be experienced in the placement of cohesive fills and have experienced personnel and appropriate equipment on the site to carry out the work.
- The entire site should be stripped of existing fill and topsoil so that dense native soil is exposed over the entire area. Excavation and fill placement should be done as a single operation so that excavated material is not stockpiled on the site and subject to the extremes of weather over time and freeze or become too wet or too dry.
- The fill should be placed in lifts no thicker than 150mm and compacted with large compaction equipment such as a vibratory drum roller so that a unified fill without lumps or voids is achieved.
- Fill should be compacted to at least 100% of Standard Proctor Maximum Dry Density.
- Fill materials should be approved for use by the geotechnical engineer prior to placement.

We expect that post construction compression in the cohesive fill described above could be as much as 1% of the fill height, in this case less than 18mm. Such settlement for the most part will be beneath the floor slab considering the recommended foundation cover due to frost protection as per the following section 5.2.

5.2 Frost Protection

For the purpose of frost protection, the underside of footings should be at least 1.5m and 1.8m below finished grade for interior and exterior footings respectively.

5.3 Excavation and Dewatering

Temporary excavations deeper than 1.2m requiring worker entry should be sloped/shored in accordance with Workers Compensation Board regulations, or as directed by a qualified professional engineer. Flatter cut slope inclinations may be required if heavy groundwater seepage is encountered or if the temporary excavations will be open during periods of high precipitation.

It is anticipated that excavation may not be required below the groundwater table. The contractor should select dewatering methods based on site conditions and construction techniques to control surface water runoff.

With regard to permanent dewatering, a conventional perimeter weeping tile drain system should be installed at the footing level. The drain system should consist of a perforated pipe surrounded by drain rock, all completely encapsulated in an approved non-woven geotextile fabric. The drain system should discharge via a tight line to the municipal storm water sewer system.

Exterior grades surrounding the building should be sloped at a minimum of 1.5 percent grade to facilitate surface water flow away from the building and preferably have a relatively impermeable surface cover immediately adjacent to the building.

5.4 Foundations

The proposed building foundation could be supported on conventional concrete spread footings, which should be founded directly on the undisturbed native silt tills, or cleaned bedrock surface or structural fill placed on top of such. It is recommended that the footing design be based on a bearing capacity at serviceability limit state of 150 kPa and factored geotechnical resistance at ultimate limit state of 225 kPa. The above bearing capacity parameters are expected to limit post-construction settlement to less than 25mm. The minimum footing widths of 450 and 600mm are recommended for strip and pad footings respectively.

As stipulated by the National Building Code of Canada (NBCC) and required by the bylaws of the Association of Professional Engineers and Geoscientists of BC, the geotechnical engineer must review bearing surfaces prior to the placement of foundations or structural fill that will support foundations to confirm the bearing surface is properly prepared and is suitable for support of the structure. It is expected that the

District of 100 Mile House will require BC Building Code Schedules B-1, B-2 and C-B (Geotechnical) for this project.

5.5 Seismic Considerations

The NBCC requires the structures be designed to resist collapse when subjected to "strong shaking", defined as ground motions with a return period of 1 in 2,475 years (or two percent probability of exceedance in 50 years). A secondary objective of the code is to limit damage to buildings caused by low to moderate shaking. NBCC has adopted use of foundation factors dependent on analysis of ground motion histories adjusted for local site conditions, characterized based on the average shear wave velocity and relative density of the earth materials in the uppermost 30m.

Seismic shear wave velocity measurements were not undertaken as part of this assessment. Given that the site is underlain by a relatively thin cover of compact to dense soils with basalt bedrock present at relatively shallow depth below surface, AMEC considers that the foundation conditions underlying the site can be characterizes as Seismic Site Class C (average shear wave velocity = 360 to 760 m/s) in accordance with Table 4.1.8.4A of the NBCC.

The geotechnical characterization of seismic site response is based on published ground motions and assumed subsurface stratigraphy and do not take into account potential focussing effects of topography. If it is found that seismic forces govern the design and small changes in the values used significantly alter the design requirements, site specific analysis may be warranted.

5.6 Foundation and Retaining Walls

The lateral earth pressure recommendations are based on the following assumptions:

1. Coulomb's at rest earth pressure theory;
2. Retained soil consists of granular soil; and
3. The retained soil is drained (no hydrostatic pressure build-up behind wall).

Retaining walls or buried foundation walls should be designed to resist an equivalent unit weight of 8.5 kN/m^3 (kPa per metre depth). The provided equivalent unit weight assumes that hydrostatic pressures do not develop and a near horizontal back-slope is used. A rectangular pressure distribution equal to 0.35q kPa (where q is the vertical surcharge pressure) may be used to estimate the horizontal pressure from construction live loads on retaining walls. AMEC recommends modelling the construction load as a vertical surcharge of 13 kPa for the design of retaining walls.

The additional seismic component of earth pressure may be assumed to behave as an inverted hydrostatic pressure distribution equal to 2.5H kPa, where H is the exposed height of the retaining wall. The resultant of the seismic force should be applied at 0.6H above the base of the retaining wall.

A coefficient of friction of 0.4 may be used to estimate the sliding resistance along the soil-footing interface.

Backfill for retaining walls should consist of granular structural fill to provide adequate drainage. A footing drain is also recommended for site retaining walls. The retaining/buried foundation wall backfill should be compacted to at least 95% of Standard Proctor Maximum Dry Density. Depending on the facing material/wall design configuration selected it may be appropriate to use smaller size/hand directed equipment for compaction within 1.2m of walls in order to minimize the potential for damage to the wall during compaction. Special provisions may be required for buried utilities crossing beneath retaining walls.

The height and location/extent of retaining walls and the type of wall has yet to be determined. Accordingly, AMEC should review preliminary retaining wall design. We can provide further geotechnical design input for reinforced earth retaining walls or other retaining wall types if desired.

5.7 Pavement Structure

The following applies to possible new paved areas associated with the new building. AMEC recommends the following minimum pavement section for automobile and light truck traffic normally associated with light to medium industrial/commercial developments:

- Minimum 65 mm asphalt surface course; overlying
- Minimum 100 mm of 20 mm minus crushed gravel base course; overlying
- Minimum 300 mm of 75 mm minus gravel subbase course.

Subgrade of paved areas should be proof rolled with a loaded ten cubic yard dump truck with highway tires or similar heavy, rubber-tired construction equipment prior to placement of any fill, subbase or base material to identify any soft areas. Soft areas identified by proof rolling should be excavated and replaced with structural fill. The depth of overexcavation will depend on the future use/loading of the subject area.

The granular subbase and base layers should be compacted to at least 100% of their Standard Proctor maximum dry densities. Imported granular base and subbase fills should meet the gradation requirements stated in Section 02226 of the Master Municipal Contract Document (MMCD) or as otherwise approved by the geotechnical engineer.

It is recommended that the geotechnical engineer review and approve all sources of candidate granular subgrade, subbase and base fill materials prior to their placement at the site. This should include the sieve analysis and Proctor testing of representative samples of the candidate fill materials.

The finished subgrade of the parking area should be sloped away from the building to provide at least 1.5 percent cross fall to assist in draining the subgrade. Paved areas should be sloped away from the building.

6.0 LIMITATIONS AND CLOSURE

The recommendations presented herein are based on a geotechnical evaluation of the findings of the site exploration and other information deemed relevant to the assessment. The material in this report reflects AMEC's best judgement in light of the information available to AMEC at the time of preparation of the report. If conditions other than those are noted during subsequent phases of the project, AMEC Earth and Environmental should be notified and given the opportunity to review and revise the current recommendations, if necessary. Recommendations presented herein may not be valid if an adequate level of field review is not provided during construction or if relevant code requirements are not met.

This report has been prepared for the exclusive use of Public Works & Government Services Canada for the specific application to the development described within this report. Any use which a third party makes of this report, or any reliance on or decisions made based on it are the responsibility of such third parties. AMEC accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report. It has been prepared in accordance with general accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

AMEC trusts this meets your immediate requirements. If you have any questions or require further information, please contact us.

Respectfully submitted,

AMEC E&E Earth and Environmental
A Division of AMEC E&E Americas

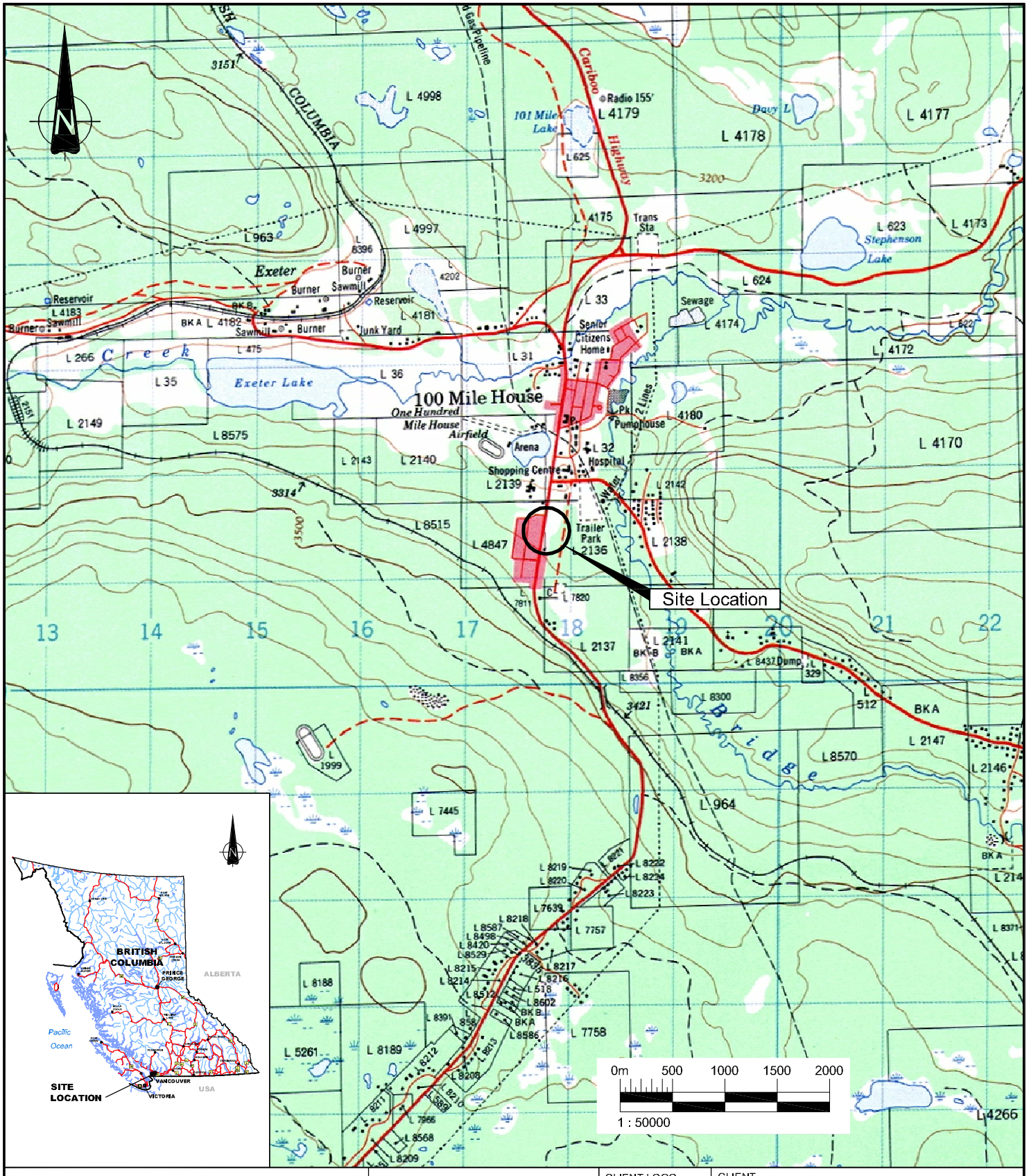
Syed Abbas, M.Eng, P. Eng.
Geotechnical Engineer

Bob Forsyth, MBA, P. Eng.
Senior Geotechnical Engineer
Office Manager

Reviewed By:

Greg Reid, P. Eng, P. Geo, PEC
Associate Geological Engineer
Kamloops, British Columbia

FIGURES



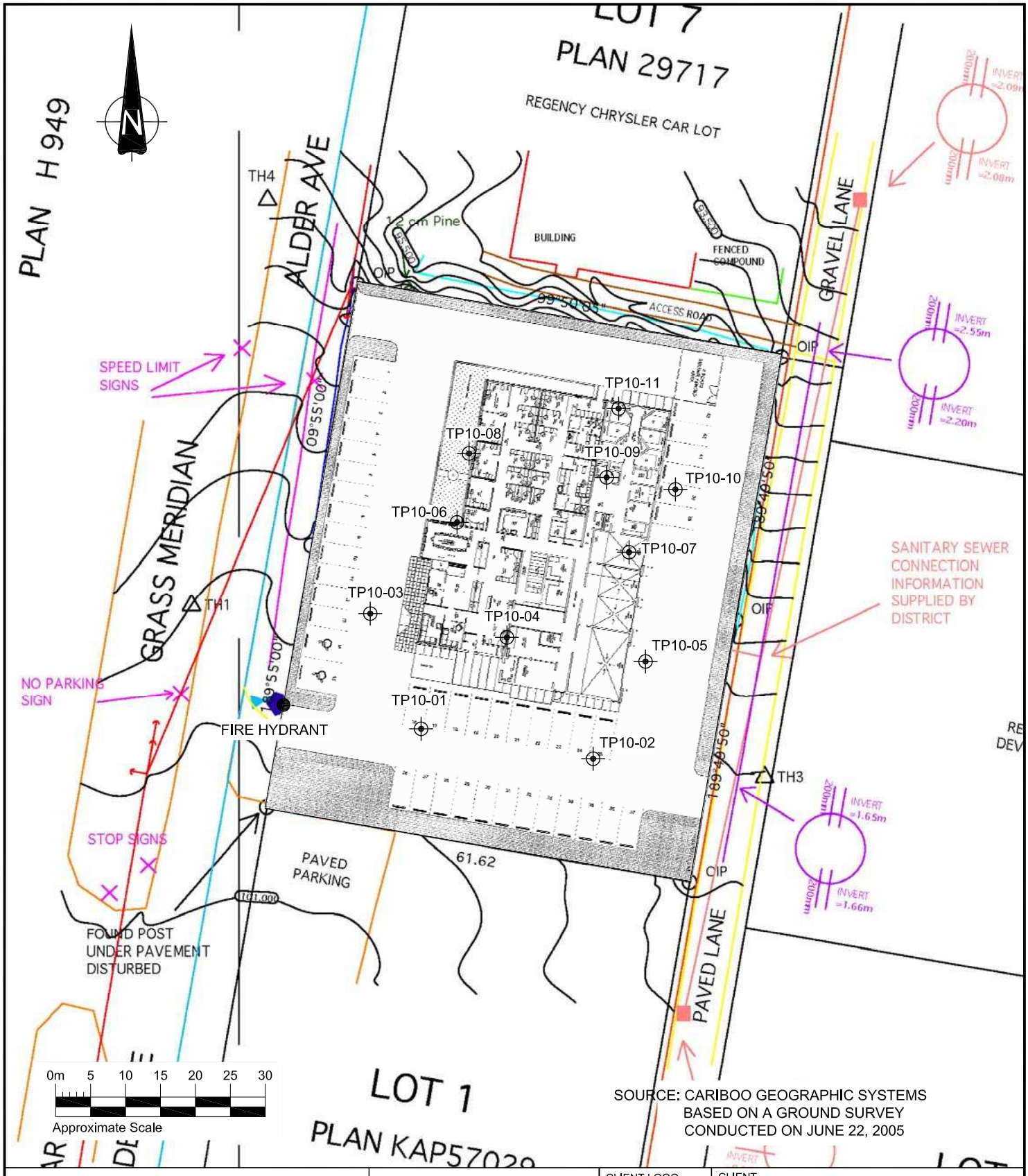
AMEC Earth & Environmental
31899 Merchantile Way, Abbotsford, B.C., V2T 4C3
Tel. 604-864-9971

CLIENT LOGO

CLIENT: PUBLIC WORKS CANADA

PROJECT: RCMP DETACHMENT 100 MILE HOUSE, B.C.	DWN BY: MW	DATUM: -	DATE: SEPTEMBER 2010
	CHK'D BY: SA	REV. NO.: A	PROJECT NO: KA21008
TITLE: LOCATION PLAN	PROJECTION: -	SCALE: AS SHOWN	FIGURE No. 1

G:\PROJECTS\Other Offices\KA-Abbotsford\KA21008 - 100 Mile House\Drafting\CAD\KA21008-001_Location.dwg - Fig 1 - Sep. 16, 2010 12:06pm - michael.m.wong



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Tel. 604-864-9971

CLIENT LOGO

CLIENT: PUBLIC WORKS CANADA

PROJECT	DWN BY:	DATUM:	DATE:
RCMP DETACHMENT 100 MILE HOUSE, B.C.	MW	-	SEPTEMBER 2010
	CHK'D BY: SA	REV. NO.: A	PROJECT NO: KA21008
TITLE: SITE PLAN	PROJECTION: -	SCALE: AS SHOWN	FIGURE No. 2

G:\PROJECTS\Other Offices\KA-Abbotsford\KA21008 - 100 Mile House\Drafting\CAD\KA21008-002_Site.dwg - Fig 2 - Sep. 27, 2010 4:17pm - michael.m.wong

APPENDIX A
Testpit Logs

TESTPIT LOG TP10-01

STARTED: 9/14/2010 **FINISHED:** 9/14/2010

DRILLING METHOD: Backhoe

SITE: Alder Avenue, 100 Mile House, BC

DEPTH (m)	SPT BLOWS PER 150 mm	% Fines < No. 200	SAMPLE TYPE AND NUMBER	SYMBOL	DEPTH	DESCRIPTION OF MATERIALS	WELL INSTALLTION DETAILS
					0.0	TOP SOIL- Organic silt, roots, trace gravel, brown, moist.	
					0.4		
					-0.4	SILT- (ML) medium stiff to hard, non to low plastic, brown, moist. (Glacial Till) Roots up to 1.2 m below ground surface.	
1			S1				
					1.9		
2			S2		-1.9	SILT- Silt mixed with volcanic rock, dense, grayish rock pieces 80 mm to 200 mm, moist.	
					2.8		
3					-2.8	-Refusal to excavation at 2.8 m below ground surface on bedrock. -No ground water seepage was noticed in open hole.	
4							
5							

Su (kPa)

10 30 50 70 90

FIELD VANE P PEN/2 ⊙
PEAK ▲
REMOULDED △

□ SPT N ◆ DCPT N
Blows/0.3 m

W_P% W% W_L%

10 30 50 70 90

34

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PROJECT NO.: KA21008-100

PROJECT: RCMP Detachment Centre

LOCATION: Cariboo Hwy, 100 Mile House, BC

LOGGED BY: SA **REVIEWED BY:** BF

SHEET 1 OF 1 **BOREHOLE No. TP10-01**

TESTPIT LOG TP10-02

STARTED: 9/14/2010 **FINISHED:** 9/14/2010

DRILLING METHOD: Backhoe

SITE: Alder Avenue, 100 Mile House, BC

DEPTH (m)	SPT BLOWS PER 150 mm	% Fines < No. 200	SAMPLE TYPE AND NUMBER	SYMBOL	DEPTH	DESCRIPTION OF MATERIALS	WELL INSTALLTION DETAILS
					0.0	TOP SOIL- Organic silt, roots, trace gravel, brown, moist.	
			S1		-0.6	SILT- (ML) medium stiff to hard, non to low plastic, brown, moist. (Glacial Till) -roots up to 0.9 m below ground surface. -light brown from 1.1 m. -from 2.2 m to 3.8 m few pieces of volcanic rock.	
					3.8	-Refusal to excavation at 3.8 m below ground surface on bedrock. -No ground water seepage was noticed in open hole.	

Su (kPa)
10 30 50 70 90
FIELD VANE P PEN/2 ⊙
PEAK ▲
REMOULDED △
□ SPT N ◆ DCPT N
Blows/0.3 m
W_P% W% W_L%
10 30 50 70 90
31

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PROJECT: RCMP Detachment Centre
LOCATION: Cariboo Hwy, 100 Mile House, BC
LOGGED BY: SA **REVIEWED BY:** BF
SHEET 1 OF 1 **BOREHOLE No. TP10-02**

N-GEO-CONVERT TEST PIT LOGS .GPJ ALL-1.GDT 20/10/10

TESTPIT LOG TP10-03

STARTED: 9/14/2010 **FINISHED:** 9/14/2010

DRILLING METHOD: Backhoe

SITE: Alder Avenue, 100 Mile House, BC

DEPTH (m)	SPT BLOWS PER 150 mm	% Fines < No. 200	SAMPLE TYPE AND NUMBER	SYMBOL	DEPTH	DESCRIPTION OF MATERIALS	WELL INSTALLTION DETAILS
					0.8	TOP SOIL- Organic silt, roots, trace gravel, brown, moist.	
1			S1		-0.8	SILT- (ML) medium stiff to hard, non to low plastic, brown, moist. (Glacial Til) Roots up to 1.5 m below ground surface. -below 1.5 m light brown. -from 2.6 m to 3.0 m few pieces of volcanic rock.	
2			S2		3.0		
3					-3.0	-Refusal to excavation at 3.0 m below ground surface on bedrock. -No ground water seepage was noticed in open hole.	
4							
5							

Su (kPa)
10 30 50 70 90

FIELD VANE P PEN/2 ⊙
PEAK ▲
REMOULDED △

□ SPT N ◆ DCPT N
Blows/0.3 m

W_P% W% W_L%
10 30 50 70 90

16
21

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PROJECT NO.: KA21008-100
PROJECT: RCMP Detachment Centre
LOCATION: Cariboo Hwy, 100 Mile House, BC
LOGGED BY: SA **REVIEWED BY:** BF
SHEET 1 OF 1 **BOREHOLE No. TP10-03**

TESTPIT LOG TP10-04

STARTED: 9/14/2010 **FINISHED:** 9/14/2010

DRILLING METHOD: Backhoe

SITE: Alder Avenue, 100 Mile House, BC

DEPTH (m)	SPT BLOWS PER 150 mm	% Fines < No. 200	SAMPLE TYPE AND NUMBER	SYMBOL	DEPTH	DESCRIPTION OF MATERIALS	WELL INSTALLTION DETAILS
					0.0	TOP SOIL- Organic silt, roots, trace gravel, brown, moist.	
					0.5		
			S1		-0.5	SILT- (ML) stiff, non plastic, brown, moist. (Glacial Till) -from 0.8 m very stiff to hard, light brown.	
1							
			S2				
2							
					2.7		
					-2.7	-Refusal to excavation at 2.7 m below ground surface on bedrock. -No ground water seepage was noticed in open hole.	
3							
4							
5							

Su (kPa)
10 30 50 70 90
FIELD VANE P PEN/2 ⊙
PEAK ▲
REMOULDED △
□ SPT N ◆ DCPT N
Blows/0.3 m
W_P% W% W_L%
10 30 50 70 90
21
14

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PROJECT: RCMP Detachment Centre
LOCATION: Cariboo Hwy, 100 Mile House, BC
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SHEET 1 OF 1 **BOREHOLE No. TP10-04**

N-GEO-CONVERT TEST PIT LOGS .GPJ ALL-1.GDT 20/10/10

TESTPIT LOG TP10-05

STARTED: 9/14/2010 **FINISHED:** 9/14/2010

DRILLING METHOD: Backhoe

SITE: Alder Avenue, 100 Mile House, BC

DEPTH (m)	SPT BLOWS PER 150 mm	% Fines < No. 200	SAMPLE TYPE AND NUMBER	SYMBOL	DEPTH	DESCRIPTION OF MATERIALS	WELL INSTALLTION DETAILS
					0.0	TOP SOIL- Organic silt, roots, trace gravel, brown, moist.	
			S1		0.5		
					-0.5	SILT- (ML) medium stiff to hard non to low plastic, brown, moist. (Glacial Till) -roots up to 0.8 m below ground surface. -light brown from 0.8 m, very stiff.	
1			S2				
2							
3					3.3		
					-3.3	-Refusal to excavation at 3.3 m below ground surface on bedrock. -No ground water seepage was noticed in open hole.	
4							
5							

Su (kPa)

10 30 50 70 90

FIELD VANE P PEN/2 ⊙
PEAK ▲
REMOULDED △

□ SPT N ◆ DCPT N
Blows/0.3 m

W_P% W% W_L%

10 30 50 70 90

13

23

N-GEO-CONVERT TEST PIT LOGS .GPJ ALL-1.GDT 20/10/10

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PROJECT NO.: KA21008-100

PROJECT: RCMP Detachment Centre

LOCATION: Cariboo Hwy, 100 Mile House, BC

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SHEET 1 OF 1 **BOREHOLE No. TP10-05**

TESTPIT LOG TP10-06

STARTED: 9/14/2010 **FINISHED:** 9/14/2010

DRILLING METHOD: Backhoe

SITE: Alder Avenue, 100 Mile House, BC

DEPTH (m)	SPT BLOWS PER 150 mm	% Fines < No. 200	SAMPLE TYPE AND NUMBER	SYMBOL	DEPTH	DESCRIPTION OF MATERIALS	WELL INSTALLTION DETAILS
					0.0	TOP SOIL- Organic silt, roots, trace gravel, brown, moist.	
					0.4		
					-0.4	SILT- (ML) stiff to hard, non to low plastic, brown, moist. (Glacial Till) - light brown below 1.1 m . -few pieces of rock below 1.9 m.	
1			S1				
2					2.4		
					-2.4	-Refusal to excavation at 2.4 m below ground surface on bedrock. -No ground water seepage was noticed in open hole.	
3							
4							
5							

Su (kPa)
10 30 50 70 90

FIELD VANE P PEN/2 ⊙
PEAK ▲
REMOULDED △

□ SPT N ◆ DCPT N
Blows/0.3 m

W_P% W% W_L%
10 30 50 70 90

14

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PROJECT NO.: KA21008-100
PROJECT: RCMP Detachment Centre
LOCATION: Cariboo Hwy, 100 Mile House, BC
LOGGED BY: SA **REVIEWED BY:** BF
SHEET 1 OF 1 **BOREHOLE No. TP10-06**

TESTPIT LOG TP10-07

STARTED: 9/14/2010 **FINISHED:** 9/14/2010

DRILLING METHOD: Backhoe

SITE: Alder Avenue, 100 Mile House, BC

DEPTH (m)	SPT BLOWS PER 150 mm	% Fines < No. 200	SAMPLE TYPE AND NUMBER	SYMBOL	DEPTH	DESCRIPTION OF MATERIALS	WELL INSTALLTION DETAILS
					0.5	TOP SOIL- Organic silt, roots, trace gravel, brown, moist.	
			S1		-0.5	SILT- (ML) stiff, non plastic, brown, moist. (Glacial Till) -from 0.8 m very stiff to hard, light brown.	
1			S2		2.7		
2					-2.7	-Refusal to excavation at 2.7 m below ground surface on bedrock. -No ground water seepage was noticed in open hole.	
3							
4							
5							

Su (kPa)
10 30 50 70 90
FIELD VANE P PEN/2 ⊙
PEAK ▲
REMOULDED △
□ SPT N ◆ DCPT N
Blows/0.3 m
W_P% W% W_L%
10 30 50 70 90

10
12

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PROJECT NO.: KA21008-100
PROJECT: RCMP Detachment Centre
LOCATION: Cariboo Hwy, 100 Mile House, BC
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SHEET 1 OF 1 **BOREHOLE No. TP10-07**

N-GEO-CONVERT TEST PIT LOGS .GPJ ALL-1.GDT 20/10/10

TESTPIT LOG TP10-08

STARTED: 9/14/2010 **FINISHED:** 9/14/2010

DRILLING METHOD: Backhoe

SITE: Alder Avenue, 100 Mile House, BC

DEPTH (m)	SPT BLOWS PER 150 mm	% Fines < No. 200	SAMPLE TYPE AND NUMBER	SYMBOL	DEPTH	DESCRIPTION OF MATERIALS	WELL INSTALLTION DETAILS
					0.4	TOP SOIL- Organic silt, roots, trace gravel, brown, moist.	
					-0.4	SILT- (ML) stiff, non plastic, brown, moist. (Glacial Till) -from 1.0 m very stiff to hard, light brown.	
1			S1				
			S2		2.6		
					-2.6	-Refusal to excavation at 2.6 m below ground surface on bedrock. -No ground water seepage was noticed in open hole.	
2							
3							
4							
5							

Su (kPa)

10 30 50 70 90

FIELD VANE P PEN/2 ⊙
PEAK ▲
REMOULDED △

□ SPT N ◆ DCPT N
Blows/0.3 m

W_P% W% W_L%

10 30 50 70 90

17

32

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PROJECT NO.: KA21008-100

PROJECT: RCMP Detachment Centre

LOCATION: Cariboo Hwy, 100 Mile House, BC

LOGGED BY: SA **REVIEWED BY:** BF

SHEET 1 OF 1 **BOREHOLE No. TP10-08**

N-GEO-CONVERT TEST PIT LOGS .GPJ ALL-1.GDT 20/10/10

TESTPIT LOG TP10-09

STARTED: 9/14/2010 **FINISHED:** 9/14/2010

DRILLING METHOD: Backhoe

SITE: Alder Avenue, 100 Mile House, BC

DEPTH (m)	SPT BLOWS PER 150 mm	% Fines < No. 200	SAMPLE TYPE AND NUMBER	SYMBOL	DEPTH	DESCRIPTION OF MATERIALS	WELL INSTALLTION DETAILS
						FILL- organic silt, pieces of rock, wood logs, loose, brown, moist.	
					1.2		
			S1		-1.2	SILT- (ML) very stiff to hard, non plastic, light brown, moist. (Glacial Till)	
					2.5		
					-2.5	-Refusal to excavation at 2.5 m below ground surface on bedrock. -No ground water seepage was noticed in open hole.	

Su (kPa)

10 30 50 70 90

FIELD VANE P PEN/2 ⊙
PEAK ▲
REMOULDED △

□ SPT N ◆ DCPT N
Blows/0.3 m

W_P% W% W_L%

10 30 50 70 90

10

1 2 3 4 5

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PROJECT NO.: KA21008-100

PROJECT: RCMP Detachment Centre

LOCATION: Cariboo Hwy, 100 Mile House, BC

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SHEET 1 OF 1 **BOREHOLE No. TP10-09**

N-GEO-CONVERT TEST PIT LOGS .GPJ ALL-1.GDT 20/10/10

TESTPIT LOG TP10-10

STARTED: 9/14/2010 **FINISHED:** 9/14/2010

DRILLING METHOD: Backhoe

SITE: Alder Avenue, 100 Mile House, BC

DEPTH (m)	SPT BLOWS PER 150 mm	% Fines < No. 200	SAMPLE TYPE AND NUMBER	SYMBOL	DEPTH	DESCRIPTION OF MATERIALS	WELL INSTALLTION DETAILS
					0.0	TOP SOIL- Organic silt, roots, trace gravel, brown, moist.	
			S1		-0.5	SILT- (ML) stiff to hard non to low plastic, brown, moist. (Glacial Till) -roots up to 0.7 m below ground surface. -light brown from 1.0 m, very stiff.	
			S2		2.5		
					-2.5	-Refusal to excavation at 2.5 m below ground surface on bedrock. -No ground water seepage was noticed in open hole.	

Su (kPa)
10 30 50 70 90

FIELD VANE P PEN/2 ⊙
PEAK ▲
REMOULDED △

□ SPT N ◆ DCPT N
Blows/0.3 m

W_P% W% W_L%
10 30 50 70 90

12

21

AMEC
Earth & Environmental
31899 Mercantile Way
Abbotsford, BC V2T 4C3

PROJECT NO.: KA21008-100

PROJECT: RCMP Detachment Centre

LOCATION: Cariboo Hwy, 100 Mile House, BC

LOGGED BY: SA **REVIEWED BY:** BF

SHEET 1 OF 1 **BOREHOLE No. TP10-10**

TESTPIT LOG TP10-11

STARTED: 9/14/2010 **FINISHED:** 9/14/2010

DRILLING METHOD: Backhoe

SITE: Alder Avenue, 100 Mile House, BC

DEPTH (m)	SPT BLOWS PER 150 mm	% Fines < No. 200	SAMPLE TYPE AND NUMBER	SYMBOL	DEPTH	DESCRIPTION OF MATERIALS	WELL INSTALLTION DETAILS
						TOP SOIL- Organic silt, roots, trace gravel, brown, moist.	
					0.3		
					-0.3	SILT- (ML) stiff to hard, non to low plastic, light brown, moist. (Glacial Till)	
					2.4		
					-2.4	-Stopped at 2.2 m below ground surface. -No ground water seepage was noticed in open hole.	

Su (kPa)
10 30 50 70 90
FIELD VANE P PEN/2 ⊙
PEAK ▲
REMOULDED △
□ SPT N ◆ DCPT N
Blows/0.3 m
W_P% W% W_L%
10 30 50 70 90

AMEC
Earth & Environmental
31899 Mercantile Way
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PROJECT NO.: KA21008-100
PROJECT: RCMP Detachment Centre
LOCATION: Cariboo Hwy, 100 Mile House, BC
LOGGED BY: SA **REVIEWED BY:** BF
SHEET 1 OF 1 **BOREHOLE No. TP10-11**

N-GEO-CONVERT TEST PIT LOGS .GPJ ALL-1.GDT 20/10/10

These requirements based upon documentation received from the Departmental Representative. Refer to Electrical drawings for additional details.

A - Room 203

1 - Floor space reserved for a 1220 x 915 x 2440 mm metal equipment cabinet supplied by Departmental Representative. Minimum 610 mm clearance around all sides of cabinet.

2 - Dedicated 20 ampere AC electrical service terminated near cabinet space.

2.1 - Distinctive outlet face (yellow or orange).

2.2 - Terminate incoming conduits on plywood backboard adjacent cabinet:
02 - 27mm Conduits
01 - 53 mm Conduit
01 - 104 mm Conduit
02 - 100mm Conduit

3 - 27 mm EMT to Room 204 terminated with 119 mm square outlet boxes c/w stainless steel cover plates, mounting height to match receptacles.

4 - 27 mm EMT to Room 202 terminated with 119 mm square outlet boxes c/w stainless steel cover plates, mounting height to match receptacles.

5 - 2-104 mm EMT to the tower junction box indicated on site plans.

5.1 - For future radio tower

5.2 - Termination should take place above ground inside a 915 x 915 x 915 mm (or similar weatherproof junction box accessible from the surface). Box to be located at the north end of the reserved space. This box will be referenced as the “Tower Junction Box”.

6 - Additional conduit runs for this room are specified in section B and C.

7 - Electrical grounding bus bar.

B - Roof Mounted Antenna Masts

1 - Base Radio: antenna mast for base radio service in the Detachment. The following will be required:

1.1 - A hot galvanized 3.5 x 0.25 RHSS pipe-mast must extend 1.5 meter above the highest point of the roof and have as much horizontal separation from the other radio mast as possible.

1.1.1 - Mast should physically be located such as to keep the conduit as short as possible to its destination in Room 130 at the Local Junction box.

1.2 - The pipe-mast is to be grounded using #2/0 insulated conductor to a 19 mm x 3.0 m ground rod.

1.3 - 53 mm EMT to be run from the pipe-mast to junction box in the ceiling of Room 130.

1.3.1 - Junction box should be sized at 300 x 300 x 150 mm (or similar).

1.3.2 - This Junction box will be referenced as the “Local Junction Box”

1.3.3 - Local Junction box should be sized for receipt of 6 - 53 mm conduits.

1.4 - Mast to support antenna as defined below.

2 - Detachment Class Repeater: antenna mast for a Detachment Class Repeater. The following will be required:

2.1 - A hot galvanized 3.5 x 0.25 RHSS pipe-mast. It must extend 1.5 meter above the highest point of the roof and have as much horizontal separation from the other radio mast as possible.

2.2 - The pipe-mast is to be grounded using #2/0 insulated conductor to a 19 mm x 3.0 m ground rod.

2.3 - 104 mm EMT is to be run from the pipe-mast to Room 203 termination at the plywood backboard.

2.4 - Mast to support antenna as defined below.

3 - Antenna Specifications
Sinclair SRL-210C-2
- Height: 3.0 m
- Weight: 16 lbs
- Rated wind velocity: 201 km/h
- Rated wind velocity with 1/2" radial ice: 137 km/h
- Lateral Thrust at 100 mph: 100 lbs

C - Inter-detachment Locals

1 - 53 mm EMT to be run from the Local Junction Box to one of the workstation desks in Room 130.

1.1 - Terminate with a 150 x 150 x 100 mm pull box in wall.

1.2 - Provide a stainless steel cover plate.

1.3 - Mounting height should match receptacles.

2 - 53 mm EMT to be run from the Local Junction Box to Room 104.

2.1 - Terminate with a 150 x 150 x 100 mm pull box in north wall just after the east entryway.

2.2 - Provide a stainless steel cover plate.

2.3 - Mounting height to match light switches.

3 - 53 mm EMT to be run from the Local Junction Box to the ceiling of Room 117.

3.1 - Terminate with a 150 x 150 x 100 mm junction box in the ceiling (central to the room). This will be referenced as the “GD Junction Box”

4 - 53 mm EMT to be run from the Local Junction Box to Room 203.

4.1 - Terminate on plywood backboard.

4.2 - Mounting height should match receptacles.

5 - 53 mm EMT to be run from the GD Junction box in Room # 117 to the station in Room 146.

5.1 - Terminate with a 150 x 150 x 100 mm pull box in wall as close to the station as possible

5.2 - Provide a stainless steel cover plate.

5.3 - Mounting height should match receptacles.

6 - 27 mm EMT to be run from the Local Junction Box to Room 129.

6.1 - Terminate with a 100 x 100 x 89 mm pull box on east central wall.

6.2 - Provide a stainless steel cover plate.

6.3 - Mounting height should match light switches

7 - 27 mm EMT to be run from the Local Junction Box to the Room 142.

7.1 - Terminate with a 100 x 100 x 89 mm pull box on west central wall.

7.2 - Provide a stainless steel cover plate.

7.3 - Mounting height should match light switches

D - Communications Tower (Not in Contract)

1 - Space reserved for a future 22.85 m communication tower (minimum 4.26 x 4.26 m).

1.1 - Foundation will be 3.65 x 3.65 m.

1.2 - Perimeter fence may be required (additional 610 mm to measurements)

1.3 - Location as indicated on site plans.

2 - 53 mm EMT to be run from the Tower Junction Box to Room 202.

2.1 - This conduit will feed AC Power service to the Tower

2.2 - Dedicated 120 V, 20 Amp, GFCI circuit to be installed in this conduit and suitably terminated in the tower junction box.

3 - 27 mm EMT conduit is to be run from the tower junction Box to Room 204.

3.1 - This conduit will source Network Connections to/from the Tower

3.2 - Terminate in Room 204 with 19 mm Square Outlet boxes c/w stainless steel cover plates mounting height to match receptacles.

3.3 - External Conduit installed in the Tower Junction box as specified in section A6

3.4 - Ensure no other Utility services (other than those specified in this document) or like run through the reserved area above.

E - General Notes

1 - All conduits are to have a minimum bending radius of 600 mm

2 - All conduits should have the minimum number of bends possible

3 - All conduits must have electrical pull-cord installed in them

4 - All termination points should be labeled per the applicable section of this document preceded by a standard header of “CSS”

4.1 - Example 1: the Local Junction box defined in B1.3 should have a label applied to its face “CSS B1.3”

4.2 - Example 2: the conduit defined in C4 should have a label on both ends “CSS C4”