



Public Works and Government Services Canada

Requisition No. _ EZ899-161059 _

DRAWINGS & SPECIFICATIONS
for
Fraser Valley Institution
Building F HVAC Upgrade

Project No.: R.074982.001

APPROVED BY:


Regional Manager, AES

2015-8-11
Date


Construction Safety Coordinator

2015-07-20
Date

TENDER:


Project Manager

2015-09-22
Date

CONSULTANTS – SEAL & SIGNATURE

Discipline

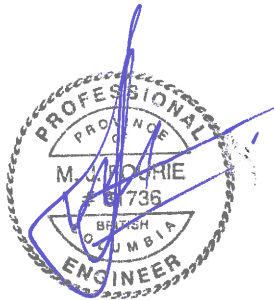
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Mechanical
(Prime)



2015 AUGUST 6th.

Electrical



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END OF PROJECT DRAWING LIST

PART 1 GENERAL

1.1 SUMMARY OF WORK

- .1 Work covered by Contract Documents:
 - .1 This Contract covers the following work at the Fraser Valley Institution, Abbotsford, BC.
- .2 Work to be performed under this Contract includes, but not limited to, the following items covered further in the Contract documents:
 - .1 Provide a detailed work plan including a project schedule and phasing. This detailed work plan shall be submitted to the Departmental Representative for review to verify that there will be no interruption of service.
 - .2 Do not start work until all essential equipment is delivered to the site and the work can proceed without delays.
 - .3 Provide as-built drawings and closeout submittals.
- .3 Contractor's Use of Premises:
 - .1 Contractor has limited use of site for work of this contract until Substantial Completion:
 - .1 Contractor use of premises for storage and access, as approved by the Departmental representative.
 - .2 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
 - .2 Vehicular access will be restricted during the inmate "count" at breakfast, lunch and dinner hours. Confirm times with Departmental Representative. Delays may occur when entering and exiting the Institution with vehicles due to security situations and heavy traffic.

1.2 WORK RESTRICTIONS

- .1 Notify Departmental Representative of intended interruption of power, communication and water services and provide schedule of interruption times.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours of notice for necessary interruption of services throughout course of work. Keep duration of interruptions to a minimum. Coordinate interruptions with local authority having jurisdiction and local residences and businesses affected by the disruption.
- .3 Provide for access by pedestrian and vehicular traffic on and around site where work is in progress.

- .4 Construct barriers in accordance with Section Temporary Barriers and Enclosures.
- .5 Security Requirements: refer to Section 01 14 10 - Security Requirements.
- .6 Hours of work:
 - .1 Perform work during normal working hours of the Institution 0730 to 1600, Monday through Friday except holidays.
 - .2 When it is necessary, arrange in advance with Departmental Representative to work outside of normal working hours.

1.3 CONSTRUCTION WORK SCHEDULE

- .1 Commence work immediately upon official notification of acceptance of offer and complete the work within 20 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 Submittal:
 - .1 Submit to Departmental Representative within 10 working days of Award of Contract, a 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 bi-weekly basis reflecting activity changes and completions, as well as activities in progress.
 - .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.
- .5 Project Meetings:
 - .1 Discuss Project Schedule at bi-weekly 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. Only PWGSC paper work is acceptable.

1.4 SUBMITTAL PROCEDURES

.1 Administrative:

- .1 Submit to Departmental Representative submittal 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 submittal 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. Submittal 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 submittal.
- .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 3.1 mega pixel resolution and stored in Jpeg format with minimal compression.
 - .2 Number of viewpoints: four (4), locations of viewpoints directed by Departmental Representative.
 - .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 3.1 mega pixel 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, 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.
 - .3 Accompany submissions with transmittal letter in duplicate.
 - .4 Submit bond copies (hard copy) as directed by Departmental Representative.
- .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 submittal is not relieved by Departmental Representative's review of submittal.
 - .6 Responsibility for deviations in submittal from requirements of Contract documents is not relieved by Departmental Representative's review of submittal, unless Departmental Representative gives written acceptance of specified deviations.

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

1.5 HEALTH AND SAFETY

- .1 Specified in Section 01 35 33.

1.6 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.

1.7 REGULATORY REQUIREMENTS

- .1 References and Codes:
 - .1 Perform Work in accordance with National Building Code of Canada (NBCC2010) and where applicable British Columbia Building Code (BCBC2012) including all amendments up to bid 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.

1.8 QUALITY CONTROL

- .1 Inspection:
 - .1 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.
 - .2 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
 - .3 Departmental Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.
- .2 Procedures:
 - .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
 - .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.
 - .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

.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 Reports:

- .1 Submit (4) four copies of inspection and test reports to Departmental Representative.

.5 Tests and Mix Designs:

- .1 Furnish test results and mix designs as may be requested.

.6 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.

.7 Mill Tests:

- .1 Submit mill test certificates as requested and as required of specification Sections.

.8 Equipment and Systems:

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

1.9 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 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 and clean reflectors and lenses used for more than three months.
- .5 Temporary Communication Facilities:
 - .1 Provide and pay for temporary telephone and fax hook up, line(s) necessary for own use.
- .6 Fire Protection:
 - .1 Provide and maintain temporary fire protection equipment during performance of Work required by governing codes, regulations and bylaws.

1.10 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 WorkSafeBC 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 moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.
 - .2 Hoists to be 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 existing roads used for access to project site.
 - .2 Build and maintain temporary access where required and provide snow removal during period of Work.
 - .3 Park vehicles outside perimeter fence in designated parking areas.
- .6 Contractor's Site Office and enclosure:
 - .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.
 - .3 Provide temporary fenced area to enclose site and operations.
- .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.

1.11 TEMPORARY BARRIERS AND ENCLOSURES

.1 Hoarding:

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

.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 Maintain immediate local access roads in clean condition used during work of this contract.

.5 Protection for Off-Site and CSC Property:

- .1 Protect surrounding CSC property from damage during performance of Work.
- .2 Be responsible for damage incurred.

.6 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.

1.12 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 best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

.3 Storage, Handling and Protection:

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

- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
 - .3 Store products subject to damage from weather in weatherproof enclosures.
 - .4 Store cementitious products clear of earth or concrete floors, and away from walls.
 - .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
 - .6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
 - .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
 - .8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative .
 - .9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.
- .4 Transportation:
- .1 Pay costs of transportation of products required in performance of Work.
 - .2 Transportation cost of products supplied by Departmental Representative will be paid for by Departmental Representative. Unload, handle and store such products.
- .5 Manufacturer's Instructions:
- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
 - .2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative may establish course of action.
 - .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

.6 Quality of Work:

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

.7 Co-ordination:

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

8 Concealment:

- .1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation, inform Departmental Representative if there is interference. Install as directed by Departmental Representative.

.9 Remedial Work:

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner neither to damage nor to 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, capped and re-routed services lines.
- .15 Contractors Options for Selection of Products:
 - .1 Products specified by "**Prescriptive**" specifications: select any product meeting or exceeding specifications.
 - .2 Products specified under "**Acceptable Products**" (used for complex Mechanical or Electrical Systems): select any one of the indicated manufacturers, or any other manufacturer meeting or exceeding the Prescriptive specifications and indicated Products.
 - .3 Products specified by performance and referenced standard: select any product meeting or exceeding the referenced standard.
 - .4 Products specified to meet particular design requirements or to match existing materials: use only material specified Approved Product. Alternative products may be considered provided full technical data is received in writing by Departmental Representative in accordance with "Instructions to Bidders".
 - .5 When products are specified by a referenced standard or by Performance specifications, upon request of Departmental Representative, obtain from manufacturer an independent laboratory report showing that the product meets or exceeds the specified requirements.
- .16 Substitution after award of Contract:
 - .1 No substitutions are permitted without prior written approval of the Departmental Representative.
 - .2 Proposals for substitution may only be submitted after Contract award. Such request must include statements of respective costs of items originally specified and the proposed substitution.
 - .3 Proposals will be considered by the Departmental Representative if:
 - .1 products selected by tenderer from those specified are not available;
 - .2 delivery date of products selected from those specified would unduly delay completion of Contract, or
 - .3 alternative product to that specified, which is brought to the attention of and considered by Departmental Representative as equivalent to the product specified, and will result in a credit to the Contract amount.
 - .4 Should the proposed substitution be accepted either in part or in whole, assume full responsibility and costs when substitution affects other work on the project. Pay for design or drawing changes required as result of substitution.

- .5 Amounts of all credits arising from approval of the substitutions will be determined by the Departmental Representative, and the Contract price will be reduced accordingly.

1.13 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.

1.14 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 purpose made saw or core drill. Pneumatic or impact tools not allowed on brittle materials 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.

1.15 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 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.
 - .5 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.
 - .6 Clean lighting reflectors, lenses, and other lighting surfaces.
 - .7 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
 - .8 Wax, seal, vacuum clean, shampoo or prepare floor finishes, as recommended by manufacturer.
 - .9 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
 - .10 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
 - .11 Remove dirt and other disfiguration from exterior surfaces.

- .12 Sweep and wash clean paved areas.
- .13 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.
- .14 Clean roofs, downspouts, and drainage systems.
- .15 Remove snow and ice from access to building.

1.16 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.
 - .1 Separate non-salvageable materials from salvaged items.
 - .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.
 - .3 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.

1.17 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 Substantial 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 Fire alarm verification report per CAN/ULC-S537, confirmation of proper installation of fire alarm panel to CAN/ULC-S527 signed off by the fire alarm technician and confirmation of fire alarm emergency power capacity. 24-hour battery test as described in CAN/ULC-S537, signed off by fire alarm technician.
 - .5 Confirmation of emergency power lighting, operating on emergency power for the required amount of time as dictated by NBCC, signed off by technician.
 - .6 Certificates required by Authority Having Jurisdictions for fire protection systems.
 - .7 Certificates required by Authority Having Jurisdictions for seismic restraints.
 - .8 Operation of systems have been demonstrated to Departments personnel.
 - .9 Work is complete and ready for Final Inspection.
- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.

1.18 CLOSEOUT SUBMITTAL

- .1 Record Drawings:
 - .1 As work progresses, maintain accurate records to show all deviations from the Contract Drawings. Note on as-built drawings as changes occur. At completion supply:
 - .1 Four (4) sets of CD's in AutoCad file format (version: 2014) with all as-built information on the diskettes.
 - .2 Four (4) sets of as-built plotted reproducible drawings.
 - .3 Four (4) sets of printed as-built drawings.
 - .4 Submit one copy of check plots to Departmental Representative prior to final printing of as-built drawings.
 - .5 Departmental Representative will supply copies of the original AutoCad files.
 - .6 Retain original logo and title block on the as-built drawings. Contractor may place on the upper right-hand title block area a small company logo, the text "AS-BUILT" and the date.

- .2 Costs for transferring as-built information from marked up working set of drawings to electronic format using ACAD and plotting service is included in the Contract.
- .2 Maintenance manual:
 - .1 On completion of project submit to Departmental Representative four (4) CD R/ disk copies and four (4) paper copies (in loose leaf type binder) of Operations and Maintenance Manual, made up as follows:
 - .1 Provide maintenance manual on CDs using pdf, or other approved format for descriptive writing, page size images and page size drawings. Organize manuals into industry standard maintenance manual tabs with links in index to each descriptive section describing the component or maintenance procedure etc.
 - .2 Organize files into CSI Masterformat numbering system or other approved descriptive titles.
 - .3 Label disk "Operation and Maintenance Data", project name, date, names of Contractor, subcontractors, consultants and subconsultants.
 - .4 Include scanned guarantees, diagrams and drawings.
 - .5 Organize contents into applicable sections of work to parallel project specification break-down. Mark each section by labeled tabs (navigational buttons).
 - .6 Drawings, diagrams and manufacturer's literature must be legible.
 - .7 Refer to Mechanical and Electrical Divisions for specific details for Mechanical and Electrical data.
 - .3 Maintenance Materials, Special Tools and Spare Parts:
 - .1 Specific requirements for maintenance materials, tools and spare parts are specified in individual sections.
 - .2 Deliver maintenance materials, special tools and spare parts to Departmental Representative and store in designated area as directed by Departmental Representative.
 - .3 Prepare lists of maintenance materials, special tools and spare parts for inclusion in Manual specified in Clause 18.2.
 - .4 Maintenance materials:
 - .1 Deliver wrapped, identify on carton or package, colour, room number, system or area as applicable where item is used.

- .5 Special tools:
 - .1 Assemble as specified;
 - .2 Include identifications and instructions on intended use of tools.
- .6 Spare parts:
 - .1 Assemble parts as specified;
 - .2 Include part number, identification of equipment or system for which parts are applicable;
 - .3 Installation instructions;
 - .4 Name and address of nearest supplier.
- .4 Warranties and Bonds:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing in maintenance manual.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.
 - .4 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until the Date of Interim Completion is determined.
 - .5 Verify that documents are in proper form, contain full information, and are notarized.
 - .6 Retain warranties and bonds until time specified for submittal.

1.19 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.

1.20 GENERAL COMMISSIONING

- .1 Commission installed systems prior to Demonstration and Training.

END OF SECTION

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Work of this Contract comprises general construction requiring demolition, renovation and construction of a portion of the Building-F Old and New Building located within the Fraser Valley Institution, Abbotsford, BC.

1.2 TIME OF COMPLETION OF THE WORK

- .1 The Contractor shall achieve the date of completion of the Work within the indicated timeline:
 - .1 From the date of notification of award of contract.
 - .2 Schedule:
 - .1 Construction 20 Weeks

- .2 The Contractor shall commence work immediately upon official notification of acceptance of offer.

1.3 SPECIAL COORDINATION AND SCHEDULING

- .1 The Contractor's attention is specifically drawn to the following areas of the work with respect to coordination and scheduling:
 - .1 Work will proceed as described on the drawings. The drawings are a guide to the requirements for this project. The contractor is required to provide detailed coordination scheduling of the work. Provide detailed schedules where the renovation will affect the operations of the existing facility.
 - .2 Procurement of all items required for the renovation and construction, installation and testing. The existing facility is in operation and therefore any disruptions caused by construction/renovation must be kept to a minimum, The contractor is advised that prior to commencement of work in the areas to be renovated all products, materials and supplies must be procured, and available for installation and testing. This must be scheduled, logged and verified to the departmental representative. All work must be scheduled in detail; reviewed with the Departmental Representative and Correctional Services Canada and agreed to.
 - .3 Coordination of Division 01, 02, 03 05, 07, 09, 21, 22, 23, 26, 28
 - .4 Commissioning of systems, commissioning with other trades, access and egress.
 - .5 Construction, Review and acceptance by Departmental Representative.
 - .1 As renovation/construction proceeds and as areas of the work is commissioned provide a detailed process acceptable to Departmental Representative.

1.4 WORK AFFECTING THE EXISTING BUILDING

.1 Work Sequence Requirements

- .1 The Contractor's attention is specifically drawn to the following areas of the work with respect to coordination and scheduling:
 - .1 The work is to be completed as described on the drawings.
 - .2 Contractor is advised that work is required on the existing roof including areas below to install new duct systems. Any and all work required on the existing roof and building, the contractor must consult with the Departmental Representative and CSC prior to commencing work.
 - .3 A complete and detailed schedule of the work must be provided for approval by the Departmental Representative prior to commencing the work.
 - .4 The contractor must include all costs for the work affecting the existing building. The contractor must factor in the overall project schedule the requirements for completing the work affecting the existing building. This includes sequencing the work to accommodate all operational requirements of the occupants of the existing building. Departmental Representative must be consulted.

.2 Fraser Valley Institution Continued Occupancy

- .1 The existing operations and security of the building must be maintained at all times.
- .2 The contractor must include in the contract all temporary measures required and with the approval of Departmental Representative to facilitate the requirements for new construction/renovation work.

.3 Alteration Project Procedures

- .1 No services may be disrupted at any time which affects the operation of the existing building or the occupants.
- .2 If existing services are affected to accomplish installation of new work consult with Departmental Representative regarding procedures. This must be shown in the project schedule. All costs must be included, no exceptions or additional costs will be considered.

1.5 HEALTH AND SAFETY OF BUILDING OCCUPANTS

- .1 Refer to Section 01 35 33 Health and Safety.
- .2 Refer to Section 01 51 00 Temporary Utilities.
- .3 The contractor is to provide in the Health and Safety Plan, contingencies should the air in the Work area affect the building occupants.

- .4 The contractor is to provide detailed scheduling and planning for construction noise generating activities. In general, noise generating activities that affect operations will not be tolerated.

1.6 CONTRACTOR USE OF PREMISES

- .1 Hours of Work:
 - .1 The institution has operational restrictions such as inmate counts that affect the contractor's movement and work. – Confirm with the Institution.
 - .2 Weekends or extended hours during the week:
 - .1 A notice to the Departmental Representative must be given.
 - .2 Approval must be obtained from the Departmental Representative.
- .2 Contractor shall limit use of premises for Work, for storage, and for access, to allow:
 - .1 Work by other contractors.
 - .2 All material, tools, product etc. must be in locked in a secure facility as required by CSC and the requirements of the project specifications.
- .3 Coordinate use of premises under direction of Departmental Representative.
- .4 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

1.7 RESPONSIBILITIES

- .1 Departmental Representative Responsibilities:
 - .1 No additional responsibilities except as described in the specifications.
- .2 Contractor Responsibilities:
 - .1 Designate submittals and delivery date for each product in progress schedule.
 - .2 Review shop drawings, product data, samples, and other submittals. Submit to Departmental Representative notification of any observed discrepancies or problems anticipated due to non-conformance with Contract Documents.
 - .3 Receive and unload products at site.
 - .4 Inspect deliveries jointly with Departmental Representative; record shortages, and damaged or defective items.
 - .5 Handle products at site, including uncrating and storage.
 - .6 Protect products from damage, and from exposure to elements.

- .7 Assemble, install, connect, adjust, and finish products.
- .8 Provide installation inspections required by public authorities.
- .9 Repair or replace items damaged by Contractor or subcontractor on site under his control.

1.8 MINIMUM STANDARDS

- .1 Unless specified otherwise, perform work in accordance with the minimum standards set forth in the National Building Code, 2010 and the requirements of Fire Commissioner of Canada.

1.9 DRAWINGS AND SPECIFICATIONS

- .1 The Departmental Representative will provide the Contractor, 2 copies of drawings and specifications. The number of copies will be determined by the Departmental Representative.

1.10 GENERAL

- .1 The Contractor shall provide and apply its skill, judgement, expertise and experience as reasonably required to complete the Work and ensure that the Work is performed in a good, proper and workmanlike manner and not less than the accepted construction industry practice of a competent contractor experienced in work similar to the Work to be performed.
- .2 The Contractor and each Subcontractor affirmatively represents that they are skilled and experienced in the performance of the Work as required by this Project and in the use and interpretation of drawings and specifications such as those included in the Contract Documents; that they have carefully reviewed the drawings and specifications of this Project and that their Contract is based solely on these Documents, not relying in any way on any explanations or interpretations - oral or written - from any other source. The Contractor agrees that it has exercised its aforementioned skill and experience and found the drawings and specifications sufficient and free from ambiguities, errors, or omissions for the purpose of determining its Contract for the performance of the Work in conformity with the drawings, specifications, and all other Contract Documents.
- .3 The Contractor shall report any error, inconsistency or omission in the Contract Documents it might discover, such review to be to the best of the Contractor's knowledge, information and belief.
- .4 The Contractor shall provide sufficient and adequate labour, materials and construction equipment necessary to properly correlate all phases of the Work to the end that the approved Construction Schedule can be maintained and the date of Substantial Performance of the Work be met. Each Contractor is responsible for all necessary development of the Work to fulfill the intent of the Contract Documents for a complete and/or functioning system whether totally defined by the drawings and specifications or not.

- .5 Each Contractor is responsible for all necessary development of the Work to fulfill the intent of the Contract Documents for a complete and/or functioning system whether totally defined by the drawings and specifications or not. In no case shall the Contractor or any of its Subcontractors proceed with work in uncertainty.

1.11 PROJECT INFORMATION AND COMMUNICATION

- .1 Information and communication required to carry out the Work of the project issued by the Departmental Representative or the Contractors shall be in electronic form. This Information and communication may be but is not limited to the following:
 - .1 Project Drawings and Specifications
 - .2 Contractor submittals
 - .3 Requests for Information.
 - .4 Other forms of project communication.
- .2 The Departmental Representative requires that the contractor set up an internet site organized to accommodate the required project information and communication.
- .3 The contractor shall manage the site and ensure that the information is up to date. The contractor shall notify the appropriate parties of information that is uploaded and updated onto the site.
- .4 The Departmental Representative, Contractor, other contractors and subcontractors must have rights to access the site.

1.12 COORDINATION

- .1 Coordinate construction activities included in various sections of the specifications to assure efficient and orderly installation of each component. Coordinate construction operations included under different sections that depend on each other for proper installation, connection and operation.
- .2 Where the installation of one component depends installation of other components before or after its own installation, schedule activities in the sequence required to obtain the best results.
- .3 Coordinate installation of different components to assure maximum accessibility for maintenance, service and repair.
- .4 Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- .5 Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building.

- .6 In finished areas except as otherwise indicated, conceal pipes, ducts and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- .7 Coordinate completion and clean up of Work of separate sections in preparation for portions of the Work designated for the Departmental Representative's partial occupancy.
- .8 After Departmental Representative occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with the Contract Documents, to minimize disruption of Departmental Representative activities.

1.13 COORDINATION OF MECHANICAL AND ELECTRICAL SERVICES WITHIN AND ABOVE CEILINGS

- .1 Before commencing installation of any mechanical and electrical services and components within and above ceilings, prepare drawings showing proposed layouts for Departmental Representative's review and approval.
- .2 Mechanical and electrical services include, but are not limited to plumbing, heating and fire protection piping, ventilation ductwork, boxes and dampers, conduit runs and junction boxes, grilles, louvres, light fixtures, speakers, detectors, and access doors and panels.
- .3 Include plan layouts and sections on drawings.
- .4 Do not commence with installation until layouts are reviewed and approved by Departmental Representative.
- .5 Remove services installed before Departmental Representative's review and approval, and reinstalled in an acceptable manner, at no cost.
- .6 Comply with layouts approved by Departmental Representative. If changes to layouts are necessary, obtain Departmental Representative's approval of changes before proceeding with them.

1.14 DOCUMENT CROSS-CHECK

- .1 The Contractor and its Subcontractors shall review all current drawings and relevant specifications. Should specifications conflict with drawings, request clarification from the Departmental Representative before proceeding.
- .2 Mechanical and electrical Subcontractors shall review and become familiar with the drawings.
- .3 Architectural work Subcontractors shall review and become familiar with the mechanical and electrical drawings.
- .4 Structural work Subcontractors shall review and become familiar with the mechanical and electrical drawings.
- .5 All costs resulting from work, including labour, materials, equipment, miscellaneous requirements related to work of other subcontractors and/or required by coordination of other subcontractors, is to be included. No additional costs will be considered.

1.15 REQUEST FOR INFORMATION

- .1 Maintain a Request for Information system for questions regarding clarifications. A Request for Information (RFI) will be a written document submitted in electronic form which includes, as a minimum, the following details: Hand written RFI's will not be accepted.
 - .1 Date.
 - .2 References to drawings and/or specifications.
 - .3 Location of the work item in question.
 - .4 Complete description of the question.
 - .5 Affect this item will have on other work.
 - .6 Suggestions to resolve this questions.
 - .7 Date that response information is required.
- .2 An RFI form is to be prepared with headings and spaces for this information to be filled in.
- .3 Allow 10 working days for response to a RFI.
- .4 The Departmental Representative's response does not authorize changes in the Contract Price or Contract Time.
- .5 RFI's are intended for clarification of drawings and specifications. RFI's shall not be used by the Contractor to identify errors or omissions in the Contract Documents, communicate directly with the Departmental Representative for clarification in this case.

1.16 DOCUMENTS

- .1 The Contractor is responsible for requesting any additional instructions or clarifications that may be required from the Departmental Representative which are needed for the performance of the Work and shall request such instructions or clarifications in time to avoid any delay in the Work.
- .2 Notwithstanding the foregoing, inconsistencies and omissions shall not include lack of reference on the drawings or in the specifications to labour or Products that are required or normally recognized within respective trade practices as being necessary for the complete execution of the Work.
- .3 Where "Notes" are included on the drawings, such work shall be included in the Contract Price. It is the Contractor's and Subcontractor's responsibility to review all "Notes" and include all related costs in the Work to perform the work identified in the "Notes." If the bidders require clarification of the scope of a "Note" such clarification shall be made prior to the tender closing, no additional costs will be considered by the Departmental Representative for bidder's failure to include all work associated with the "Notes".

- .4 Where typical is noted on the drawings, the requirements of the work apply to all conditions whether or not shown for each specific condition. The typical conditions apply to all subtrades work. It is the Contractor's and Subcontractor's responsibility to review the requirements and include all costs, no additional costs will be considered by the Departmental Representative for bidder's failure to include all work considered to be typical.
- .5 The Project consists of Products and assemblies that may require the work of more than one trade to complete. The Contractor, its Suppliers, manufacturers, architectural trades, mechanical trades, electrical trades and specialty trades are advised that all materials, products, cutting, fitting, patching, scheduling, coordination, and site conditions must be taken into account for the completion of the work and included in the Contract Price, no claims for additional costs will be considered by the Departmental Representative for failure to do so.

1.17 SPECIFICATION

- .1 The specifications and drawings are arranged in a manner to indicate the content of the Work. These sections do not however obligate the Departmental Representative to establish limits or limit the responsibility of any Subcontractor or Supplier. The onus for defining the extent of the Subcontractor's work remains with the Contractor to interpret all documents as a whole, and who will ensure that when awarding subcontracts, the area or scope of responsibility of any particular Subcontractor or Supplier is set out in full detail.
- .2 Division 1 of the specification specifies Work that is the direct responsibility of the General Contractor, administrative procedures and general requirements applying to all Subcontractors. Division 1 shall not be interpreted as defining limits of responsibility between the Contractor and its Subcontractors.
- .3 Ensure that Subcontractors understand that the General Conditions of the Contract and Division 1 apply to sections of the specification governing their Work.
- .4 Wherever in the Contract Documents the words "approval", "approved", "direction", "directed", "selection", "selected", "request", "requested", "report", "reviewed" and similar words are used, such approvals, directions, selections, requests and reports shall be given by the Departmental Representative unless specifically stated otherwise.
- .5 Wherever in the Contract Documents the word "provide" is used in any form, it shall mean that the Work concerned shall include both supply and installation of the products required for the completion of that part of the Work.
- .6 Wherever in the Contract Documents the word "supply" is used in any form, it shall mean that the Work specified to be supplied includes delivery to site and unloading at location directed.
- .7 Wherever in the Contract Documents the word "installed" issued in any form, it shall mean Work specified for installation includes receiving, uncrating, unpacking; moving from stored location to place of installation; and installing to meet specified requirements.

- .8 Wherever in the Contract Documents it is specified that Work is to proceed or to meet approval, direction, selection or request of jurisdictional authorities or others, such approval, direction, selection or request shall be in writing.
- .9 Wherever in the Contract Documents or as directed by the Departmental Representative it is specified that Work is to be repaired, made good or replaced, perform the work without any additional cost to the Contract.
- .10 Wherever in the specifications the term "Related Sections" is used, it shall be taken to mean Work that is directly related to the section but not specified therein. The purpose of this clause is to redirect the reader to other sections of the specification for Work related to this section. This clause shall not be construed as a definition of trade responsibility, nor is it exhaustive in its description of related Sections and is included for convenience only.
- .11 Except where a reference standard is specifically dated in the specifications, references to standards will be taken to mean the latest edition in effect at the date of award of this Contract. In the case of standards (dated or not) which appear in the specifications and which are referenced in the National Building Code, the specific edition of the standard referenced in the code shall govern.
- .12 Where a standard is revised, supplemented or amended after award of the Contract, carry out the Work in accordance with latest edition of such standards. If the revision to the standard is such that a revision to the Contract Price is necessary, submit claims to the Departmental Representative in accordance with provisions of the Contract Documents.

1.18 DRAWINGS

- .1 Refer to Section 01 78 00 for requirement to maintain a system of current drawings at all times.
- .2 Drawings are in part diagrammatic and are intended to convey the content of the Work required and, as such, indicate general and approximate location, arrangement and sizes of materials, elements, fixtures, equipment and outlets. Obtain more accurate information about locations, arrangement and sizes by studying, familiarizing with and correlating the Contract Documents, including coordination with the shop drawings, and becoming totally familiar with conditions and spaces affecting these matters before proceeding with the Work. Where job conditions require reasonable adjustments in the indicated locations and arrangements, make the necessary modifications at no additional cost to the Contract. Similarly, where existing conditions interfere with new installation and required location, include such relocation in the Work of this Contract. Install and arrange fixtures and equipment in such a way as to conserve as much headroom clearance and space as possible.
- .3 The Contractor is responsible for coordination of metric dimensions as shown on the drawings and as specified.

1.19 DOCUMENTS ON SITE

- .1 Maintain at the job site one copy of each of the following:

- .1 Contract drawings.
- .2 Specifications.
- .3 Addenda.
- .4 Reviewed shop drawings, product data and samples.
- .5 Change orders.
- .6 Other modifications to Contract.
- .7 Field test reports.
- .8 National Building Code.
- .9 Copy of all permits from authorities having jurisdiction.
- .10 Building permit drawings.
- .11 Industrial Health and Safety Regulations of Worksafe BC.
- .12 Contractor's Safety Program.
- .13 Construction Schedule.
- .14 Record drawings.
- .15 Fire Safety Program.
- .16 Site reports.
- .17 Field instructions.
- .18 WHMIS brochures.

END OF SECTION

PART 1 GENERAL

1.1 Purpose

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

1.2 Purpose

- .1 "Contraband" means:
 - .1 an intoxicant, including alcoholic beverages, drugs and narcotics
 - .2 a weapon or a component thereof, ammunition for a weapon, and anything that is designed to kill, injure or disable a person or that is altered so as to be capable of killing, injuring or disabling a person, when possessed without prior authorization,
 - .3 an explosive or a bomb or a component thereof,
 - .4 currency over any applicable prescribed limit, \$25.00, and
 - .5 any item not described in paragraphs (a) to (d) that could jeopardize the security of a Penitentiary or the safety of persons, when that item is possessed without prior authorization.
- .2 Unauthorized smoking and related Items@ means all smoking items including, but not limited to, cigarettes, cigars, tobacco, chewing tobacco, cigarette making machines, matches and lighters.
- .3 "Commercial Vehicle" means any motor vehicle used for the shipment of material, equipment and tools required for the construction project.
- .4 "CSC" means Correctional Service Canada.
- .5 "Director" means Director or Warden of the Institution as applicable or their representative.
- .6 "Construction employees" means persons working for the general contractor, the sub-contractors, equipment operators, material suppliers, testing and inspection companies and regulatory agencies.
- .7 "Departmental Representative" means the Public Works and Government Services Canada representative defined in General Conditions.
- .8 "Perimeter" means the fenced or walled area of the institution that restrains the movement of the inmates.

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

1.3 Preliminary Proceedings

- .1 At construction start-up meeting:
 - .1 Discuss the nature and extent of all activities involved in the Project.
 - .2 Establish mutually acceptable security procedures in accordance with this instruction and the institution's particular requirements.
- .2 The Contractors' responsibilities:
 - .1 Ensure that all construction employees are aware of the CSC security requirements.
 - .2 Ensure that a copy of the CSC security requirements is always prominently on display at the job site.
 - .3 Co-operate with institutional personnel in ensuring that security requirements are observed by all construction employees.

1.4 Construction Employees

- .1 Submit CPIC form and scanned copy of government issued ID for each employee to the Departmental Representative.
- .2 Allow 10 working days for processing of security clearances. Employees will not be admitted to the Institution without a valid security clearance in place and a recent picture identification such as a provincial driver's license. Security clearances obtained from other CSC institutions are not valid at this institution except as approved otherwise.
- .3 The Director may require that facial photographs may be taken of construction employees and these photographs may be displayed at appropriate locations in the institution or in an electronic database for identification purposes. The Director may require that Photo ID cards be provided for all construction workers. ID cards will then be left at the designated entrance to be picked upon arrival at the institution and shall be displayed prominently on the construction employees clothing at all time while employees are at the institution.
- .4 Entry to Institutional Property will be refused to any person there may be reason to believe may be a security risk.
- .5 Any person employed on the construction site will be subject to immediate removal from Institutional Property if they:
 - .1 appear to be under the influence of alcohol, drugs or narcotics.
 - .2 behave in an unusual or disorderly manner.
 - .3 are in possession of contraband.

1.5 Vehicles

- .1 All unattended vehicles on CSC property must have windows closed; fuel caps locked, doors and trunks locked and keys removed. The keys must be securely in the possession of the owner or an employee of the company that owns the vehicle.
- .2 The director may limit at any time the number and type of vehicles allowed within the Institution.
- .3 Drivers of delivery vehicles for material required by the project will require security clearances and must remain with their vehicle the entire time that the vehicle is in the Institution. The director may require that these vehicles be escorted by Institutional staff or PWGSC Construction Escorts while in the Institution.
- .4 If the Director permits trailers to be left inside the secure perimeter of the Institution, the trailer doors must be locked at all times. All windows must be securely locked bars when left unoccupied. Cover all windows with expanded metal mesh. When not in use lock all storage trailers located inside and outside the perimeter. All storage trailers inside and outside the perimeter must be locked when not in use.

1.6 Parking

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

1.7 Shipments

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

1.8 Telephones

- .1 The installation of telephones, facsimile machines and computers with Internet connections is not permitted within the Institution perimeter unless prior approved by the Director.
- .2 The Director will ensure that approved telephones, facsimile machine and computers with Internet connections are located where they are not accessible to inmates. All computers will have an approved password protection that will stop an Internet connection to unauthorized personnel.
- .3 Wireless cellular and digital telephones, including but not limited to devices for telephone messaging, pagers, Blackberries, PDAs, telephone used as 2-way radios are not permitted within the Institution unless approved by the Director. If wireless cellular telephones are permitted, the user will not permit their use by any inmate.
- .4 The Director may approve but limit the use of 2-way radios.

1.9 Work Hours

- .1 Work hours within the Institution are: generally 7:30am to 16:00 with some exceptions. Refer to Division 01 and coordinate with Director for exceptions.
- .2 Work is not permitted during weekends and statutory holidays without the permission of the Director. A minimum of seven days advance notice will be required to obtain the required permission. In case of emergencies or other special circumstances, this advance notice may be waved by the Director.

1.10 Overtime Work

- .1 Conform to Division 1.
- .2 Provide 48 hours advance notice to Director for all work to be performed after normal working hours of the Institution. Notify Director immediately if emergency work is required, such as to complete a concrete pour or make the construction site safe and secure.

1.11 Tools and Equipment

- .1 Maintain a complete list of all tools and equipment to be used during the construction project. Make this inventory available for inspection when required by the Institution.
- .2 Throughout the construction project maintain up-to-date the list of tools and equipment specified above.
- .3 Keep all tools and equipment under constant supervision, particularly power-driven and cartridge-driven tools, cartridges, files, saw blades, rod saws, wire, rope, ladders and any sort of jacking device.
- .4 Store all tools and equipment in approved secure locations.
- .5 Lock all tool boxes when not in use. Keys to remain in the possession of the employees of the contractor. Secure and lock scaffolding when not erected and when erected Secure in a manner agreed upon with the Institution designate.
- .6 Report all missing or lost tools or equipment immediately to the Departmental Representative/Director.
- .7 The Director will ensure that the security staff members carry out checks of the Contractor's tools and equipment against the list provided by the Contractor. These checks may be carried out at the following intervals:
 - .1 At the beginning and conclusion of every work day or shift upon entering and exiting the Institution.
 - .2 At any time when contractor is on Institution property.

- .8 Certain tools/equipment such as cartridges and hacksaw blades are highly controlled items. The contractor will be given at the beginning of the day, a quantity that will permit one day's work. Used blades/cartridges will be returned to the Director's representative at the end of each day. Maintain up to date inventory of all used blades/cartridges.
- .9 If propane or natural gas is used for heating the construction, the institution will require that the contractor supervise the construction site during non-working hours.

1.12 Keys

- .1 Security Hardware Keys.
 - .1 Arrange with the security hardware supplier/installer to have the keys for the security hardware to be delivered directly to Institution, specifically the Security Maintenance Officer (SMO).
 - .2 The SMO will provide a receipt to the Contractor for security hardware keys.
 - .3 Provide a copy of the receipt to the Departmental Representative.
- .2 Other Keys
 - .1 Use standard construction cylinders for locks for his use during the construction period.
 - .2 Issue instructions to employees and sub-trades, as necessary, to ensure safe custody of the construction set of keys.
- .3 Upon completion of each phase of the construction, the CSC representative will, in conjunction with the lock manufacturer:
 - .1 Prepare an operational keying schedule
 - .2 Accept the operational keys and cylinders directly from the lock manufacturer.
 - .3 Arrange for removal and return of the construction cores and install the operational core in all locks.
- .4 Upon putting operational security keys into use, the PWGSC construction escort will obtain these keys as they are required from the SMO and open doors as required by the Contractor. The Contractor shall issue instructions to his employees advising them that all security keys shall always remain with the PWGSC construction escort.

1.13 Security Hardware

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

1.14 Prescription Drugs

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

1.15 Smoking Restrictions

- .1 Smoking is not permitted inside correctional facilities or outdoors within the perimeter of a correctional facility and persons must not possess unauthorized smoking items within the perimeter of a correctional facility.
- .2 Persons in violation of this policy will be requested to immediately cease smoking or dispose of any unauthorized smoking items and, if they persist will be directed to leave the Institution.
- .3 Smoking is permitted outside the perimeter of a correctional facility in an area designated by the Director.

1.16 Contraband

- .1 Weapons, ammunition, explosives, alcoholic beverages, drugs and narcotics are prohibited on institutional property.
- .2 The discovery of contraband on the construction site and the identification of the person(s) responsible for the contraband shall be reported immediately to the Director.
- .3 Contractors should be vigilant with both their staff and the staff of their sub-contractors and suppliers that the discovery of contraband may result in cancellation of the security clearance of the affected employee. Serious infractions may result in the removal of the company from the Institution for the duration of the construction.
- .4 Presence of arms and ammunition in vehicles of contractors, sub-contractors and suppliers or employees of these will result in the immediate cancellation of security clearances for the driver of the vehicle.

1.17 Searches

- .1 All vehicles and persons entering institutional property may be subject to search.
- .2 When the Director suspects, on reasonable grounds, that an employee of the Contractor is in possession of contraband, he may order that person to be searched.
- .3 All employees entering the Institution may be subject to screening of personal effects for traces of contraband drug residue.

1.18 Access and Removal from Institution Property

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

1.19 Movement Vehicles

- .1 Construction vehicles are not to leave the Institution until an inmate count is completed. Escorted commercial vehicles will be allowed to enter or leave the institution through the vehicle access gate during the following hours:
 - .1 AM: 0745 hrs. to 1100 hrs.
 - .2 PM: 1300hrs. to 1530 hrs.
- .2 The contractor will advise the Director twenty four (24) hours in advance to the arrival on the site of heavy equipment such as concrete trucks, cranes, etc.
- .3 Vehicles being loaded with soil or other debris, or any vehicle considered impossible to search, must be under continuous supervision by CSC staff or PWGSC construction escorts working under the authority of the Director.
- .4 Commercial vehicles will only be allowed access to institutional property when their contents are certified by the Contractor or his representative as being strictly necessary to the execution of the construction project.
- .5 Vehicles will be refused access to institutional property if, in the opinion of the Director, they contain any article which may jeopardize the security of the institution. Arrange with Director for parking of contractor=s vehicles at minimum security Institutions.
- .6 Private vehicles of construction employees will not be allowed within the security wall or fence of medium or maximum security institutions without the authorization of the Director.
- .7 With the approval of the Director, certain equipment may be permitted to remain on the construction site overnight or over the weekend. This equipment must be securely locked, with the battery removed. The Director may require that the equipment be secured with a chain and padlock to another solid object.

1.20 Movement of Construction Employees on Institutional Property

- .1 Subject to the requirements of good security, the Director will permit the Contractor and his employees as much freedom of action and movement as is possible.
- .2 However, notwithstanding paragraph above, the Director may:
 - .1 Prohibit or restrict access to any part of the institution.
 - .2 Require that in certain areas of the institution, either during the entire construction project or at certain intervals, construction employees only be allowed access when accompanied by a member of the CSC security staff or PWGSC Construction Escort Officer.
- .3 During the lunch and coffee/health breaks, all construction employees will remain within the construction site. Construction employees are not permitted to eat in the Institution cafeteria and dining room.

1.21 Surveillance and Inspection

- .1 Construction activities and all related movement of personnel and vehicles will be subject to surveillance and inspection by CSC security staff members to ensure that established security requirements are met.
- .2 CSC staff members will ensure that an understanding of the need to carry out surveillance and inspections, as specified above, is established among construction employees and maintained throughout the construction project.

1.22 Stoppage of Work

- .1 The director may request at any time that the contractor, his employees, sub-contractors and their employees not enter or leave the work site immediately due to a security situation occurring within the Institution. The contractor's site supervisor will note the name of the staff member giving the instruction, the time of the request and obey the order as quickly as possible.
- .2 The contractor shall advise the Departmental Representative of this interruption of the work within 24 hours.

1.23 Contact with Inmates

- .1 Unless specifically authorized, it is forbidden to come into contact with inmates, to talk with them, to receive objects from them or to give them objects. Any employee doing any of the above will be removed from the site and his security clearance revoked.
- .2 Digital cameras (or any other type) are not allowed on CSC property.
- .3 Notwithstanding the above paragraph, if the director approves of the use of cameras, it is strictly forbidden to take pictures of inmates, of CSC staff members or of any part of the Institution other than those required as part of this contract.

1.24 Completion of Construction Project

- .1 Upon completion of the construction project or, when applicable, the takeover of a facility, the Contractor shall remove all remaining construction material, tools and equipment that are not specified to remain in the Institution as part of the construction contract.

END OF SECTION

Part 1 General

1.1 SCHEDULING PROJECT SCOPE

- .1 Refer to Section 01 11 00 Summary of Work.
- .2 Refer to Section 01 14 10 Security Requirements.
- .3 Review the Time of Completion of the Work and confirm to the Departmental Representative that the work will be completed within the time allotted.
- .4 The contractor must provide detailed schedules of work for each phase as it affects the operations of the facility.

1.2 SYSTEM DESCRIPTION

- .1 Project Time Management: describes processes required to ensure timely completion of Project. These processes ensure that various elements of Project are properly coordinated. It consists of planning, time estimating, scheduling, progress monitoring and control.
- .2 Planning: this is most basic function of management, that of determining presentation of action and is essential.
 - .1 It involves focusing on an objective consideration of future, and integrating forward thinking with analysis; therefore, in planning, implicit assumptions are made about future so that action can be taken today.
 - .2 Planning and scheduling facilitates accomplishment of objectives and should be considered a continuous interactive process involving planning, review, scheduling, analysis, monitoring and reporting.
- .3 Ensure that planning process is iterative and results in generally top-down processing with more detail being developed as planning progresses, and decisions concerning options and alternatives are made. This implies progressively more reliability of scheduling data. Detail Project schedule is used for analysis and progress monitoring.
- .4 Ensure project schedule efficiencies through monitoring.
 - .1 When activities begin on time and are performed according to estimated durations without interruptions, original Critical Path will remain accurate. Changes and delays will however, create an essential need for continual monitoring of Project activities.
 - .2 Monitor progress of Project in detail to ensure integrity of Critical Path, by comparing actual completions of individual activities with their scheduled completions, and review progress of activities that have started but are not yet completed.
 - .3 Monitoring should be done sufficiently often so that causes of delays are immediately identified and removed if possible.

- .5 Project monitoring and reporting: as Project progresses, keep team aware of changes to schedule, and possible consequences. In addition to CPM networks, use narrative reports to provide advice on seriousness of difficulties and measures to overcome them.
 - .1 Narrative reporting begins with statement on general status of Project followed by a summarization of delays, potential problems, corrective measures and Project status criticality.

1.3 SUBMITTALS

- .1 Prepare submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include costs for execution, preparation and reproduction of schedule submittals in bid documents, failure to comply with each required submission, may result in progress payment being withheld.
- .3 Submit letter ensuring that schedule has been prepared in co-ordination with major subcontractors.
- .4 Submit Project planning, monitoring and control system data as required by Departmental Representative in following form:
 - .1 CD files in original scheduling software containing schedule information, clearly labelled with data date, specific update, and person responsible for update.
 - .2 Listing of project activities including milestones and logical connectors, networks (sub-networks) from Project start to end. Sort activities by activity identification number and accompany with descriptions. List early and late start and finish dates together with durations, codes and float.
 - .3 Criticality report listing activities and milestones with up to 5 days total float used as first sort for ready identification of critical paths through entire project. List early and late starts and finishes dates, together with durations, codes and float for critical activities.
 - .4 Provide listing for each trade, activities due to start, to be underway, and finished. Provide list activity identification number, description and duration. Provide columns for entry of actual start and finish dates, duration remaining and remarks concerning action required.
- .5 Submit monthly schedule updates and written reports.
- .6 Maintain a submittal log.

1.4 QUALITY ASSURANCE

- .1 Use experienced personnel, fully qualified in planning and scheduling to provide services from start of construction to Final Certificate, including commissioning.

1.5 PROJECT MEETING

- .1 Meet with Departmental Representative within 5 working days of Award of Contract date, to establish scope of Work and approach to project construction operations.

1.6 DETAIL SCHEDULE

- .1 Provide detailed project schedule (CPM logic diagram) within 14 working days of Award of Contract date showing activity sequencing, interdependencies and duration estimates. Include listed activities as follows:
 - .1 Project Phases
 - .2 Work that affects facility operations
 - .3 Shop drawings
 - .4 Samples
 - .5 Mock-ups
 - .6 Approvals
 - .7 Procurement
 - .8 Construction
 - .9 Installation
 - .10 Site works
 - .11 Testing
 - .12 Commissioning and acceptance
- .2 Clearly show sequence and interdependence of construction activities and indicate:
 - .1 Start and completion of all items of Work, their major components, and interim milestone completion dates.
 - .2 Activities for procurement, delivery, installation and completion of each major piece of equipment, materials and other supplies, including:
 - .1 Time for submittals, re-submittals and review.
 - .2 Time for fabrication and delivery of manufactured products for Work.
 - .3 Interdependence of procurement and construction activities.
 - .3 Include sufficient detail to assure adequate planning and execution of Work. Activities should generally range in duration from 3 to 15 workdays each.

- .3 Provide level of detail for project activities such that sequence and interdependency of Contract tasks are demonstrated and allow coordination and control of project activities. Show continuous flow from left to right.
- .4 Ensure activities with no float are calculated and clearly indicated on logical CPM construction network system as being, whenever possible, continuous series of activities throughout length of Project to form "Critical Path." Increased number of critical activities is seen as an indication of increased risk.

1.7 REVIEW OF THE CPM SCHEDULE

- .1 Allow 10 work days for review by Departmental Representative of proposed schedule.
- .2 Upon receipt of reviewed schedule, make necessary revisions and resubmit to Departmental Representative for review within 5 work days.
- .3 Promptly provide additional information to validate practicability of schedule as required by Departmental Representative.
- .4 Submittal of schedule indicates that it meets Contract requirements and will be executed generally in sequence.

1.8 COMPLIANCE WITH CPM SCHEDULE

- .1 Comply with reviewed schedule.
- .2 Proceed with significant changes and deviations from scheduled sequence of activities which cause delay, only after review by Departmental Representative.
- .3 Identify activities that are behind schedule and causing delay. Provide measures to regain slippage.
 - .1 Corrective measures may include:
 - .1 An increase of personnel on site for effected activities or work package.
 - .2 An increase in materials and equipment.
 - .3 Additional work shifts.

1.9 PROGRESS MONITORING AND REPORTING

- .1 On an ongoing basis, schedule on job site must show "Progress to Date". Arrange participation on and off site of subcontractors and suppliers, as, and when necessary, for purpose of network planning, scheduling, updating and progress monitoring. Inspect Work with Departmental Representative at least once monthly to establish progress on each current activity shown on applicable networks.
- .2 Maintain a daily log of progress of the work.

- .3 Perform schedule update monthly status dated on last working day of month. Update to reflect activities completed to date, activities in progress, logic and duration changes.
- .4 Do not automatically update actual start and finish dates by using default mechanisms found in project management software.
- .5 Requirements for monthly progress monitoring and reporting are basis for progress payment request.
- .6 Submit monthly schedule updates with the progress payment request.
- .7 Submit monthly written report based on schedule, showing Work to date performed, comparing Work progress to planned, and presenting current forecasts. Report must summarize progress, defining problem areas and anticipated delays with respect to Work schedule, and critical paths. Explain alternatives for possible schedule recovery to mitigate any potential delay. Include in report:
 - .1 Description of progress made.
 - .2 Pending items and status of: permits, shop drawings, samples, mockups, deliveries, Change Orders, possible time extensions.
 - .3 Status of Contract completion date and milestones.
 - .4 Current and anticipated problem areas, potential delays and corrective measures.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 45 00 - Quality Control.
- .2 Section 01 91 41 - Demonstration and Training.
- .3 Section 01 78 00 - Closeout Submittals.

1.2 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 Substitutions must be submitted in accordance with the requirements specified in section 01 61 00. Substitutions will not be reviewed until approval from the Departmental Representative is obtained.
- .4 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .5 Where items or information is not produced in SI Metric units converted values are acceptable.
- .6 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and 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.
- .7 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .8 Verify field measurements and affected adjacent Work are coordinated.
- .9 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .10 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .11 Keep one reviewed copy of each submission on site.
- .12 Maintain a submittal log.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .3 Allow 14 working days for Departmental Representative's review of each submission.
- .4 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .5 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of any revisions other than those requested.
- .6 Accompany submissions with transmittal letter, in duplicate, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .7 Submissions shall include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

- .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
- .8 After Departmental Representative's review, distribute copies.
- .9 Submit one electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .10 Submit one electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product. Notwithstanding the foregoing, submit full shop drawings including but not limited to the following items: toilet partitions, washroom accessories (provide layout drawing), detention and commercial doors and frames, detention windows, and chain link fencing.
- .11 Delete information not applicable to project.
- .12 Supplement standard information to provide details applicable to project.
- .13 Shop drawings will be reviewed by the Departmental Representative for general conformance with the design concept of the project and general compliance with information given in the Contract Documents. The Departmental Representative will signify the status of the review by stamping and dating the electronic copy accordingly, in one of the following manners:
 - .1 Reviewed
 - .2 Reviewed as Noted
 - .3 Revise and Resubmit
 - .4 Not Reviewed

The Departmental Representative will return the electronic copy to the Contractor for their use and for copying for record keeping purposes and for distribution to Subcontractors and to suppliers.

- .14 The Contractor shall distribute copies of the returned shop drawings by the Departmental Representative as **“Reviewed,” “Reviewed as Noted”** to the Site Office and to the offices of Subcontractors, and suppliers.
- .15 Shop drawings stamped **“Revise and Resubmit”** or **“Not Reviewed”** will be returned and shall be corrected and resubmitted to the Departmental Representative following the requirements stated above.
- .16 Only shop drawings stamped **“Reviewed”** and **“Reviewed as Noted”** shall be used on the site and used for fabrication and installation of work. All other shop drawings shall be considered as being not reviewed and shall not be used on site or for fabrication and installation of work.
- .17 Conform to review comments and stamped instructions of each shop drawing reviewed.
- .18 Only drawings noted for revision and re-submission need be resubmitted. Include revisions required by previous reviews before re-submission of shop drawings.
- .19 No new details or information shall be added to shop drawings after they have been fully reviewed.
- .20 No work dependent on shop drawing information shall proceed until review is given and verification received from the Departmental Representative. Be responsible for work performed prior to receipt of reviewed shop drawings. No review comments shall be construed as authorization for Changes in the Work.
- .21 Each Subcontractor or supplier shall fabricate work exactly as shown on shop drawings and if shop practice dictates revision, shall revise shop drawings and resubmit.
- .22 File one copy of each finally revised and corrected shop drawing on site.
- .23 Consider this article the minimum requirement. Further instruction contained in any particular specification section governs for that section of the Work.
- .24 Shop drawings must be in Metric measurement.
- .25 The review of shop drawings by the Departmental Representative is for sole purpose of ascertaining conformance with general concept. This review shall not mean that PWGSC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting all requirements of construction and Contract Documents. Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of all sub-trades.

- .26 The Contractor will have a system in place to allow the Departmental Representative, Contractor and its Subcontractors to have electronic access to the project submittals, shop drawings, project communication and latest drawings on file through a internet site. The Contractor and its Subcontractors are required to access the system to obtain the latest drawings on which their shop drawings will be based. If shop drawings are submitted based on out dated drawings shop drawings will be returned without further action. The users of the electronic system, once entered into the system, will be informed electronically of updated drawings available to them on the system. Photo copies of the Departmental Representatives design drawings will not be accepted.
- .27 The Departmental Representative's CADD files shall not be used by the Contractor, its Subcontractors or Suppliers for use in preparing shop drawings.
- .28 A copy of final reviewed shop drawings in electronic format shall be included in operating and maintenance manuals specified under Section 01 78 00.

1.4 SAMPLES

- .1 Submit for review samples as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to site office.
- .3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.5 MOCK-UPS

- .1 Erect mock-ups in accordance with 01 45 00 - Quality Control.

1.6 CERTIFICATIONS

- .1 When specified in individual specification sections, submit certification by manufacturer to the Departmental Representative to indicate material or Product conforms to or exceeds specified requirements.
- .2 Certificates may be recent or previous test results on material or Product, but must be acceptable to the Departmental Representative.

1.7 MANUFACTURER'S FIELD REPORTS

- .1 Submit reports for the Departmental Representative's benefit as contract administrator.
- .2 Submit reports in duplicate within 10 days of observation, to the Departmental Representative for information.
- .3 Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the Contract Documents.

1.8 PROGRESS DIARY

- .1 Keep a permanent, written record on the site of the progress of the Work. Keep record open to the inspection of the Departmental Representative, and copies shall be furnished to the Departmental Representative upon request.
- .2 The diary shall record all pertinent data such as:
 - .1 Daily weather conditions.
 - .2 Commencement, progress and completion of various portions of the Work.
 - .3 Dates of all site meetings.
 - .4 Dates of visits or inspections by government authorities, inspectors, utility companies and any other visitors to the site.
 - .5 Record of work force employed.
 - .6 Information required by Contractor or Subcontractor. Clarifications requested and answers received.
 - .7 Materials causing delay.
 - .8 Actions or events causing delay.
- .3 Record of all quality control inspections and fire safety inspections including corrective actions taken.

1.9 PHOTOGRAPHS

- .1 Provide a digital photographic record/history of the progress of the Work. The record to include electronic files and hard copies of each photograph taken.
- .2 Take a minimum of 150 digital photographs monthly showing the progress of the Work for each building showing both interior and exterior views. Process each digital photograph to provide a coloured print.
- .3 Provide a photograph album(s) on site containing site photographs and update monthly with new photographs taken the previous month. Keep the album(s) available for review by the Departmental Representative.

- .4 Photographs to be 100 x 150 mm in size, matte finish. In the lower right-hand corner the photograph shall have a white patch marked with the date of exposure, building, and direction of view.
- .5 Upon completion of the Work submit a labelled compact disk(s) containing the record of all photographs taken and the photograph album(s)

1.10 CERTIFICATES AND TRANSCRIPTS

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcription of insurance immediately after award of Contract.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 14 10 – Security Requirements
- .2 Section 01 74 00 - Cleaning and Special Cleaning Procedures
- .3 Division 22 – Plumbing, Division 23 - HVAC: Cutting, capping, abandonment and relocation of mechanical services and utilities.
- .4 Division 26 – Electrical

1.2 REFERENCES

- .1 National Building Code, Safety Measures at Construction and Demolition Site.
- .2 Workers' Compensation Board (WCB) of British Columbia Regulations.
- .3 CSA S350-M1980 - "Code of Practice for Safety in Demolition of Structure."

1.3 QUALITY ASSURANCE

- .1 Assign work to trades experienced, efficient and skilled in the work designated to remain or to be removed so as to cause the least damage to each type of work encountered.

1.4 SITE CONDITIONS

- .1 The drawings and schedules indicate the general extent of existing surfaces, cabinets, fittings and equipment requiring patching, making good and re-finishing. The drawings and specifications do not necessarily indicate or describe the entire and complete extent of the work. The Contractor is responsible for reviewing and assessing the existing construction to determine the extent of work necessary to repair, patch and make good the existing surfaces.
- .2 Where existing pre-finished materials are required to be replaced to re-finish surfaces including but not limited to: ceramic tiles, and wood veneer and identical replacement finishes no longer available, submit samples of proposed replacement materials to the Departmental Representative for review prior to commencement of the affected work.
- .3 During the Work, wall inserts and plugs may be encountered. Remove inserts and plugs, patch holes.
- .4 If while carrying out alteration Work, the Contractor or its Subcontractors expose conditions which are in contravention with applicable regulatory codes and requirements of authorities having jurisdiction, unsafe or in any way less than the acceptable industry standard for the particular item, immediately notify the Departmental Representative before proceeding with further Work. The Departmental Representative will review the condition and issue the appropriate instruction.

- .5 All Work performed and materials used, to be not less than the standard of quality for the existing finished building, except where such existing materials are no longer available, are inappropriate for the intended reconstruction or detailed otherwise on the drawings.
- .6 Break into existing utilities, services and other areas of the Work as required to make proper connections to existing work. Patch and make good existing work that may be damaged through the Work and reasonably match new to existing in all respects. Use extreme care when breaking into existing work as some services may not be shown or identified.

1.5 SECURITY

- .1 Reference Section 01 11 00.
- .2 Reference Section 01 14 10.
- .3 Obtain Departmental Representative permission prior to commencing any work in the alteration work areas and ensure worker observe all of the existing security regulations wherever such regulations apply.
- .4 Make provisions to maintain security in a manner acceptable to the Departmental Representative.

1.6 ACCESS

- .1 Maintain free access to areas not under construction at all times.
- .2 Maintain existing entrances and fire exits free from obstruction throughout alteration work.
- .3 The Institution and Departmental Representative has complete jurisdiction over the entry of Contractor's staff and workers to the existing buildings and control of construction vehicle routes within site, including and existing or necessary regulations which may be imposed for duration of the Contract.
- .4 Arrange and schedule access to the Work and agreed to by the Departmental Representative.

1.7 EXISTING SERVICES

- .1 The drawings may diagrammatically show some known utilities including abandoned and relocated utilities in their approximate locations. These locations are not guaranteed nor is their existence confirmed.
- .2 Become familiar with all available information and documents regarding existing building services and ensure that they are maintained continuously throughout the entire period of construction and alterations.
- .3 There are existing services including but not limited to: electrical, plumbing, BSCS systems hidden in concrete floors and concrete block walls. Where access is required, locate existing services using ground penetrating radar or similar methods as specified under this section.

- .4 Protect and maintain existing active services designated to remain or as required to facilitate the work.

1.8 PROTECTION

- .1 Take all necessary precautions to fully protect those portions of the existing building, to remain, against damage during demolition and/or installation of new Work.
- .2 Take special provisions to protect existing building areas, when exposed, by removal of existing walls, roofs or other exterior surfaces. Take necessary precautions and measures to ensure the interior of the existing building is weather tight and fully secure at all times.
- .3 Make good damage of any nature to existing building or its contents, except where required by the Work, to the satisfaction of the Departmental Representative and at no additional cost. Making good means restoration to at least original condition in terms of strength, safety, workmanship, and appearance.
- .4 Upon completion of the work in a given area, thoroughly clean all floors, walls, fixtures, cable trays, pipes, ducts and all other surfaces above and below the existing ceilings to the satisfaction of the Departmental Representative.

1.9 INSPECTION

- .1 Inspect the work and notify the Departmental Representative of any conditions affecting the performance of the work. Review the drawings and determine the total content of work to follow.
- .2 Ensure all services, whether buried, built-in or exposed, are properly located and staked as to position, type of service, size, direction of flow.
- .3 Inspect materials, equipment, components to be reused or turned over to the Departmental Representative. Note their condition and advise the Departmental Representative in writing of any defects or conditions which would affect removal and reuse.

1.10 PREPARATION

- .1 Take adequate measures during demolition to protect the public in conformance with CSA S350 and requirements of authorities having jurisdiction.
- .2 Provide all bracing, shoring, underpinning or needling as needed to maintain building and its components structurally secure and free of deflection or stress until permanent support completed.
- .3 Provide protection to ensure materials, finishes and surfaces to remain will not be damaged, scratched, or marred by Work of this section.
- .4 Ensure that affected services and utilities designated for removal have been disconnected prior to the commencement of Work.

1.11 ALTERATIONS, CUTTING AND PROTECTION

- .1 Perform cutting and removal work so as not to cut or remove more than is necessary and so as not to damage adjacent work.
- .2 Assign patching of finish materials to mechanics skilled in the work of the finish trade involved.
- .3 Protect remaining finishes, equipment and adjacent work from damage caused by cutting, moving, removal and patching operations. Protect surfaces which will remain a part of the finished work.
- .4 Remove debris promptly from the area of work. Load removed material directly on trucks for removal from site.
- .5 Suppress dust. Prevent the occurrence of unsanitary conditions, dirt or debris on the site.

1.12 CUTTING AND CORING

- .1 Determine the location of reinforcing steel, concealed mechanical and electrical services prior to cutting or coring.
- .2 The approved method is ground penetrating radar. The contractor must allow for these services in the contract price. No additional costs will be considered.
- .3 Refer to the drawings and examine site conditions to determine cutting and coring required. Cut and core existing work as required to facilitate the installation of plumbing, mechanical, electrical and other services as shown or reasonably implied by the Contract Documents and as required by trades to facilitate installation of their work. Review existing conditions by site investigation and other methods as required to obtain information for such evaluation. Use dry cutting and coring methods where possible or take adequate measures to collect water during cutting and coring operations.
- .4 Saw-cut all new access openings in existing concrete and concrete block. The saw cuts openings so that the concrete and concrete block can be removed without saw cut overruns. Saw-cut new access openings to a maximum depth of 10mm, then had chip out the remaining material, taking care not to damage existing services.
- .5 Take care not to remove more existing material than required. Excessive removal of material may damage the structure. No beams or columns are to be cut or in any way damaged. Before cutting or coring any holes, check that no beam or column will be encountered.
- .6 Keep the size of any new mechanical, electrical or plumbing opening in the existing structure to a minimum. Where groups of services occur, put through one or two larger cored holes. A line of holes may damage the capacity of the existing slabs.

1.13 PATCHING, EXTENDING AND MATCHING

- .1 Patch and extend existing work using skilled mechanics who are capable of matching the existing quality of workmanship. The quality of patched or extended work not to be less than that specified for new work as specified in the sections of the specifications which follow.

- .2 In areas where a portion of an existing finished surface is damaged, lifted, stained, or otherwise made or found to be imperfect, patch or replace the imperfect portion of the surface with matching material.
- .3 Unless otherwise shown on the drawings, do not incorporate salvaged or used material in new construction, except where small quantities of finish material which are difficult to match or duplicate is approved for patching or extending purposes by the Departmental Representative.
- .4 Provide adequate support or substrate for patching of finishes.
- .5 If the imperfect surface was painted or coated, repaint or recoat the patched portion in such a way that uniform colour and texture over the entire surface results.
- .6 If the surrounding surface cannot be matched, repaint or recoat the entire surface.
- .7 In the sections of the specifications which follow these general requirements, no concerted attempt has been made to describe each of the various existing products that must be used to patch, match, extend or replace existing work. Obtain all such products in time to complete the work on schedule. Provide such products in quality which is in no way inferior to the existing products.
- .8 The quality of the products that exist in the building, as apparent during pre-bid site visits, will serve as the specification requirement for strength, appearance and other characteristics.
- .9 Where new work abuts or finishes flush with existing work, make the transition as smooth and workmanlike as possible. Patched work to match existing adjacent work in texture and appearance so as to make the patch or transition invisible to the eye at a distance of 1m.
- .10 Where drywall, wood, metal or other finished surface is cut in such a way that a smooth transition with new work is not possible, terminate the existing surface in a neat fashion along a straight line at a natural line of division and provide trim appropriate to the finished surface.
- .11 Where two (2) or more spaces are indicated to become one (1) space, rework floors and ceilings so that horizontal planes are without breaks, steps or bulkheads result unless otherwise detailed on the drawings.
- .12 In cases of extreme change of level 50mm or more, obtain instructions from the Departmental Representative as to method of making transition. Either stepping, bulkheading, encasement, ramping, sloping or change of transition line to be employed, or a combination of these, as directed in each case by the Departmental Representative.
- .13 Restore existing work that is damaged during construction to a condition equal to its condition at the time of the start of work.
- .14 At locations in existing areas where partitions are removed, patch the floors, walls and ceilings with finish materials to match adjacent finishes, unless otherwise shown on the drawings.

- .15 Where a product or type of construction occurs in the existing building, and it is not specified as a part of the new work, provide such products or types of construction as needed to patch, extend or match the existing work.
- .16 These specifications will generally not describe existing products or standards of execution, nor will they enumerate products which are not a part of the new construction. The existing product is its own specification.
- .17 The presence of any product or type of construction in the old work shall cause its patching, extending or matching to be performed, as necessary to make the work complete and consistent, to identical standards of quality and visual appearance.
- .18 Patch damaged existing fireproofing and firestopping. Where existing fireproofing and firestopping is damaged during the installation of new construction, repair damaged materials to original condition.

1.14 REPAIR

- .1 Replace work damaged in the course of alterations, except at areas approved by the Departmental Representative for repair.
- .2 Where full removal of extensive amounts of almost suitable work would be needed to replace damaged portions, then filling, spackling, straightening and similar repair techniques, followed by full painting or other finishing, will be permitted.
- .3 If the repaired work is not brought up to standard for new work, the Departmental Representative will direct that it be cut out and replaced with new work.

1.15 CLEANING

- .1 As soon as work in each area of the alterations is complete, clean up all surfaces, remove equipment, salvage and debris, and return in condition suitable for use by the Departmental Representative as quickly as possible.
- .2 Clean up at the end of each day and keep dust and contamination of the work to a minimum.
- .3 Continuously during the work of this section remove all dirt, debris discarded material and deposit in waste containers. Keep routes to and from waste containers clear.

END OF SECTION

PART 1 - GENERAL

1.1 References

- .1 Government of Canada.
 - .1 Canada Labour Code - Part II
 - .2 Canada Occupational Health and Safety Regulations.
- .2 National Building Code of Canada (NBC):
 - .1 Part 8, Safety Measures at Construction and Demolition Sites.
- .3 Canadian Standards Association (CSA) as amended:
 - .1 CSA Z797-2009 Code of Practice for Access Scaffold
 - .2 CSA S269.1-1975 (R2003) Falsework for Construction Purposes
 - .3 CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures
- .4 Fire Protection Engineering Services, HRSDC:
 - .1 FCC No. 301, Standard for Construction Operations.
 - .2 FCC No. 302, Standard for Welding and Cutting.
- .5 National Building Code of Canada (NBCC 2005):
 - .1 Part 8, Safety Measures at Construction and Demolition Sites
- .6 American National Standards Institute (ANSI):
 - .1 ANSI A10.3, Operations – Safety Requirements for Powder-Actuated Fastening Systems.
- .7 Province of British Columbia::
 - .1 Workers Compensation Act Part 3-Occupational Health and Safety.
 - .2 Occupational Health and Safety Regulation

1.2 Related Sections

- .1 Refer to the following current NMS sections as required:
 - .1 Section 00 01 50 General Requirements

1.3 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.

1.4 Compliance with Regulations

- .1 PWGSC may terminate the Contract without liability to PWGSC where the Contractor, in the opinion of PWGSC, refuses to comply with a requirement of the Workers' Compensation Act or the Occupational Health and Safety Regulations.
- .2 It is the Contractor's responsibility to ensure that all workers are qualified, competent and certified to perform the work as required by the Workers' Compensation Act or the Occupational Health and Safety Regulations.

1.5 Submittals

- .1 Submit to Departmental Representative submittals listed for review in accordance with Section 00 01 50.
- .2 Work effected by submittal shall not proceed until review is complete.
- .3 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.
- .4 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 10 days after receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative.
- .5 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.

- .6 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.

1.6 Responsibility

- .1 Assume responsibility as the Prime Contractor for work under this contract.
- .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.

1.7 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.

1.8 General Conditions

- .1 Provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.
- .2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.
 - .1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.
 - .2 Secure site at night time or provide security guard as deemed necessary to protect site against entry.

1.9 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.

1.10 Work Permits

- .1 Obtain specialty permit related to project before start of work.

1.11 Filing of Notice

- .1 The General Contractor is to complete and submit a Notice of Project as required by Provincial authorities.
- .2 Provide copies of all notices to the Departmental Representative.

1.12 Health and Safety Plan

- .1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards.
- .2 Prepare and comply with a site-specific project Health and Safety Plan based on hazard assessment, including, but not limited to, the following:
 - .1 Primary requirements:
 - .1 Contractor's safety policy.
 - .2 Identification of applicable compliance obligations.
 - .3 Definition of responsibilities for project safety/organization chart for project.
 - .4 General safety rules for project.
 - .5 Job-specific safe work, procedures.
 - .6 Inspection policy and procedures.
 - .7 Incident reporting and investigation policy and procedures.
 - .8 Occupational Health and Safety Committee/Representative procedures.
 - .9 Occupational Health and Safety meetings.

- .10 Occupational Health and Safety communications and record keeping procedures.
- .2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.
- .3 List hazardous materials to be brought on site as required by work.
- .4 Indicate Engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.
- .5 Identify personal protective equipment (PPE) to be used by workers.
- .6 Identify personnel and alternates responsible for site safety and health.
- .7 Identify personnel training requirements and training plan, including site orientation for new workers.
- .3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.
- .4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.
- .5 Departmental Representative's review: the review of Health and Safety Plan by Public Works and Government Services Canada (PWGSC) 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.

1.13 Emergency Procedures

- .1 List standard operating procedures and measures to be taken in emergency situations. Include an evacuation plan and emergency contacts (i.e. names/telephone numbers) of:
 - .1 Designated personnel from own company.
 - .2 Regulatory agencies applicable to work and as per legislated regulations.
 - .3 Local emergency resources.
 - .4 Departmental Representative.
- .2 Include the following provisions in the emergency procedures:
 - .1 Notify workers and the first-aid attendant, 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 or residences 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.
 - .5 Work on, over, under and adjacent to water.
 - .6 Workplaces where there are persons who require physical assistance to be moved.
- .4 Design and mark emergency exit routes to provide quick and unimpeded exit.
- .5 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.

1.14 Hazardous Products

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials, and regarding labeling and provision of Material Safety Data Sheets (MSDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.
- .2 Where use of hazardous and toxic products cannot be avoided:
 - .1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per Section 01 01 50.
 - .2 In conjunction with Departmental Representative, schedule to carry out work during "off hours" when tenants have left the building.

1.15 Electrical Safety Requirements

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

- .1 Before undertaking any work, coordinate required energizing and de-energizing of new and existing circuits with Departmental Representative.
- .2 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.

1.16 Electrical Lockout

- .1 Develop, implement and enforce use of established procedures to provide electrical lockout and to ensure the health and safety of workers for every event where work must be done on any electrical circuit or facility.
- .2 Prepare the lockout procedures in writing, listing step-by-step processes to be followed by workers, including how to prepare and issue the request/authorization form. Have procedures available for review upon request by the Departmental Representative.
- .3 Keep the documents and lockout tags at the site and list in a log book for the full duration of the Contract. Upon request, make such data available for viewing by Departmental Representative or by any authorized safety representative.

1.17 Overloading

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

1.18 Falsework

- .1 Design and construct falsework in accordance with CSA S269.1.

1.19 Scaffolding

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

1.20 Confined Spaces

- .1 Carry out work in confined spaces in compliance with Provincial regulations.

1.21 Power-Actuated Devices

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

1.22 Fire Safety and Hot Work

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

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

1.23 Fire Safety Requirements

- .1 Store oily/paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
- .2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.24 Fire Protection and Alarm System

- .1 Do not obstruct, shut-off or leave inactive at the end of a working day or shift, the fire protection and alarm systems.
- .2 Do not use fire hydrants, standpipes and hose systems for purposes other than firefighting.
- .3 Be responsible/liable for costs incurred from the fire department, the building owner and the tenants, resulting from false alarms.

1.25 Unforeseen Hazards

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

1.26 Posted Documents

- .1 Post legible versions of the following documents on site:
 - .1 Health and Safety Plan.
 - .2 Sequence of work.
 - .3 Emergency procedures.
 - .4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.
 - .5 Notice of Project.
 - .6 Floor plans or site plans. Must be posted in a non-inmate access are and locked up when not being used.
 - .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.

1.27 Meetings

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

1.28 Correction of Non-Compliance

- .1 Immediately address health and safety non-compliance issues identified by the Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance with health and safety issues identified.
- .3 The Departmental Representative may issue a "stop work order" if non-compliance of health and safety regulations is not corrected immediately or within posted time. The General Contractor/subcontractors will be responsible for any costs arising from such a "stop work order".

END OF SECTION

Part 1 General

1.1 REFERENCES AND CODES

- .1 Perform Work in accordance with National Building Code of Canada 2010 (NBC) 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.

1.2 SECURITY REQUIREMENTS

- .1 Comply with the requirements in section 01 14 10 Security Requirements.
- .2 Comply with any additional operational requirements established by Fraser Valley Institution.

1.3 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions.
- .2 Smoking is permitted on the site outside the perimeter fence in a designated area.

END OF SECTION

Part 1 General

1.1 ASSOCIATIONS

- .1 AA - Aluminum Association, 900 19th Street N.W., Washington, D.C., U.S.A. 20006
URL <http://www.aluminum.org>
- .2 AASHTO - American Association of State Highway and Transportation Officials, 444 N
Capitol Street N.W., Suite 249, Washington, D.C., U.S.A. 20001 URL
<http://www.aashto.org>
- .3 ACEC Association of Consulting Engineers of Canada, 130 Albert Street, Suite 616,
Ottawa, ON. K1P 5G4 URL <http://www.acec.ca>
- .4 AHA - American Hardboard Association, 1210W Northwest Hwy., Palatine, Illinois,
U.S.A. 60067 URL: <http://www.hardboard.org>
- .5 AITC - American Institute of Timber Construction, 7012 S. Revere Parkway, Suite 140,
Englewood, Colorado, U.S.A. 80112 URL <http://www.aitc-glulam.org>
- .6 AMCA - Air Movement and Control Association Inc., 30 West University Drive,
Arlington Heights, Illinois, U.S.A. 60004-1893 URL <http://www.amca.org>
- .7 ANSI - American National Standards Institute, 25 West 43rd Street, 4th Floor, New
York, New York, U.S.A. 10036 URL <http://www.ansi.org>
- .8 APA - The Engineered Wood Association, P.O. Box 11700, Tacoma, Washington,
U.S.A. 98411-0700 URL <http://www.apawood.org>
- .9 API - American Petroleum Institute, 1220 L St. Northwest, Washington, D.C., U.S.A.
20005-4070 URL <http://www.api.org>
- .10 ARI - Air Conditioning and Refrigeration Institute, 4100 N Fairfax Drive, Suite 200,
Arlington, Virginia, U.S.A. 22203 URL <http://www.ari.org>
- .11 ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning Engineers,
1791 Tullie Circle NE, Atlanta, Georgia, U.S.A. 30329 URL <http://www.ashrae.org>
- .12 ASME - American Society of Mechanical Engineers, ASME Headquarters, 3 Park
Avenue, New York, New York, U.S.A. 10016-5990 URL <http://www.asme.org>
- .13 ISAP - International Society for Asphalt Paving, 400 Selby Avenue, Suite 1, St. Paul,
MN 55102 U.S.A. URL <http://www.asphalt.org>
- .14 ASTM - American Society for Testing and Materials, 100 Barr Harbor Drive West,
Conshohocken, Pennsylvania 19428-2959 URL <http://www.astm.org>.
- .15 AWCI - Association of the Wall and Ceiling Industries International, 803 West Broad
Street, Suite 600, Falls Church, VA, U.S.A. 22046 URL <http://www.awci.org>

- .16 AWMAC - Architectural Woodwork Manufacturers Association of Canada, 516-4 Street West, High River, Alberta T1V 1B6 URL <http://www.awmac.com>. Alexandria, VA U.S.A. 22314-1757 URL <http://www.awpa.org>
- .17 AWPAA - American Wood Preservers' Association, P.O. Box 5690, Granbury Texas, U.S.A. 76049-0690 URL <http://www.awpa.com>
- .18 AWS - American Welding Society, 550 N.W. LeJeune Road, Miami, Florida U.S.A. 33126 URL <http://www.amweld.org>
- .19 AWWA - American Water Works Association, 6666 W. Quincy Avenue, Denver, Colorado, U.S.A. 80235 URL <http://www.awwa.org>
- .20 CCA Canadian Construction Association, 75 Albert St., Suite 400 Ottawa, Ontario, K1P 5E7 URL <http://www.cca-acc.com>
- .21 CCDC Canadian Construction Documents Committee, Refer to ACEC, CCA, CSC or RAIC
- .22 CGA - Canadian Gas Association, 20 Eglinton Avenue West, Suite 1305, Toronto, Ontario M4R 1K8 URL <http://www.cga.ca>
- .23 CGSB - Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, Quebec K1A 0S5 URL <http://w3.pwgsc.gc.ca/cgsb>
- .24 CISC - Canadian Institute of Steel Construction, 201 Consumers Road, Suite 300, Willowdale, Ontario M2J 4G8 URL <http://www.cisc-icca.ca>
- .25 CLA - Canadian Lumbermen's Association, 27 Goulburn Avenue, Ottawa, Ontario, K1N 8C7 URL <http://www.cla-ca.ca>
- .26 CNLA - Canadian Nursery Landscape Association, RR #4, Stn. Main, 7856 Fifth Street, Milton, Ontario. L9T 2X8 URL <http://www.canadanursery.com>
- .27 CRCA - Canadian Roofing Contractors Association, 155 Queen Street, Suite 1300, Ottawa, Ontario K1P 6L1 URL <http://www.roofingcanada.com>
- .28 CSA - Canadian Standards Association International, 178 Rexdale Blvd., Toronto, Ontario M9W 1R3 URL <http://www.csa-international.org>
- .29 CSC - Construction Specifications Canada, 120 Carlton Street, Suite 312, Toronto, Ontario M5A 4K2 URL <http://www.csc-dcc.ca>
- .30 CSDMA - Canadian Steel Door Manufacturers Association, One Yonge Street, Suite 1801, Toronto, Ontario M5E 1W7
- .31 CSPI - Corrugated Steel Pipe Institute, 652 Bishop Street N, Unit 2A, Cambridge, Ontario N3H 4V6 URL <http://www.cspi.ca>
- .32 CSSBI - Canadian Sheet Steel Building Institute, 652 Bishop St. N., Unit 2A, Cambridge, Ontario N3H 4V6 URL <http://www.cssbi.ca>

- .33 CUFCA Canadian Urethane Foam Contractor's Association, Box 3214, Winnipeg, Manitoba, R3C 4E7 URL <http://www.cufca.ca>
- .34 CWC - Canadian Wood Council, 1400 Blair Place, Suite 210, Ottawa, Ontario K1J 9B8 URL <http://www.cwc.ca>
- .35 EC - Environment Canada, Conservation and Protection, Inquiry Centre, 351 St. Joseph Blvd, Hull, Québec KIA 0H3 URL <http://www.ec.gc.ca>
- .36 EFC - Electro Federation of Canada, 5800 Explorer Drive, Suite 200, Mississauga, Ontario L4W 5K9 URL <http://www.electrofed.com>
- .37 EIMA EIFS Industry Manufacturer's Association, 3000 Corporate Center Drive, Suite 270, Morrow, Georgia U.S.A. 30260 URL <http://www.eima.com>
- .38 FCC - Fire Commissioner of Canada, Place du Portage, Phase II, 165 rue Hotel de Ville, Hull, Quebec K1A 0J2 <http://info.load-otea.hrdc-drhc.gc.ca/fire-prevention/standards/commissioner.shtml>
- .39 Federal Halocarbon regulation 2003
- .40 HRSDC Fire Protection - Fire Commissioner of Canada, Place du Portage, Phase II, 165 rue Hotel de Ville, Hull, Quebec K1A 0J2 <http://info.load-otea.hrdc-drhc.gc.ca/fire-prevention/standards/commissioner.shtml>
- .41 IEEE - Institute of Electrical and Electronics Engineers, IEE Corporate Office, 3 Park Avenue, 17th Floor, New York, New York U.S.A. 10016-5997 URL <http://www.ieee.org>
- .42 MPI - The Master Painters Institute, 4090 Graveley Street, Burnaby, BC V5C 3T6 URL <http://www.paintinfo.com>
- .43 MSS - Manufacturers Standardization Society of the Valve and Fittings Industry, 127 Park Street, N.E., Vienna, Virginia U.S.A. 22180-4602 URL <http://www.mss-hq.com>
- .44 NAAMM - National Association of Architectural Metal Manufacturers, 8 South Michigan Avenue, Suite 1000, Chicago, Illinois U.S.A. 60603 URL <http://www.naamm.org>
- .45 NABA - National Air Barrier Association, PO Box 2747, Winnipeg, Manitoba, R3C 4E7 URL <http://www.naba.ca>
- .46 NEMA - National Electrical Manufacturers Association, 1300 N. 17th Street, Suite 1847, Rosslyn, Virginia 22209 URL <http://www.nema.org>
- .47 NFPA - National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101 Quincy, Massachusetts, U.S.A. 02269-9101 URL <http://www.nfpa.org>
- .48 NFSA - National Fire Sprinkler Association, P.O. Box 1000, Patterson, New York, U.S.A. 12563 URL <http://www.nfsa.org>

- .49 NHLA - National Hardwood Lumber Association, 6830 Raleigh-La Grange Road, Memphis, TN, U.S.A 38184-0518 URL <http://www.natlhardwood.org>
- .50 NLGA - National Lumber Grades Authority, 406-First Capital Place, 960 Quayside Drive, New Westminster, B.C. V3M 6G2
- .51 NRC - National Research Council, Building M-58, 1200 Montreal Road, Ottawa, Ontario K1A 0R6 URL <http://www.nrc.gc.ca>
- .52 NSPE National Society of Professional Engineers, 1420 King Street, Alexandria, VA U.S.A. 22314-2794 URL <http://www.nspe.org>
- .53 PCI - Prestressed Concrete Institute, 209 W. Jackson Blvd., Suite 500, Chicago, Illinois, U.S.A. 60606-6938 URL <http://www.pci.org>
- .54 PEI - Porcelain Enamel Institute, PO Box 920220, Norcross, GA U.S.A. 30010 URL <http://www.porecelainenamel.com>
- .55 QPL - Qualification Program List, c/o Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, Quebec K1A 1G6 URL <http://www.pwgsc.gc.ca/cgsb>
- .56 RAIC Royal Architectural Institute of Canada, 55 Murray Street, Suite 330, Ottawa, Ontario, K1N 5M3 URL <http://www.raic.org>
- .57 SCC - Standards Council of Canada, 270 Albert Street, Suite 2000, Ottawa, Ontario K1P 6N7 URL <http://www.scc.ca>
- .58 SSPC - The Society for Protective Coatings, 40 24th Street, 6th Floor, Pittsburgh, Pennsylvania 15222-4656 URL <http://www.sspc.org>
- .59 TPI - Truss Plate Institute, 583 D'Onofrio Drive, Suite 200, Madison, WI, U.S.A. 53719 URL <http://www.tpinst.org>
- .60 UL - Underwriters' Laboratories, 333 Pfingsten Road, Northbrook, Illinois, U.S.A. 60062-2096 URL <http://www.ul.com>
- .61 ULC - Underwriters' Laboratories of Canada, 7 Crouse Road, Toronto, Ontario M1R 3A9 URL <http://www.ulc.ca>

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Inspection and testing, administrative, and enforcement requirements.
- .2 Quality control program.
- .3 Tests and mix designs.
- .4 Mock-ups.
- .5 Mill tests.
- .6 Equipment and system adjust and balance.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 42 00 - References.
- .3 Section 01 78 00 - Closeout Submittals.

1.3 GENERAL

- .1 At Project commencement, establish quality assurance benchmarks and quality expectations for all workers and Subcontractors to follow.
- .2 The Specification identifies a minimum level of quality, exceed this minimum level.
- .3 Identify a person in the employ of the Contractor to monitor Work quality and to report quality assurance steps being taken, identified or discovered disparities, and corrective action taken.
- .4 Submit written reports monthly to the Departmental Representative, to accompany progress claims.
- .5 Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- .6 Comply with manufacturer's instructions, including each step in sequence. Should manufacturer's instructions conflict with Contract Documents, request clarification from Departmental Representative before proceeding.
- .7 Comply with specified standards as minimum quality for the work except where more stringent tolerance, codes, or specified requirements indicate higher standards or more precise workmanship.
- .8 Perform work with persons qualified to produce required and specified quality.

1.4 QUALITY CONTROL PROGRAM

- .1 Develop a quality control program. Program requires approval of the Departmental Representative and prior to commencement of Work.
- .2 Within fourteen (14) days of award of Contract, submit five (5) copies of the quality control program and list of independent inspection agencies for review.
- .3 Prepare all test results in triplicate and provide copies of all tests concurrently to the Departmental Representative and Contractor.
- .4 All test results shall specify at least the following data:
 - .1 Type of test.
 - .2 Dates of sampling, testing and reporting.
 - .3 Personnel involved.
 - .4 Location of test (with sketch if required).
 - .5 Specified requirements.
 - .6 Test results.
 - .7 Remarks regarding conformance with Contract Documents.
- .5 Provide written test results to the Departmental Representative within 12 hours of tests. If the tests are completed on Site, provide the Departmental Representative with field memo summarizing results immediately following testing.
- .6 Minimum testing requirements shall be in accordance with all applicable bylaws, regulations, standards, building codes and requirements of authorities having jurisdiction.

1.5 QUALITY CONTROL PLAN

- .1 Include the following in the quality control plan:
 - .1 An organization chart for the project group including identification of the quality control group and the quality control manager.
 - .2 Resumes of the quality control manager and key quality control personnel.
 - .3 A statement from the Contractor's management that the quality control manager has authority to reject or require correction of work.
 - .4 A process for initiating, tracking and resolving rejected work.
 - .5 A procedure for the quality control of Subcontractors complying with the requirements of the Contract.

- .6 An outline of the required communication with the Departmental Representative including:
 - .1 reporting procedures, both daily and summary reports;
 - .2 arrangements for pre-work reviews to be organized by the Contractor;
 - .3 arrangements for weekly quality control review meetings; and
 - .4 coordination of quality control activities with quality assurance.
- .7 A list of test procedures, identification of protocols for sampling and designation of the frequency for each test.
- .8 Procedures for pre-qualification of materials.
- .9 Provide copies of proposed inspection and testing reporting forms.
- .10 Identification of certifications held by the Contractor and relevant to the Work.
- .11 A definition of Contractor's management procedure for auditing the quality control plan.

1.6 INSPECTION

- .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 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.
- .3 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.
- .4 Departmental Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

1.7 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged by the Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative.
 - .1 Submit for approval by Departmental Representative proposed Independent Inspection/Testing Agencies

- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and re-inspection.

1.8 ACCESS TO WORK

- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

1.9 PROCEDURES

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

1.10 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.
- .3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative may deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Departmental Representative.

1.11 REPORTS

- .1 Submit electronic copies of inspection and test reports to Departmental Representative.
- .2 Provide copies to Subcontractor of work being inspected or tested manufacturer or fabricator of material being inspected or tested.

1.12 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs as may be requested.
- .2 The cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work shall be appraised by Departmental Representative and may be authorized as recoverable.

1.13 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 all locations acceptable to Departmental Representative.
- .3 Prepare mock-ups for Departmental Representative's 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 Remove mock-up at conclusion of Work or when acceptable to Departmental Representative.
- .7 Except where otherwise specified, mock-ups may remain as part of Work.
- .8 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.
- .9 Mock-ups shall be constructed of actual materials to be used in the work unless otherwise approved by the Departmental Representative.

1.14 MILL TESTS

- .1 Submit mill test certificates as required of specification Sections.

1.15 EQUIPMENT AND SYSTEMS

- .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 INSTALLATION AND REMOVAL

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

1.3 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 non-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 Refer to mechanical drawings and specifications for additional construction exhaust and ventilation requirements for this project.
 - .2 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
 - .3 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
 - .4 Dispose of exhaust materials in manner that will not result in harmful exposure to

persons.

- .5 Ventilate storage spaces containing hazardous or volatile materials.
- .6 Ventilate temporary sanitary facilities.
- .7 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .6 Permanent heating system of building, may be used when available. Be responsible for damage to heating system if use is permitted.
- .7 On completion of Work for which permanent heating system is used, replace filters, and clean.
- .8 Ensure Date of Substantial Performance and Warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Departmental Representative.
- .9 Pay costs for maintaining temporary heat, when using permanent heating system.
- .10 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
 - .1 Conform to 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.
- .11 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.
- .12 The Contractor is responsible for determining the ventilation requirements in accordance with governing regulations and for providing adequate ventilation throughout. Provide temporary mechanical ventilation in combination with natural ventilation as necessary.
- .13 Well before gypsum board work begins and continuous throughout the setting and drying periods, maintain a temperature range between 13 degC to 21 degC day and night.
- .14 For a period of ten days prior to the installing of interior finishing, varnishing, and painting and until final acceptance of the Work or until full occupancy by the Departmental Representative, provide sufficient heat to produce a temperature of not less than 21°C.
- .15 Supply heat and air in a manner which shall avoid the rapid drying of material but thoroughly dry to such an extent that no remaining moisture will affect finish material.

- .16 Operate the heating and ventilation systems each day, including Saturdays, Sundays and holidays; operating shall include necessary operating personnel.

1.4 TEMPORARY POWER AND LIGHT

- .1 Existing services will provide power during construction for temporary lighting and operating of power tools.
- .2 Arrange for connection. Pay costs for installation, maintenance and removal.
- .3 Temporary power for equipment requiring in excess of above is responsibility of Contractor.
- .4 Existing services will provide lighting throughout project. Ensure level of illumination on floors and stairs is not less than 162 lx.

1.5 TEMPORARY COMMUNICATION FACILITIES

- .1 The location of the contractors facilities will be within the construction area within the construction security fence and exact location will be determined upon award of contract.
- .2 Provide and pay for temporary landline telephone and fax lines, equipment necessary for own use and use of Departmental Representative.
- .3 Provide and pay for a high speed internet connection and maintain a computer on site. The Departmental Representatives will communicate via email and issue all sketches and instructions via email.
- .4 Refer to Section 01 14 10 Security Requirements in regard to telephone and internet access and safety.
- .5 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Departmental Representative. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than 2 months.

1.6 FIRE PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 51 00 - Temporary Utilities.
- .2 Section 01 56 00 - Temporary Barriers and Enclosures.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CGSB 1-GP-189-2000, Primer, Alkyd, Wood, Exterior.
 - .2 CGSB 1.59-2000, Alkyd Exterior Gloss Enamel.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN3-A23.1-/A23.2-2000, Concrete Materials and Methods for Concrete Construction/Method of Test for Concrete.
 - .2 CSA-0121-M1978 (R2003), Douglas Fir Plywood.
 - .3 CAN/CSA-Z321-96, Signs and Symbols for the Occupational Environment.

1.3 INSTALLATION AND REMOVAL

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

1.4 WORK IN EXISTING BUILDING

- .1 The work of this project is to be completed in phases, refer to phasing drawings for requirements.
- .2 Where required for building security, provide temporary secure barriers as shown on the drawings and as directed by the Departmental Representative. Temporary secure barriers must be reviewed and approved by Departmental Representative upon completion of work. If Departmental Representative requests changes, make changes as requested.
- .3 Where Noise and Dust Making Activities are carried out, provide temporary hoarding as required and approved by the Departmental Representative. Refer to Phasing Drawings.

1.5 SCAFFOLDING

- .1 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms, and temporary stairs, as required for performance of the Work.

1.6 HOISTING

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

- .2 Hoists and cranes shall be operated by qualified operator.

1.7 SITE ACCESS AND CONTRACTOR LAYDOWN AREA

- .1 The work of this contract is within the secure perimeter of the existing institution. All access will be through the existing Principle Entrance of the Institution.
 - .1 Reference Section 01 14 10 Security Requirements.
- .2 PWGSC has designated a Contractor Laydown area for this project. The contractor will be required to use this area only for construction operations. Note obtain and follow all rules and regulations.
 - .1 Reference Section 01 14 10 Security Requirements.
- .3 Material and equipment deliveries must be through the Principle Entrance of the Institution.
- .4 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .5 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.
- .6 Refer to Section 01 14 10 for special security requirements.

1.8 CONSTRUCTION PARKING

- .1 Parking will be permitted in areas designated by the Departmental Representative.
- .2 Provide and maintain adequate access to project site.
- .3 The use existing roads for access to project site will not be permitted.
 - .1 If access using existing roads is permitted, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.
 - .2 Use of existing roads will not in any way impede current institution operations and security. Consult with Departmental Representative on conditions of use.
 - .3 The Perimeter road around the institution must remain clear at all times. No exceptions. This road is continuously patrolled by correctional officers.
- .4 No personal vehicles are permitted within the secure construction perimeter area. Construction vehicles only are permitted.
- .5 Provisions for equipment necessary for the Work of the project to be established when contractor moves on site.
- .6 Contractors' requirements and restrictions to be established when contractor moves on site.

1.9 OFFICES

- .1 The Departmental Representative will designate a location and allocate space for the Contractor's site office.
- .2 Provide a clearly marked and fully stocked first-aid case in a readily available location.
- .3 Subcontractors may provide their own offices as necessary. The Departmental Representative reserves the right to approve or reject space for these trailers. If approved, the Departmental Representative will designate the location and allocate space for the Subcontractor's Site Office(s)
- .4 Departmental Representative's Site office:
 - .1 Located in the PWGSC offices.
 - .2 To accommodate site meetings.

1.10 EQUIPMENT, TOOL AND MATERIALS 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.

1.11 SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.
- .3 When permanent water and drain connections are completed, provide temporary water closets and urinals complete with temporary enclosures, inside building. Permanent facilities may be used on approval of Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 51 00 - Temporary Utilities.
- .2 Section 01 52 00 - Construction Facilities.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CGSB 1.189M-84, Primer, Alkyd, Wood, Exterior.
 - .2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-O121-M1978, Douglas Fir Plywood.

1.3 INSTALLATION AND REMOVAL

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

1.4 SECURITY FENCING

- .1 Temporary Security Fencing through the Existing Security Fencing will be constructed by the Contractor. The access through the Security Fencing will be through the existing Principal Entrance Gates.
- .2 Security fencing has been installed around the site. Correctional Services Canada will maintain this fence but the Contractor must not touch the fence.
 - .1 Any damage to the fencing caused by contractor will be repaired by the contractor or at the contractor's expense. As an example if he damages the MDS cables or any other security system component PWGSC/CSC may arrange for repair at the contractor's expense.
 - .2 The Critical security systems including the MDS cables between the fences which are only 200mm below ground surface as well as the other systems, FDS, PIDS PA are on or in the Perimeter Fence zone. These systems need to be protected during the work.
- .3 Do not stockpile or store material or equipment within 6 meters of the perimeter secure fences.

1.5 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs in accordance with WCB regulations.

1.6 WEATHER ENCLOSURES

- .1 Provide weather tight closures to unfinished openings, tops of shafts and other openings in floors and roofs.
- .2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
- .3 Design enclosures to withstand wind pressure and snow loading.

1.7 ACCESS TO SITE

- .1 Access to Site will be limited. Refer to Section 01 52 00 Construction Facilities for parking.

1.8 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 and staff operations. Requirements will be provided when the contractor moves on site.

1.9 FIRE ROUTES

- .1 Maintain access to property including overhead clearances for use by emergency response vehicles. Detailed requirements will be provided when the contractor moves on site.

1.10 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

- .1 Protect immediate adjoining site areas, surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

1.11 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.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 42 00 - References
- .2 Section 01 73 00 - Execution

1.2 REFERENCE STANDARDS

- .1 Within text of specification sections, reference may be made to reference standards. List of standards reference writing organizations is contained in Section 01 42 00 - References.
- .2 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .3 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.
- .4 Cost for such testing will be borne by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.
- .5 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.

1.3 ACCEPTABLE PRODUCTS

- .1 Materials and products specified by "Prescriptive" or "Performance" specifications: select any material meeting or exceeding specifications.
- .2 Materials specified by reference standard: select any material meeting or exceeding the specified standard.
- .3 Materials specified under "Acceptable Materials" or "Acceptable Products": select any one of the indicated manufacturers, or any other manufacturer meeting or exceeding the Prescriptive specifications.
- .4 When materials are specified by a reference standard or by a Prescriptive or Performance specification, upon request of Departmental Representative, obtain from manufacturer an independent laboratory report showing that the material or equipment meets or exceeds the specified requirements.

1.4 SUBSTITUTION AFTER CONTRACT AWARD

- .1 No substitutions will be permitted without prior written approval of the Departmental Representative.
- .2 Proposals for substitution may only be submitted after Contract award. Such request must include statements of respective costs of items originally specified and the proposed substitution.

- .3 Proposals will be considered by Departmental Representative if:
 - .1 Materials selected by tenderer from those specified, are not available;
 - .2 Delivery date of materials selected from those materials specified would unduly delay completion of Contract; or
 - .3 Alternative material to that specified, which is brought to the attention of and considered by Departmental Representative as equivalent to the material specified, and will result in a credit to the Contract amount.

1.5 QUALITY

- .1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.6 AVAILABILITY

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.7 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 materials on solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.8 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.

1.9 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise indicated in specifications install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative may establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

1.10 QUALITY OF WORK

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

- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.11 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.

1.12 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.

1.13 REMEDIAL WORK

- .1 Refer to Section 01 73 00 - Execution.
- .2 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.
- .3 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.14 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.

1.15 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.

1.16 SECURITY FASTENERS

- .1 Where exposed fasteners are required to secure components in place, use TAMPER RESISTANT TORX PLUS SCREW (5 lobe design) as manufactured by Camcar Textron, of Rockford, Illinois; or equivalent.
- .2 Security Fasteners are required in all inmate areas and inmate accessible areas.
- .3 Security Fasteners are required for all Architectural, Mechanical, Electrical and Building Security and Communications Systems.
- .4 Components requiring security fasteners include, but are not limited to:
 - .1 Doors, drawers, and movable parts of architectural woodwork.
 - .2 Metal fabrications and all detention fabrications.
 - .3 Doors and frames.
 - .4 Access panels and doors.
 - .5 Windows.
 - .6 Door hardware.
 - .7 Glass stops.
 - .8 Toilet and bath accessories.
 - .9 Mechanical components such as fixtures, cabinets, grilles, drains, plumbing trim, fitments, and cover plates.
 - .10 Electrical components such as panels, cover plates, fixtures, detectors, fans and fitments.
- .5 Provide Departmental Representative with fifty (50) screw drivers for each different size of security fastener provided.

1.17 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.

1.18 EXISTING UTILITIES

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 11 00 - Summary of Work.
- .2 Section 01 33 00 - Submittal Procedures.
- .3 Individual product Sections: cutting and patching incidental to work of section. Advance notification to other sections required.

1.2 SUBMITTALS

- .1 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of any element of Project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of any operational element.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of Departmental Representative or separate contractor.
- .2 Include in request:
 - .1 Identification of Project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of Departmental Representative or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.

1.3 MATERIALS

- .1 Required for original installation.
- .2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.

1.4 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.

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

END OF SECTION

Part 1 General

1.1 RELATED SECTION

- .1 Section 01 74 19 - Waste Management and Disposal.
- .2 Section 01 77 00 - Closeout Procedures.

1.2 SPECIAL CLEANING

- .1 Special cleaning requirements for existing construction, including existing work which will be covered up by new work and existing work to remain as is in the finished work.

1.3 REFERENCES

- .1 Work Safe B.C. Regulations.

1.4 SPECIAL CLEANING PERFORMANCE REQUIREMENTS

- .1 Existing building construction remaining part of the finished work will require a complete and thorough cleaning before installation of new construction and finishes. Existing construction remaining unaltered by the new work but forming part of the finished work is required to be cleaned.
- .2 Cleaning includes but is not limited to all interior walls, floor and ceiling surfaces including concealed spaces such as attics, access floor, walls and soffits above accessible ceilings. Clean existing fittings, fixtures, equipment, doors, frames, electrical outlets, lights, cabinets, diffusers, panels, glazing, and metalwork.
- .3 Remove all dirt, dust, sawdust, aggregate dust, mildew, moulds, fungus, insects and other foreign materials to return the existing surface to an as new condition as much as possible. Removal of permanent stains is not a requirement unless the stain is unsuitable for the application of new finishes or is odourous.
- .4 The cleaning method selected will depend on the surface to be cleaned, its condition at the time of cleaning, the material to be removed by the cleaning process, and the requirements for new construction or finish to be applied.
- .5 Cleaning methods can include but are not limited to hand cleaning, power tool cleaning. Steam cleaning and pressure washing are not acceptable in the existing institution.
- .6 The method of cleaning and the cleaning products to be used will be left entirely to the discretion of the Contractor to suit the surface to be cleaned.
- .7 Where the method is disruptive to the operation of the existing facility, review and obtain approval from the Departmental Representative. The Contractor is advised that the work will be carried out within an existing operational building. The materials and processes must not disrupt the existing persons or operations within the institution. If required the cleaning must be carried out on a schedule acceptable to the institution.

- .8 The Contractor will be responsible for repair of finishes and materials damaged during cleaning where aggressive cleaning methods result in damage to finishes and materials.
- .9 Prepare a test patch clean on a surface to be concealed prior to commencing work on an entire area or surface.
- .10 The Contractor will be responsible for repair of damage or replacement of existing surfaces and finishes where in appropriate cleaning products and methods have been used.
- .11 Where existing construction cannot be cleaned effectively by available cleaning methods obtain direction from the Departmental Representative.
- .12 The requirements of this section are in addition to the requirements of specification trade sections which prescribe the preparation and/or acceptance of existing surfaces before the application of new finishes. Ensure that cleaning products to be used do not affect the occupants of the building and do not affect the application of new finishes to existing cleaned surfaces.

1.5 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.
- .3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .4 Provide on-site containers for collection of waste materials and debris.
- .5 Provide and use clearly marked separate bins for recycling. Refer to Section 01 74 19 - Waste Management and Disposal.
- .6 Remove waste material and debris from site and deposit in waste container at end of each working day.
- .7 Dispose of waste materials and debris off site.
- .8 Clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations.
- .9 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .10 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose. Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer. Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.6 DEMOLISHED MATERIALS AND CONSTRUCTION WASTE

- .1 The Contractor is responsible for ensuring that all materials are properly disposed of and that under no circumstances are demolished materials, construction waste, screws, fasteners, connectors and other similar items to be left in walls, ceilings, cavities, pockets, and voids.

1.7 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 debris including that caused by Departmental Representative or other Contractors.
- .5 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.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 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.
- .8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.
- .9 Clean lighting reflectors, lenses, and other lighting surfaces.
- .10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .11 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.
- .12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .13 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .14 Remove dirt and other disfiguration from exterior surfaces.
- .15 Clean and sweep roofs, gutters, areaways, and sunken wells.

- .16 Sweep and wash clean paved areas.
- .17 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.
- .18 Clean roofs, downspouts, and drainage systems.
- .19 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

- .1 Materials Source Separation Program (MSSP): Consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
- .2 Recyclable: Ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse by others.
- .3 Recycle: Process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .4 Recycling: Process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .5 Reuse: Repeated use of product in same form but not necessarily for same purpose. Reuse includes:
 - .1 Salvaging reusable materials from re-modeling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
 - .2 Returning reusable items including pallets or unused products to vendors.
- .6 Salvage: Removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .7 Separate Condition: Refers to waste sorted into individual types.
- .8 Source Separation: Acts of keeping different types of waste materials separate beginning from first time they became waste.
- .9 Waste Audit (WA): Detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction. Indicates quantities of reuse, recycling and landfill.
- .10 Waste Reduction Workplan (WRW): Written report which addresses opportunities for reduction, reuse, or recycling of materials.

1.2 DOCUMENTS

- .1 Maintain at job site, one copy of following documents:
 - .1 Waste Audit.
 - .2 Waste Reduction Workplan.
 - .3 Material Source Separation Plan.

1.3 MATERIALS SOURCE SEPARATION

- .1 Before project start-up prepare Materials Source Separation Program (MSSP) and provide containers to deposit re-usable and/or recyclable materials of the following:
 - .1 Gypsum Board.
 - .2 Insulation.
 - .3 Acoustical ceiling panels.
 - .4 Metals.
 - .5 Wood.
 - .6 Cardboard.
 - .7 Plastics
 - .8 Other materials as indicated in technical sections.
- .2 Submit before final payment summary of waste materials salvaged for reuse, recycling or disposal by project using deconstruction/disassembly material audit form:
 - .1 Provide receipts, scale tickets, waybills, and show quantities and types of materials reused, recycled, co-mingled and separated off-site or disposed of.
 - .2 For each material reused, sold or recycled from project, include amount and the destination.
 - .3 For each material land filled or incinerated from project, include amount of material and identity of landfill, incinerator or transfer station.
- .3 Implement Materials Source Separation Program (MSSP) for waste generated on project in compliance with methods as approved by Departmental Representative.
- .4 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
- .5 Locate separated materials in areas which minimize material damage.
- .6 Provide inventory of quantities of demolition materials to be salvaged for reuse, recycling, or disposal.

1.4 DIVERSION OF MATERIALS

- .1 Create a list of materials for separation from the general waste stream and stockpiled in separate containers, in compliance with fire regulations and to Departmental Representative's approval.
- .2 Mark containers and provide instruction on disposal practices.

1.5 STORAGE, HANDLING AND APPLICATION

- .1 Conform to Waste Reduction Work Plan.
- .2 Handle waste materials not being reused, salvaged or recycled in accordance with authority having jurisdiction and fire regulations.
- .3 Collect, handle, store on site and transport off-site, all materials in separated condition, to an approved and authorized recycling facility.
- .4 Provide Departmental Representative with receipts indicating quantity of material delivered to landfill.
- .5 Except as specified otherwise, materials removed from the site become the contractor's responsibility.
- .6 On-site sale of salvaged/recycled material is not permitted.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Administrative procedures preceding preliminary and final inspections of Work.

1.2 RELATED SECTIONS

- .1 Section 01 78 00 - Closeout Submittals.
- .2 Section 01 91 13 - Commissioning.

1.3 INSPECTION AND DECLARATION

- .1 Project Phasing:
 - .1 The contractor shall submit a plan that inspects completed work at the completion of each phase, corrects the work prior to proceeding to the next phase of the work.
- .2 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
 - .2 Request Departmental Representative's Inspection.
- .3 Departmental Representative's Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.
- .4 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 authorities having jurisdiction.
 - .5 Commissioning of all systems: Final commissioning reports have been submitted to the Departmental Representative.
 - .6 Operation of systems has been demonstrated to Departmental Representative's personnel.
 - .7 Work is complete and ready for Final Inspection.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 45 00 - Quality Control.
- .2 Section 01 77 00 - Closeout Procedures.
- .3 Section 01 91 13 - Commissioning.
- .4 Section 01 91 41 - Demonstration and Training.

1.2 SUBMISSION

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Copy will be returned after final inspection, with Departmental Representative's comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 Two weeks prior to Interim Completion of the Work, submit to the Departmental Representative four final copies of operating and maintenance manuals in English.
- .5 Hard copies of the Operating and Maintenance Manual System are required as specified under clause 1.3. Provide 4x copies.
- .6 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .7 If requested, furnish evidence as to type, source and quality of products provided.
- .8 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .9 Pay costs of transportation.

1.3 FORMAT HARD COPY MANUALS

- .1 Organize data in the form of an instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

- .5 Arrange content by Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: Manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in dwg format on CD.

1.4 CONTENTS - EACH VOLUME

- .1 Table of Contents: provide title of project;
 - .1 date of submission;
 - .2 names, addresses, and telephone and fax numbers of Contractor, Subcontractors, Suppliers with name of responsible parties;
 - .3 schedule of products and systems, indexed to content of volume.
 - .4 copy of hardware schedule and paint schedules, complete with the actual manufacturer, supplier and identification names and numbers.
 - .5 all extended guarantees, warranties, maintenance bonds, certificates, letters of guarantees, registration cards, as called for in the various sections of the specification.
 - .6 complete set of all final reviewed shop drawings.
 - .7 certificates of inspection by authorities having jurisdiction.
 - .8 test reports and certificates as applicable.
 - .9 complete set of as constructed drawings.
- .2 For each product or system:
 - .1 list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in

Section 01 45 00 - Quality Control.

- .6 Training: Refer to Section 01 91 41 - Demonstration and Training.

1.5 'AS CONSTRUCTED' DRAWINGS AND SAMPLES

- .1 In addition to requirements in General Conditions, maintain at the site one record copy of:
- .1 Contract Drawings;
 - .2 Specifications;
 - .3 Addenda;
 - .4 Change Orders and other modifications to the Contract;
 - .5 Reviewed shop drawings, product data, and samples;
 - .6 Field test records;
 - .7 Inspection certificates;
 - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.
- .6 Provide an electronic copy of as constructed drawings.

1.6 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of black line opaque drawings provided by Departmental Representative.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: legibly mark each item to record actual

construction, including:

- .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 References to related shop drawings and modifications.
- .5 Specifications: legibly mark each item to record actual construction, including:
- .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.7 EQUIPMENT AND SYSTEMS

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.

- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control and 01 91 13 - Commissioning.
- .15 Additional requirements: As specified in individual specification sections.

1.8 MATERIALS AND FINISHES

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional Requirements: as specified in individual specifications sections.

1.9 SPARE PARTS

- .1 Provide spare parts, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.10 MAINTENANCE MATERIALS

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in the Operating and Maintenance Manuals.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.11 SPECIAL TOOLS

- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

1.12 STORAGE, HANDLING AND PROTECTION

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

1.13 WARRANTIES AND BONDS

- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
- .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 Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.

- .7 Retain warranties and bonds until time specified for submittal.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 45 00 - Quality Control.

1.2 QUALITY ASSURANCE

- .1 Provide third party commissioning agent(s) for mechanical and electrical systems acceptable to the Departmental Representative. Provide costs of commissioning in tender price.
- .2 Commissioning Agent(s) for testing to be a current member in good standing of AABC certified to perform specified services. Comply with applicable procedures and standards of the certification sponsoring association.
- .3 The Commissioning Agent(s) to be responsible for scheduling inspections and including reports in their final submission prior to turnover.

1.3 SUBMITTALS

- .1 Submit the names of a minimum three (3) commissioning agents proposed to perform commissioning and testing services, complete with references and CV of each member of the agency who will be doing the work for this project. Submit documentation to confirm agencies compliance with quality assurance provision.
- .2 Prior to commencing commissioning services, submit 3 preliminary specimen copies of each of report forms proposed for use.
- .3 Upon completion of commissioning services, prepare and submit preliminary report. Prepare final report with corrections and completed work requested, at time of turnover. Submit 3 copies and one electronic PDF file of final reports on approved forms.
- .4 The project will not be turned over without a final report showing no deficiencies or outstanding work. Once the building is occupied there will be no opportunities to return to the range to complete work unless escorted.

1.4 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 immediately to Departmental Representative any deficiencies or defects noted during performance of services.

1.5 FINAL REPORTS

- .1 Commissioning agent to prepare final reports. Submit Operation and Maintenance manuals , testing results and reports to Commissioning Agent for final submission to Departmental Representative.
- .2 Ensure each form bears signature of recorder, and that of supervisor of reporting organization.
- .3 Identify each instrument used, and latest date of calibration of each.

1.6 COMMISSIONING AGENT'S RESPONSIBILITIES

- .1 Conduct testing and commissioning of the HVAC Equipment in accordance with the requirements in Division 23.
 - .1 The equipment supplied and installed under the General Contract will be commissioned as specified in Division 23.
- .2 Conduct mechanical system testing and balancing in accordance with mechanical requirements in Division 23 Conduct electrical testing in accordance with electrical requirements in Division 26.
- .3 Conduct a room by room inspection and sign off on every detail in each room. Based on the requirements stipulated in the specification provide to the Departmental Representative a full schedule of items to be inspected.
- .4 Room by room inspections to include:
 - .1 HVAC systems installation and operation.
 - .2 Mechanical and electrical equipment installation and operation.
- .5 Conduct a complete inspection of all vertical and horizontal service spaces inside and out including:
 - .1 Mechanical and electrical systems.
 - .2 Maintenance access.

1.7 PREPARATION

- .1 Provide instruments required for testing, adjusting, and balancing 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.

1.8 EXECUTION

- .1 Conduct room to room inspection.
- .2 Test equipment, balance distribution systems, and adjust devices for HVAC systems.
- .3 For schedule of Mechanical systems requiring testing, adjusting, and balancing services, refer to Division 23.
- .4 For schedule of Electrical systems requiring testing, start up and verification refer to Division 26, where it applies to the electrical systems.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 78 00 - Closeout Submittals
- .3 Section 01 91 13 - Commissioning

1.2 DESCRIPTION

- .1 Demonstrate scheduled operation and maintenance of equipment and systems to Departmental Representative's personnel two weeks prior to date of interim completion.
- .2 Departmental Representative will provide list of CSC personnel to Contractor and coordinate dates and times.

1.3 QUALITY CONTROL

- .1 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Departmental Representative's personnel, and provide written report that demonstration and instructions have been completed.

1.4 SUBMITTALS

- .1 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Departmental Representative's approval.
- .2 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .3 Give time and date of each demonstration, with list of persons present.

1.5 CONDITIONS FOR DEMONSTRATIONS

- .1 Equipment has been inspected and put into operation.
- .2 Testing, adjusting, and balancing has been performed in accordance with Section 01 91 13 - Commissioning and equipment and systems are fully operational.
- .3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.6 PREPARATION

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

1.7 DEMONSTRATION AND INSTRUCTIONS

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Alteration project procedures.
- .2 Removal and or salvage of designated construction.
- .3 Disposal of materials.

1.2 RELATED SECTIONS

- .1 Section 01 11 00 - Summary of Work:
 - .1 Work Affecting the Existing Building
- .2 Section 01 52 00 - Construction Facilities.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA S350-M1980(R1998), Code of Practice for Safety in Demolition of Structures.
- .2 National Building Code Part 8

1.4 SUBMITTALS

- .1 Submit detailed schedule for any and all work affecting the existing building. Consult with CSC regarding work required. Submit schedule minimum 10 calendar days prior to scheduled work.
- .2 Comply with requirement of 01 74 19 - Waste Management and Disposal.

1.5 SCHEDULING

- .1 Reference requirements in Section 01 11 00 Summary of Work
- .2 Perform noisy, malodorous, dusty, work:
 - .1 As directed by CSC and the Departmental Representative.

1.6 SUBMITTALS

- .1 Submit with the project schedule a coordinated complete series of drawings diagrams, details and supporting data clearly showing sequence of demolition and removal work, reconstruction, occupant moves required, material storage, temporary barriers for all phases of the demolition construction work.
- .2 The contractor will not be permitted to proceed until agreement with CSC and the Departmental Representative are obtained on the schedule and drawings.
- .3 Submit the qualifications and names of the persons experienced and qualified for the deconstruction work as described below.

1.7 SITE CONDITIONS

- .1 Review the Project Specific Hazardous Building Materials Assessment for Fraser Valley Institute with the Departmental Representative.
 - .1 Remove hazardous materials in a manner consistent with the Occupational Health & Safety Regulation, General Hazard Requirements of the Work Safe BC, and other applicable regulations. Changes to the Work will be dealt in accordance with the provisions of the Contract Documents.
 - .2 Handle and dispose of all hazardous and banned materials in accordance with the Special Waste Regulation, and Regional and Municipal regulations. These hazardous and banned materials include but are not limited to asbestos, drywall (banned from disposal), underground storage tanks, Polychlorinated Biphenyls (PCBs), abandoned chemicals (gasoline, pesticides, herbicides, flammable and combustible substances), freon from cooling equipment, lead-based paints, smoke detectors, and mercury containing switches.
- .2 Should material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous be encountered, stop work, take preventative measures, and notify Departmental Representative immediately.
 - .1 Do not proceed until written instructions have been received from Departmental Representative.
- .3 Notify Departmental Representative minimum 5 working days before disrupting building access or services.
- .4 The Contractor shall accept the site as it exists and will be responsible for all deconstruction work as required.

1.8 ALTERATION PROJECT PROCEDURES

- .1 Scope: Reference Mechanical Drawing M000 and Specifications.
 - .1 The approximate operating hours of the specific facility spaces is as follows:

- Programs Wing staff office area 7:30 to 16:00 Monday to Friday closed on weekends.
 - Programs wing school area 7:30 to 16:00 Monday to Friday, closed on weekends.
 - The Library and some of the class rooms are used in the evening until 22:00 all week.
 - Case Management areas 7:30 to 16:00 Monday to Friday, closed on weekends.
 - Center section area rooms 46 and 47 can be 24 /7.
- .2 The institution may accommodate various deviations for the noted operating hours of the specific spaces noted. Contractor may coordinate with Departmental Representative.
- .3 The project is required to be completed in phases. Within the tender documentation there is an estimated five phases. The contractor is to consider this scheme as a basis for developing the management and construction of the project.
- .4 Remove and reconstruct existing construction as required to install the requirements of the documents.
- .5 Existing Conditions:
- .1 Visit site at own expense prior to submission of bids and must take whatever time is required to ascertain existing site conditions and surrounding features related to the proposed deconstruction.
 - .2 Confirm conditions are suitable for execution of the work. No additional sums of money will be allowed for after acceptance of bid for any items resulting from lack of understanding and familiarity with the site conditions, and failing to report immediately to the Departmental Representative any discrepancies observed on site that are in conflict with the intent of drawings and specifications.
 - .3 Accept the site as it exists and be responsible for all deconstruction work as required.
 - .4 The contractor must include all costs for the work in the existing building.
- .2 Materials: As specified in Product sections; match existing Products and work for patching and extending work.
- .3 Employ skilled and experienced installer to perform alteration work.
- .4 Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.
- .5 Remove, cut, and patch Work in a manner to minimize damage and to provide means of restoring Products and finishes to original condition.
- .6 Refinish existing visible surfaces to remain in renovated rooms and spaces, to renewed

condition for each material, with a neat transition to adjacent finishes.

- .7 Where new Work abuts or aligns with existing, provide a smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.
- .8 When finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at a natural line of division and submit recommendation to Departmental Representative for review.
- .9 Where a change of plane of 6 mm or more occurs, submit recommendation for providing a smooth transition; to Departmental Representative for review. Request instructions from the Departmental Representative.
- .10 Patch or replace portions of existing surfaces which are damaged, lifted, discoloured, or showing other imperfections.
- .11 Finish surfaces as specified in individual Product sections.

1.9 PROTECTION

- .1 Prevent movement, settlement, or other damage to adjacent structures, utilities, and parts of building to remain in place. Provide bracing and shoring required.
- .2 Keep noise, dust, and inconvenience to occupants to a minimum.
 - .1 Refer to Section 01 11 00 Summary of Work
 - .2 Noisy work will only be permitted at times agreed to and accepted by the Departmental Representative.
- .3 Protect building mechanical and electrical systems, services and equipment.
- .4 Provide temporary dust screens, covers, railings, supports and other protection as required.
- .5 Do not overload any portion of the structure with material or equipment
- .6 Where existing load bearing partitions are to be removed, do not commence work until new support structure is installed, inspected and approved by the Departmental Representative.
- .7 Cease operations and notify the Departmental Representative if safety of any adjacent work or structure appears to be endangered. Take all precautions to support the structure. Do not resume operations until reviewed with the Departmental Representative.
- .8 Ensure safe passage of building occupants around area of demolition. Remove debris and clean areas of access immediately.

1.10 PROJECT CONDITIONS

- .1 Conduct demolition to minimize interference with adjacent and occupied building areas.

1.11 QUALITY ASSURANCE

- .1 Salvage or Demolition Firm: Company (ies) must be experienced and specializing in performing the work of this section with documented experience in similar types of deconstruction work.
- .2 Qualifications of Workers: Provide a supervisor who shall be present at all times during the deconstruction work and who shall be thoroughly familiar with the work required and who shall direct all work. Provide one (1) person on site who is responsible for maintaining the safety barriers and protection of the workers and the public.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 PREPARATION

- .1 Inspect building & site with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .2 Provide, erect, and maintain temporary barriers security partitions at locations indicated agreed to with CSC and the Departmental Representative.
 - .1 Erect and maintain temporary partitions to prevent spread of dust, odours, and noise to permit continued occupancy. Refer to phasing drawings and Demolition Drawing M000. The extent of the partitions required may exceed the information shown on the phasing drawing or demolition drawings.
- .3 Erect and maintain weatherproof closures for exterior openings.
- .4 Protect existing materials which are not to be demolished.
- .5 Prevent movement of structure; provide bracing and shoring.

3.2 PROTECTION

- .1 Maintain public safety and traffic control precautions at all times during the demolition work, using properly trained qualified persons to control all Contractor's activities, vehicles, equipment, traffic and all public pedestrian and vehicles traffic that are coming to and from the site or passing along the vicinity of the site access locations.
- .2 Prevent movement, settlement, or damage to adjacent structures, utilities, and parts of building to remain in place. Provide bracing and shoring required.
- .3 Keep noise, dust, and inconvenience to occupants to minimum.

- .4 Protect building systems, services and equipment.
- .5 Do Work in accordance with Section 01 35 33 - Health and Safety.

3.3 SALVAGE

- .1 Refer to demolition drawings and specifications for items to be salvaged for reuse.
- .2 Remove items to be reused, store as directed by Departmental Representative and re-install under appropriate section of specification.

3.4 SITE REMOVALS

- .1 Remove items as indicated.

3.5 DEMOLITION

- .1 The electrical, BSCS, Mechanical services MUST NOT be terminated within the building at any time. Notify the building Departmental Representative of any requirements for partial termination of services in accordance with Division 1 requirements. Keep down time at a minimum.
- .2 Remove parts of existing building to permit new construction. Sort materials into appropriate piles for reuse, recycling, or disposal.
 - .1 Demolish in an orderly and careful manner. Protect existing supporting structural members.
 - .2 Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.
 - .3 Remove temporary Work.

3.6 DISPOSAL

- .1 Dispose of removed materials, to appropriate recycling facilities except where specified otherwise, in accordance with authority having jurisdiction.

END OF SECTION

- .1 Obtain Departmental Representative's approval for use of earth forms.
- .2 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

- .3 Align form joints and make watertight using tape or other approved methods to maintain leak-free seal during concrete placement. Keep form joints to minimum. This clause applies to Architectural Concrete only. However, this does not relieve the Contractor from providing good workmanship and making efforts to minimize joint leakage for all concrete work.
- .4 Clean formwork in accordance with CAN/CSA-A23.1-09 before placing concrete.
- .5 Leave formwork in place for following minimum periods of time after placing concrete.
 - .1 1 day for concrete pads

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 All labour, Material, services, and equipment necessary and incidental for the concrete reinforcement as specified herein and indicated on the Drawings. All material and work specified in this Section shall be the responsibility of one contractor who will be held solely responsible for providing and co-ordinating all parts and installation.

1.2 DOCUMENTS

- .1 This section of the Specifications forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

1.3 RELATED WORK

- .1 Concrete Formwork: Section 03 10 00
- .2 Cast-in-Place Concrete: Section 03 30 00
- .3 Specific notes, details and specifications on structural drawing take precedence over these specifications.

1.4 REFERENCES

- .1 Do reinforcing work in accordance with CAN/CSA-A23.1-09.

1.5 SOURCE QUALITY

- .1 Inform Departmental Representative of proposed source of material to be supplied.
- .2 Testing of the reinforcement will be at the discretion of the Departmental Representative.

1.6 SUBSTITUTES

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

Part 2 Products

2.1 MATERIALS

- .1 Reinforcing steel: billet steel, Grade 400, deformed bars to CSA G30.18-M92 (R2007), unless indicated otherwise.
- .2 Welded steel wire fabric: to CSA G30.5. Provide in flat sheets only.

2.2 FABRICATION

- .1 Fabricate reinforcing in accordance with CAN/CSA-A23.1
- .2 Horizontal reinforcement to be made continuous around corners by use of corner bars of

same size and strength as horizontal bars and as indicated on the drawings.

Part 3 Execution

3.1 FIELD BENDING

- .1 Do not field bend reinforcement except where indicated or authorized by Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure. Use appropriate bending devices that provide code prescribed min. bending radii.
- .3 Replace bars which develop cracks or splits.

3.2 PLACING

- .1 Place reinforcing steel as indicated on drawings and in accordance with CAN/CSA-A23.1.
- .2 Reinforcement shall be protected by the minimum thickness of concrete indicated on drawings and as specified in CAN/CSA-A23.1.
- .3 Clean reinforcing steel of excess rust, dirt, mud and previously deposited concrete prior to placing concrete. Concrete reinforcement with oil spills shall be sandblasted before use. Clean reinforcement of all ice prior to placing concrete.
- .4 Anchor bolts, dowels, and steel embedments shall be set before concrete placement and shall not be inserted into placed concrete.
- .5 Drilled dowels to existing concrete shall be anchored with Hilti RE500 maximum (where specified on the drawings) to the embedment shown on the drawings. Where no embedment is shown on the drawings, the "standard" embedment specified by Hilti (or equivalent) shall be used. Installation of dowels using Hilti adhesive shall be by trained personnel only.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 All labour, Material, services, and equipment necessary and incidental for the cast-in-place concrete as specified herein and indicated on the Drawings. All material and work specified in this Section shall be the responsibility of one contractor who will be held solely responsible for providing and co-ordinating all parts and installation.

1.2 DOCUMENTS

- .1 This section of the Specifications forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

1.3 RELATED WORK

- .1 Concrete Formwork: Section 03 10 00
- .2 Concrete Reinforcing: Section 03 20 00

1.4 REFERENCE

- .1 Do work in accordance with CAN/CSA-A23.1-09 and CAN/CSA A23.2-09, except where specified otherwise.

1.5 CERTIFICATES

- .1 Provide certification that plant, equipment and materials to be used in concrete comply with the requirements of CAN/CSA-A23.1.
- .2 Provide certification that mix proportions selected will produce concrete of specified quality and yield, and that strength will comply with CAN/CSA-A23.1.

1.6 QUALITY CONTROL

- .1 Submit proposed quality control procedures for Departmental Representative's review.

1.7 SAMPLES AND PROTOTYPES

- .1 Material samples: submit the following samples of materials for approval to the Departmental Representative. Approved samples shall be used as the acceptable standard for all materials used on the project.
- .2 Forming materials,
- .3 Gaskets, sealing materials, and form jointing system (as applicable).
- .4 Form release agent.

Part 2 Products

2.1 MATERIALS

- .1 Portland cement: Type GU and to CAN/CSA-A3000-08. No mixing of brands permitted.
- .2 Water: to CAN/CSA-A23.1-09.
- .3 Aggregates: to CAN/CSA-A23.1-09. Coarse aggregates to be normal density.
- .4 Air entraining admixture: to CAN3-A266.1.
- .5 Chemical admixtures: to CAN3-A266.2 and CAN/CSA S413-07. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .6 Super-plasticizer: to CAN3-A266.5 "Guidelines for the use of Super-plasticizing Admixtures in Concrete".
- .7 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticising agents of pouring consistency, capable of developing a compressive strength of 50 MPa at 28 days.
- .8 Concrete curing and sealing compound: Where slabs are to receive resilient flooring or carpeting, use curing compounds compatible with flooring adhesive. Do not use where bond required for additional concrete or surface coating. Acceptable products are as specified in Section 03 36 20.
- .9 Bonding agent: formulated for bonding new concrete to cured concrete.

2.2 CONCRETE MIXES

- .1 Design concrete mixes in accordance with CAN/CSA-A23.1 alternate 1, to give the properties shown in tabular form on structural drawings.

Part 3 Execution

3.1 GENERAL

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

3.2 WORKMANSHIP

- .1 Obtain Departmental Representative's approval before placing concrete. Provide 24 hours' notice, minimum, prior to placing concrete.
- .2 Pumping of concrete is permitted only after approval of equipment and mix design.
- .3 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .4 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing. Provide minimum of 7 day moist curing for all slabs.

- .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 concrete over snow or ice.
- .7 Follow cold weather concrete procedures in CAN/CSA A23.1 and as noted on the drawings.
- .8 Concrete shall be deposited continuously, or in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or plains of weakness. If a section cannot be placed continuously, construction joints shall be located as permitted by the Departmental Representative. All pour and construction joints shall be formed with a straight-edge fixed to formwork. Placing shall be carried out at such a rate that concrete which is being integrated with fresh concrete is still plastic.
- .9 Compact concrete with high-frequency vibrators applied directly to concrete by experienced personnel. Do not over-vibrate.
- .10 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Attach steel dowels of deformed steel reinforcing bars with Hilti RE 500 epoxy adhesive to the depths shown on the drawings or specified by the manufacturer.
- .11 Take every precaution to protect finished surfaces from stains and abrasions. Surfaces and edges likely to be damaged during the construction period shall be especially protected.
- .12 Do not place load upon new concrete until authorized by Departmental Representative.

3.3 INSERTS

- .1 NO sleeves, ducts, pipes or other openings shall pass through joists, beams, slab bands, column capitals or columns, except where expressly detailed on structural drawings or approved by the Departmental Representative.
- .2 Anchor bolts: Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.

3.4 TOLERANCES

- .1 Concrete tolerances to be in accordance with CAN/CSA-A23.1, or as noted in Sub-section 3.1.6 of Section 03 10 00, Concrete Formwork.

3.5 PATCHING

- .1 General:
 - .1 Areas to be repaired shall be determined by the Departmental Representative and shall not exceed 0.2 m² for each 100 m² of surface area, and shall be widely dispersed. Repairs shall match the surrounding area. Patching of slabs and concrete paving will not be accepted. Removal and replacement of work shall be

at no additional cost.

- .2 Before commencing any repair work, the Contractor shall confirm repair procedures with the Departmental Representative and establish the formula required by trial mix. The Contractor shall demonstrate his repair techniques on a prototype sample panel.
- .2 Repair of cracks in concrete slabs and slabs-on-grade shall be the sole responsibility of the Contractor at no expense to the Departmental Representative to satisfy the installation and performance requirements of the floor finishes. This may include grinding off curled edges at slab cracks.

3.6 FINISHING

- .1 Formed surface: The finishes to be provided for the various formed surfaces shall be:
 - .1 Unexposed Finish:
 - .1 This finish shall apply to formed surfaces which are not exposed to view and where roughness is not objectionable.
 - .2 The surface, in general, shall not require any treatment after form removal, other than repair of defective concrete, snap-tie holes, and the removal of ridges and surface irregularities.
 - .2 Unformed surface: The finish to be provided for the various unformed surfaces shall be:
 - .1 Final finishing shall be accomplished by mechanical floating, mechanical trowelling, creation of the specified surface finish, and tooling of edges and joints, in that order. Exposed edges and corners shall be as detailed. Surfaces at tooled edges shall be trowelled and sand-blasted to remove tool edge marks. Hand floating and trowelling shall only be permitted in small areas of restricted access. All final finishing procedures shall conform to the requirements of CAN/CSA-A23.1, Clause 7.
 - .2 Final finishing shall commence after bleed water has disappeared from the surface and when the concrete has stiffened sufficiently to prevent the working of excess water to the surface. No additional dry cement or water shall be used to facilitate finishing.

3.7 HOUSEKEEPING AND EQUIPMENT PADS

- .1 Provide concrete pads and curbs under equipment where indicated on drawings and as specified in Division 21, 22, 23 and Division 26, 28 and to approved shop drawings. Prepare base concrete with a rough scratch finish and use an approved bonding agent to bond concrete pad to base course. Dowel pads and curbs to base slab in accordance with details on the drawings.

3.8 QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory pre-approved by the Departmental Representative in accordance with CAN/CSA-A23.1. Non-destructive Methods for Testing Concrete shall be in accordance with CAN/CSA-A23.2.
- .2 Contractor will pay for costs of tests.
- .3 Testing Laboratory will take additional test cylinders during cold weather concreting. Cure cylinders on job site under the same conditions as concrete which they represent.
- .4 If results of tests show concrete to be less than specified in quality or strength, the Departmental Representative shall have the right to have the mix designs altered for the remainder of the work at no cost. Further testing and remedial measures required by CAN/CSA-A23.1 shall be done, the costs of this work paid for by the Contractor.
- .5 Inspection or testing will not augment or replace Contractor quality control nor relieve him of his contractual responsibilities.
- .6 Contractor to coordinate testing agency with concrete placement providing testing agency with sufficient time to provide personnel and equipment.
- .7 Where field tests show that concrete is not within tolerance for slump and air, the truck shall be returned to the batch plant as soon as the results are obtained. The contractor shall not place concrete that has been shown not to meet the specifications.
- .8 For additional information see Section 01 45 00 Quality Control.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 - Waste Management and Disposal.
- .3 Section 01 61 00 - Product Requirements
- .4 Section 09 90 00 - Painting.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A53/A53M-10, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A307-07b, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.
 - .2 CAN/CGSB-1.181-99, Ready-Mixed, Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-G40.20/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel.
 - .2 CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CAN/CSA-S16-09, Limit States Design of Steel Structures.
 - .4 CSA W48-09, Filler Metals and Allied Materials for Metal Arc Welding
 - .5 CSA W59-03 (R2008), Welded Steel Construction (Metal Arc Welding).

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings
 - .1 Submit shop drawings in accordance with Section 01 3300 - Submittal Procedures.

- .2 Have shop drawings prepared by a structural engineer registered in B.C. for items required to be designed in accordance with Part 4.0 of the National Building Code.
- .3 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.4 LETTERS OF ASSURANCE

- .1 Have the Engineer responsible for sealing the engineered shop drawings submit to the Departmental Representative Schedule B-1 Assurance of Professional Design and Commitment for Field Review and Schedule B-2 Summary of Design and Field Review Requirements with the shop drawings.
- .2 Engineer to provide field review of the installation and submit to the Departmental Representative Schedule C-B Assurance of Professional Field Review and Compliance upon completion of the work.

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 Do steel welding to CSA W59 by fabricators certified by the Canadian Welding Bureau - CSA W47.1. All fabrications to be certified to Division 1 or Division 2.
- .4 Do steel resistance welding to CSA W55.3 by fabricators certified by the Canadian Welding Bureau - CSA W47.1.
- .5 Do aluminum welding to CSA W59.2 by fabricators certified by the Canadian Welding Bureau to CSA W47.2. All fabrications to be certified to Division 1 or Division 2.
- .6 Submit Welders Certificates for welders employed on the Work, to verify qualification within the previous 12 months.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, Shipping, Handling and Unloading:
 - .1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Product Requirements.
- .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.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Waste Management and Disposal.
- .2 Remove from site and dispose of 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.

Part 2 Products

2.1 MATERIALS

- .1 Steel sections and plates: to CAN/CSA-G40.20/G40.21, Grade 350W.
- .2 Steel pipe: to ASTM A53/A53M standard weight], black finish.
- .3 Steel Tubing: ASTM A500, Grade B.
- .4 Welding materials: to CSA W59.
- .5 Welding electrodes: to CSA W48 Series.
- .6 B Bolts, Nuts, and Washers: ASTM A307 galvanized to ASTM A153 for galvanized components.
- .7 Grout:
 - .1 Non-shrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C1107/C1107M-11, specifically recommended by manufacturer for heavy-duty loading applications.
 - .2 Non-shrink, Non-metallic Flowable Grout: Factory-packaged, non-staining, non-corrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- .8 Fasteners
 - .1 Security Fasteners: In accordance with Section 01 61 00.
 - .2 Fastener other than security fasteners:
 - .1 General: Provide zinc plated fasteners complying with ASTM B633, Class Fe/Zn 25 for electrodeposited zinc coating, for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.
 - .2 For aluminum fabrications provide Type 304 stainless steel fasteners.

- .3 Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade, with hex nuts, ASTM A563, and, where indicated, flat washers.
- .4 Machine Screws: ANSI B18.6.3.
- .5 Lag Bolts: ANSI B18.2.1.
- .6 Plain Washers: Round, carbon steel, ANSI B18.22.1.
- .7 Lock Washers: Helical, spring type, carbon steel, ANSI B18.21.1.
- .8 Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E488 conducted by a qualified independent testing agency.
- .9 Material: Carbon steel components zinc-plated to comply with ASTM B633, Class Fe/Zn 5.
- .10 Material: Group 1 alloy 304 or 316 stainless-steel bolts and nuts complying with ASTM F593 and ASTM F594.

2.2 FABRICATION

- .1 For Work Exposed To View: Take special care in choosing materials that are smooth and free of blemishes such as pits, roller marks, trade names, scale and roughness. Fabricate work with uniform, hairline tight joints. Form welded joints and seams continuously and grind flush and smooth to be invisible after painting. Fillet welds will not be accepted; plug welds and flush welds are required. For exposed fasteners, in inmate areas use security fasteners in other areas, use hex head bolts or Robertson head machine screws.
- .2 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .3 Where possible, fit and shop assemble work, ready for erection.
- .4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush. Fabricate all miscellaneous metalwork shown and detailed in the drawings and listed in this section in the quantities required.
- .5 Assemble built up work in the shop and match mark for correct field erection. Execute work in accordance with reviewed shop drawings.
- .6 All copes, mitres and butt cuts in surfaces exposed to view shall be made with uniform gaps of 3.0 mm if detailed to be open joints or in uniform contact if detailed without gaps.
- .7 Weld in such a manner as to avoid distortion, discolouration or damage to the members.
- .8 Weld exposed exterior work continuously to provide a proper weathering seal to prevent leakage and other damage.

- .9 Weld interior work continuously along the entire line of contact except where spot welding is indicated or permitted.
- .10 Grind smooth welds where exposed to view.
- .11 Provide all required holes in metalwork for attaching other materials.
- .12 Drill for countersunk screws if exposed to view unless otherwise shown or accepted by the Departmental Representative.
- .13 Locate holes in structural members for connections or for other purposes so as not to cause appreciable reduction in the strength of members.
- .14 Reinforce all work to suit the purpose for which it is intended and to withstand design loads.
- .15 Fabricate work square, true, straight and accurate to detail with sharply, defined profiles.
- .16 Fabricate curved work to smooth, uniform constant radii as detailed.
- .17 Joints in materials shall be cut to form fine hairline joints flush with adjacent surfaces.
- .18 Provide suitable temporary bracing as required to maintain alignment during shipment and erection
- .19 Galvanize exterior items after fabrication.

2.3 FINISHES

- .1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m² to CAN/CSA-G164. Locate galvanizing exterior drain/vent holes such that all holes will be to underside of installed item in final position.
- .2 Shop coat primer for non-painted steel: to CAN/CGSB-1.40.
- .3 Zinc primer for non-painted steel: zinc rich, ready mix to CAN/CGSB-1.181.
- .4 For items to be finish painted conform to Section 09 90 00 for primer types.

2.4 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.

2.5 SHOP PREPARATION FOR PAINTING

- .1 Clean metal of all loose mill scale, rust, oil, dirt and all other foreign matter.

- .2 Clean interior metal to be painted in accordance with SSPC SPI Solvent Cleaning followed with SSPC SP.6 Commercial Blast Cleaning.
- .3 Clean exterior metal to be painted in accordance with SSPC SPI Solvent Cleaning followed with SSP C SP.10 Near White Metal Blast Cleaning.
- .4 Remove or repair sharp edges, burrs, weld spatter and other defects to steel members prior to application of primers.

2.6 SHOP PAINTING

- .1 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items. For items to be finish painted apply primers in accordance with MPI requirements Section 09 90 00. Apply primer as specified under Section 09 90 00 in accordance with manufacturer's directions. Ensure that primer is applied within 8 hours of completion of surface preparations.
- .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 degrees C.
- .3 Clean surfaces to be field welded; do not paint.
- .4 All exterior metal in contact with masonry or concrete shall be back-primed before installation.
- .5 If the correct primer is not applied by this section of the Work, this section is responsible for removal of the incorrect primer, re-conditioning the surface and applying the correct primer as specified, including removal and re-installation of the affected work as required.
- .6 Primer applied to surfaces not properly prepared in accordance with specified SSPC preparations will be rejected by the Departmental Representative and shall be removed, brought up to the specified requirements and re-installed by the Contractor at no additional cost to the Departmental Representative.
- .7 All paint and primer to be free of lead.

Part 3 Execution

3.1 ERECTION

- .1 Do welding work in accordance with CSA W59 unless specified otherwise.
- .2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .3 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .4 Exposed fastening devices to match finish and be compatible with material through which they pass.

- .5 Provide components for building by other sections in accordance with shop drawings and schedule.
- .6 Make field connections with bolts to CAN/CSA-S16, or weld.
- .7 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.
- .9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

3.2 SCHEDULES

- .1 Refer to the drawings.

3.3 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit product data sheets for sheet vapour retarders. Include:
 - .1 Product characteristics.
 - .2 Performance criteria.
 - .3 Limitations.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Waste Management and Disposal, and with the Waste Reduction Workplan.
- .2 Collect, package and store polyethylene cut offs and waste material for recycling in accordance with Waste Management Plan.

Part 2 Products

2.1 SHEET VAPOUR BARRIER

- .1 Polyethylene film: to CAN/CGSB-51.34, 0.15 mm thick.

2.2 ACCESSORIES

- .1 Joint sealing tape: Type recommended by vapour barrier manufacturer, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.

Part 3 Execution

3.1 INSTALLATION

- .1 Ensure services are installed and inspected prior to installation of retarder.
- .2 Seal off the ground area occupied by the building to prevent migration of moisture from ground to building space.
- .3 Lay membrane in full widths and lengths over gravel and lap joints a minimum 300 mm.

- .4 Where membrane abuts vertical surfaces, carry up vertical walls to top of slabs.
- .5 Seal all laps and joints, and tight to all services projections.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 - Waste Management and Disposal.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM International)
 - .1 ASTM A653/A653M03, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 Roofing Practices Manual as published by the Roofing Contractor's Association of British Columbia.
- .3 Sheet Metal and Air Conditioning Contractor's National Association, Inc., "Architectural Sheet Metal Manual" (SMACNA).

1.3 SAMPLES

- .1 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 74 19 – Waste Management and Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard 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 paint and sealant material must be disposed of at an official hazardous material collections site as approved by Departmental Representative.
- .8 Unused paint and sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .9 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 SHEET METAL MATERIALS

- .1 Zinc coated steel sheet: minimum 0.61 mm thickness, commercial quality to ASTM A653/A653M, with Z275 designation zinc coating, prefinished with PPG Duranar , custom colour as selected by the Departmental Representative.

2.2 ACCESSORIES

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Plastic cement: to CAN/CGSB 37.5.
- .3 Self-adhered Membrane: SBS modified asphalt, minimum 40 mil thickness.
- .4 Sealants: In accordance with Section 07 92 00.
- .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, to CSA B111, flat head roofing nails of length and thickness suitable for metal flashing application.
- .7 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .8 Touch-up paint: as recommended by prefinished material manufacturer.

2.3 FABRICATION

- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable RCABC details, SMACNA details 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 to be embedded in concrete or mortar.

2.4 METAL FLASHINGS AND FORM SHEET METAL

- .1 Form flashings, copings, cap flashings and fascias to profiles indicated of 0.61 mm thick galvanized, prefinished steel.
- .2 Form roof edge metal upstands from minimum 1.22 mm thick, galvanized steel. To Form roof edge metal upstands ("Sheet Metal Parapet") or other descriptions noted on drawings from minimum 1.22mm thick galvanized steel or as specified thickness on drawings.

Part 3 Execution

3.1 INSTALLATION OF SELF ADHERED MEMBRANE

- .1 Inspect self-adhered membrane for damage upon delivery to site. Replace defective material.
- .2 Install membrane as detailed in strict accordance with manufacturer's written directions.
- .3 Prior to installation of membrane cover all exposed fasteners, sharp corners and other similar conditions detrimental to the membrane with small strips or patches of membrane to prevent sharp edges from penetrating finished membrane.
- .4 Install membrane under cap flashings and over upper leg of cross cavity flashings.

3.2 INSTALLATION

- .1 Install sheet metal work in accordance with RCABC details, SMACNA details and as indicated.
- .2 Use concealed fastenings except where approved before installation.
- .3 Counter flash bituminous flashings at intersections of roof with vertical surfaces and curbs. Flash joints using S-lock seams forming tight fit over hook strips, as detailed.
- .4 Use standing seams at corners.
- .5 Lock end joints and caulk with sealant.
- .6 Install surface mounted reglets true and level, and caulk top of reglet with sealant.
- .7 Insert metal flashing into reglets and under cap flashings to form weather tight junction.
- .8 Turn top edge of flashing into recessed reglet or mortar joint minimum of 25 mm. Lead wedge flashing securely into joint.
- .9 Caulk flashing at reglet and cap flashing with sealant.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Fire stopping and smoke seals within mechanical assemblies (i.e., inside ducts, dampers) and electrical assemblies (i.e. inside cable trays) are specified in Divisions 21 , 22, 23, 25, 26, 27, 28 respectively.

1.2 REFERENCES

- .1 Underwriter's Laboratories of Canada (ULC)
 - .1 ULC-S115-1995, Fire Tests of Firestop Systems.

1.3 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit duplicate 300 x 300 mm samples showing actual firestop material proposed for project.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation. Construction details should accurately reflect actual job conditions.
- .3 Show location of all seals covered under this section including numbered index of seals and applicable underwriter's listing design.

1.5 PRODUCT DATA

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

1.6 QUALIFICATIONS

- .1 Manufacturer: Company specializing in manufacturing Products of this section with a minimum of three (3) years experience. Provide a manufacturer's direct technical representative to be on site during initial installation of fire stop systems to train personnel in proper selection and installation procedures. The technical representative shall carry out regular site inspections during the firestopping work to ensure that the installation is carried out in accordance with manufacturer's printed installation instructions and that deficiencies are corrected.
- .2 Applicator: Approved, certified, licensed or otherwise qualified by the manufacturer of firestopping materials with a minimum of three (3) years proven experience. Submit Certificate.

- .3 Product: Manufactured under an underwriter's follow-up program and bearing listing ULC or cUL label.
- .4 Pre-Installation Conference: Convene a meeting between related sections following award of contract to discuss firestopping requirements. Ensure that other sections are aware of the maximum and minimum clearance requirements to the penetration stipulated by the underwriter's design listing.
- .5 Equivalencies: For those firestop applications that exist for which no ULC or cUL tested system is available through a manufacturer, a manufacturer's engineering judgement derived from similar ULC or cUL system designs or other tests shall be submitted to local authorities having jurisdiction for their review and approval prior to installation.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Waste Management and Disposal.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

Part 2 Products

2.1 GENERAL

- .1 General: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire resistance rated systems.

2.2 MATERIALS

- .1 Firestopping Systems: Tested in accordance with ULC S-115 or CAN4-S115M, listed and certified by a third party testing agency, asbestos free, ULC or cUL labelled, and bearing the following rating:
 - .1 Firestop System Rating: In accordance with the National Building Code.
 - .2 Firestop system shall act as an effective smoke seal and have a flame spread rating less than 25.
- .2 Service penetration assemblies: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.
- .3 Service penetration firestop components: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.13 and ULC Guide No.40 U19.15 under the Label Service of ULC.

- .4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
- .5 The fire protection rating of installed firestopping assembly in a non rated floor or wall assembly shall not be less than twenty (20) minutes when tested in accordance with CAN4-S115M.
- .6 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .7 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .8 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .9 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .10 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .11 Sealants for vertical joints: non-sagging.

Part 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 Maintain insulation around pipes and ducts penetrating fire separation.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.2 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 unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
- .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .4 Tool or trowel exposed surfaces to a neat finish.
- .5 Remove excess compound promptly as work progresses and upon completion.

3.3 INSPECTION

- .1 Notify Departmental Representative when ready for inspection and prior to concealing or enclosing firestopping materials and service penetration assemblies.

3.4 SCHEDULE

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

3.5 CLEAN UP

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures:
- .2 Section 01 45 00 - Quality Control:
- .3 Section 01 61 00 - Basic Product Requirements:
- .4 Section 01 74 19 - Waste Management Disposal:
- .5 Section 07 62 00 – Sheet Metal Flashing and Trim:

1.3 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
 - .2 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE/MOCK-UP

- .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
- .2 Construct mock-up to show location, size, shape and depth of joint s complete with back-up material, primer, caulking and sealant.
- .3 Mock-up will be used:
 - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
- .4 Locate where directed.
- .5 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with sealant work.
- .6 When accepted, mock-up will demonstrate minimum standard of quality required for this Work. Approved mock-up may remain as part of finished Work.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 - Product Requirements.
- .2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard 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 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.

- .9 Fold up metal banding, flatten, and place in designated area for recycling.

1.8 PROJECT CONDITIONS

- .1 Environmental Limitations:

- .1 Do not proceed with installation of joint sealants under following conditions:

- .1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C.

- .2 When joint substrates are wet.

- .2 Joint-Width Conditions:

- .1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

- .3 Joint-Substrate Conditions:

- .1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.9 ENVIRONMENTAL REQUIREMENTS

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

Part 2 Products

2.1 SEALANT MATERIALS

- .1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.
- .2 When low toxicity caulks are not possible, confine usage to areas which offgas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.
- .3 Where sealants are qualified with primers use only these primers.
- .4 Colours as selected by the Departmental Representative from manufacturer's complete range of available colours.

2.2 SEALANT MATERIAL DESIGNATIONS

- .1 Urethanes One Part.
 - .1 CAN/CGSB-19.13.
 - .2 Applicable: Exterior locations in non-secure areas at joints between dissimilar construction.
- .2 Silicones One Part.
 - .1 To CAN/CGSB-19.13.
 - .2 Applicable: Exterior locations in non-secure areas for metal to metal contact.
- .3 Mildew resistant:
 - .1 Applicable: Interior non-secure areas including: junction of washroom fixtures
 - .2 to walls and floors; junction of vanities to walls; around washroom accessories in tile surfaces; joint between vanity counters and backsplash; joints between wall tiles at internal corners.
- .4 Security Sealants – Interior
 - .1 Two-part, non-sag, chemically curing epoxy adhesive/sealant, specifically designed for use in interior security areas.
 - .2 Acceptable Product: Pecora Dynapoxy EP-1200; or equivalent.
 - .3 Applicable: Interior joints as detailed.
 - .4 In Addition to (over and above) the scope shown on all the drawings, provide for an additional supply and install of 500 linear meters of sealant. After award, the Contractor upon request from the Departmental Representative, provide a break out cost of the additional 500 linear meters in the Schedule of Values. Locations will be determined by the Departmental Representative as work proceeds up to and including the completion of the work of this Contract. The contractor must allow in their schedule, time for the Departmental Representative to review the as built building conditions for the purposes of determining locations and providing directions to apply the additional sealant.
- .5 Security Sealants – Exterior
 - .1 Two-part, non-sag, chemically curing epoxy sealant, specifically designed for use in exterior security areas.
 - .2 Acceptable Product: Euclid Chemical Euco #452-P epoxy system; or equivalent.
 - .3 Applicable: Exterior joints as detailed.

- .4 In Addition to (over and above) the scope shown on all the drawings, provide for an additional supply and install of 50 linear meters of sealant. After award, the Contractor upon request from the Departmental Representative, provide a break out cost of the additional 50 linear meters in the Schedule of Values. Locations will be determined by the Departmental Representative as work proceeds up to and including the completion of the work of this Contract. The contractor must allow in their schedule, time for the Departmental Representative to review the as built building conditions for the purposes of determining locations and providing directions to apply the additional sealant.
- .6 Preformed Compressible and Non-Compressible back-up materials.
 - .1 Polyethylene, Urethane, Neoprene or Vinyl Foam.
 - .1 Extruded closed cell foam backer rod.
 - .2 Size: oversize 30 to 50 %.
 - .2 Neoprene or Butyl Rubber.
 - .1 Round solid rod, Shore A hardness 70.
 - .3 High Density Foam.
 - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m³ density, or neoprene foam backer, size as recommended by manufacturer.
 - .4 Bond Breaker Tape.
 - .1 Polyethylene bond breaker tape which will not bond to sealant.

2.3 JOINT CLEANER

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

Part 3 Execution

3.1 PROTECTION

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

3.2 SURFACE PREPARATION

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

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

3.3 PRIMING

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

3.4 BACKUP MATERIAL

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

3.5 MIXING

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

3.6 APPLICATION

- .1 Sealant:
 - .1 Apply sealant in accordance with manufacturer's written instructions.
 - .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
 - .3 Apply sealant in continuous beads.
 - .4 Apply sealant using gun with proper size nozzle.
 - .5 Use sufficient pressure to fill voids and joints solid.
 - .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
 - .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
 - .8 Remove excess compound promptly as work progresses and upon completion.

.2 Curing:

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

.3 Clean-up:

- .1 Clean adjacent surfaces immediately and leave Work neat and clean.
- .2 Remove excess and droppings, using recommended cleaners as work progresses.
- .3 Remove masking tape after initial set of sealant.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 09 29 00 - Gypsum Board: Gypsum board.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A645-05 Standard For Non-Structural Steel Framing Members.
 - .2 ASTM A653/A653M-08, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .3 ASTM A1003-M08, Standard specification for sheet steel, carbon, metallic and non-metallic coated for cold formed framing members.
 - .4 ASTM C1002-07, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.40-97, Primer, Structural Steel, Oil Alkyd Type.
 - .2 CAN/CGSB-19.21-M87, Sealing and Bedding Compound Acoustical.

1.3 DESIGN REQUIREMENTS

- .1 Include the cost of engineered design of all interior steel stud partition framing in the Contract Price.
 - .1 Design framing to limit deflection to $L/240$.
 - .2 Use studs having same width as shown on the drawings.
 - .3 Install studs at spacing not greater than that shown on the drawings.
 - .4 Design assemblies to resist safely and effectively all loads and effects of loads in accordance with Part 4.0 of the National Building Code for equipment, washroom accessories, fixtures, cabinets, backing plates, anchorages and similar items supported on or anchored to steel stud partitions, including work shown on the drawings, equipment supplied by the Departmental Representative to the Contractor for installation and equipment supplied and installed by the Departmental Representative. Obtain information regarding equipment loads from the Departmental Representative.

1.4 SUBMITTALS

- .1 Submit engineered shop drawings for steel stud framing, prepared, signed and sealed by a structural engineer registered in the Province of British Columbia.

1.5 LETTERS OF ASSURANCE

- .1 Have the engineer responsible for sealing the engineered shop drawings submit to the Departmental Representative, Schedule B-1 Assurance of Professional Design and Commitment for Field Review and Schedule B-2 Summary of Design and Field Review Requirements with the shop drawings.
 - .1 Engineer to provide field review of the installation and submit to the Departmental Representative Schedule C-B Assurance of Professional Field Review and Compliance upon completion of the work.

1.6 QUALITY ASSURANCE

- .1 Work of this section shall conform to the Association of Wall and Ceiling Contractors (AWCC) Standards Manual.
- .2 Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members", for calculating structural characteristics of cold-formed metal framing.
- .3 Manufacturer Qualifications: Company specializing in work of this section, with minimum 5 years documented experience.
- .4 Installer Qualifications: Company specializing in work of this section, with minimum 3 years documented experience in commercial quality work of comparable scope.
- .5 Regulatory Requirements:
 - .1 Comply with local and provincial codes, ordinances, and other regulatory requirements.
 - .2 Comply with applicable ULC or WH tested design for fire-resistive assemblies.
- .6 Coordination:
 - .1 Conform with Product Requirements in Division 01, for coordination with related Sections.
 - .2 Coordinate installation of backing and bearing plates for casework, equipment, specialties, utilities, and other items required by other Sections, including Division 22 Plumbing, Division 23 Heating, Ventilating and Air Conditioning and Division 26 Electrical.
 - .3 Coordinate work of this Section with Section 07 84 00 Firestopping for firestopping installations prior to installation of gypsum board systems.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Divert steel scraps from landfill by disposal at nearest metal recycling facility.
 - .1 Divert reusable materials for reuse at nearest used building materials facility or similar type facility.

- .2 Divert unused primer materials from landfill through disposal at a special wastes depot.

Part 2 Products

2.1 MATERIALS

- .1 Non-load bearing channel stud framing: to ASTM C 645, stud size as scheduled and detailed, roll formed from 0.91 mm thickness hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460 mm centres.
- .2 Floor and ceiling tracks: to ASTM C 645, in widths to suit stud sizes, 32 mm flange height, and 50 mm flange height under structural steel framing.
- .3 Metal channel stiffener: 38 x 12 mm size, 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.
- .4 Acoustical sealant: to CAN/CGSB-19.21.
- .5 Acoustical Insulating strip: rubberized, moisture resistant 3 mm thick foam strip, 12 mm wide, with self sticking adhesive on one face, lengths as required.
- .6 Security Mesh: 3/4-13F security mesh (Product No. 0700320) as supplied by PacificWest Systems Supply, telephone: 604-294-6864, or approved substitution.

Part 3 Execution

3.1 ERECTION

- .1 Install steel stud tracks and studs in accordance with engineered shop drawings.
- .2 Align partition tracks at floor and ceiling and secure at 600 mm o.c. maximum, unless lesser spacing prescribed on engineered shop drawings.
- .3 Install damp proof course under stud shoe tracks of partitions on slabs on grade.
- .4 Place studs vertically at 400 mm oc maximum and not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .5 Erect metal studding to tolerance of 1:1000.
- .6 Attach studs to bottom track using screws.
- .7 Install 50 mm deep ceiling tracks under structural steel framing above. Cut steel studs 12 mm short of underside of structure to allow for deflection.
- .8 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

- .9 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.
- .10 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.
- .11 Install heavy gauge single jamb studs at openings.
- .12 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.
- .13 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.
- .14 Provide 40 mm stud or furring channel secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions.
- .15 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .16 Extend partitions to ceiling height except where noted otherwise on drawings.
- .17 Install continuous insulating strips to isolate studs from uninsulated surfaces.
- .18 Install two continuous beads of acoustical sealant or insulating strip under studs and tracks around perimeter of sound control partitions.

3.2 SECURITY MESH

- .1 Install security mesh to walls as scheduled.
- .2 Spot weld mesh to studs at each stud and at 200 mm o.c. vertically.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 - Waste Management and Disposal.
- .3 Section 09 22 16 – Non-structural Metal Framing.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C36/C36M-01, Specification for Gypsum Wallboard.
 - .2 ASTM C79/C79M-01, Standard Specification for Treated Core and Non-treated Core Gypsum Sheathing Board.
 - .3 ASTM C442/C442M-01, Specification for Gypsum Backing Board, Gypsum Coreboard, and Gypsum Shaftliner Board.
 - .4 ASTM C475-01, Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .5 ASTM C514-01, Specification for Nails for the Application of Gypsum Board.
 - .6 ASTM C630/C630M-01, Specification for Water-Resistant Gypsum Backing Board.
 - .7 ASTM C840-01, Specification for Application and Finishing of Gypsum Board.
 - .8 Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.84 mm to 2.84 mm in Thickness.
 - .9 ASTM C1002-01, Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - .10 ASTM C1047-99, Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - .11 ASTM C1280-99, Specification for Application of Gypsum Sheathing Board.
 - .12 ASTM C1177-01, Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- .2 Association of the Wall and Ceilings Industries International (AWCI)
- .3 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-1988(R2000), Surface Burning Characteristics of Building Materials and Assemblies.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in original packages, containers or bundles bearing manufacturers brand name and identification.
- .2 Store materials inside, level, under cover. Keep dry. Protect from weather, other elements and damage from construction operations and other causes.
- .3 Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal accessories and trim from being bent or damaged.

1.4 SITE ENVIRONMENTAL REQUIREMENTS

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

1.5 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 paper, plastic, polystyrene, corrugated packaging material for recycling in accordance with Waste Management Plan.
- .4 Divert unused gypsum from landfill to gypsum recycling facility for disposal by Departmental Representative.
- .5 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Standard board: to ASTM C36/C36M regular, and Type X, 1200 mm wide x maximum practical length, ends square cut, edges beveled, thickness as detailed.
- .2 Backing board and coreboard: to ASTM C442/C442M regular, and Type X, squared edges, thickness as detailed.
- .3 Water-resistant board: to ASTM C630/C630M regular, and Type X, 1200 mm wide x maximum practical length, thickness as detailed.
- .4 Abuse Resistant Board: Minimum Performance Levels

- .1 Surface Abrasion: Level 2 Tested in accordance with ASTM C 1629 and ASTM D 4977.
- .2 Indentation Resistance: Level 1 Tested in accordance with ASTM C 1629 and ASTM D 5420.
- .3 Soft-body Impact: Level 1 Tested in accordance with ASTM C 1629 and ASTM E 695.

	Abrasion	Indentation	Hard Body Impact	Soft Body Impact
Category 1	15 cycles	0.15 in.	30 ft-lbs	120 ft-lbs
Category 2	30 cycles	0.13 in.	40 ft-lbs	180 ft-lbs
Category 3	100 cycles	0.10 in.	80 ft-lbs	210 ft-lbs
Category 4	500 cycles	0.08 in.	110 ft-lbs	300 ft-lbs
Category 5	1000 cycles	N/A	N/A	N/A

- .4 Acceptable Product – Where Moisture and Mold Resistant GWB is specified on drawings.
 - .1 United States Gypsum - Fiberock® brand aqua-tough™ Gypsum Fiber Interior Panels, or equivalent. Satisfies Category 2 Criteria.
 - .2 Finish – USG Brand tuff-hide Primer-Surfacer, or equivalent.
- .5 Acceptable Product – Where VHI GWB is specified on drawings.
 - .1 United States Gypsum - Fiberock® Brand VHI Abuse-Resistant Gypsum Fiber Interior Panels, or equivalent.
 - .2 Finish – USG Brand tuff-hide Primer-Surfacer, or equivalent.
 - .3 Provide control joints in walls longer than 10m.
- .6 Paperless Gypsum Wallboard: to ASTM C 1177 and ASTM C 630, thickness as detailed. Acceptable Product: Georgia Pacific Dens Armor Plus, or equivalent.
- .7 Glass mat gypsum substrate sheathing: to ASTM C1177/C1177M, thickness as detailed, 1200 mm wide x maximum practical length.
- .8 Steel drill screws: to ASTM C1002.
- .9 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, metal, zinc-coated by electrolytic process, 0.5 mm base thickness, perforated flanges, one piece length per location.
- .9 Joint compound: to ASTM C475, asbestos-free.

Part 3 Execution

3.1 ERECTION

- .1 Do application and finishing of gypsum board in accordance with ASTM C840 except where specified otherwise.
- .2 Do application of gypsum sheathing in accordance with ASTM C1280.

3.2 APPLICATION

- .1 Do not apply gypsum board until bucks, anchors, blocking, sound attenuation, electrical and mechanical work are approved.
- .2 Apply gypsum board to metal furring or framing using screw fasteners. Maximum spacing of screws 300 mm on centre.
 - .1 Single-Layer Application:
 - .1 Apply gypsum board on ceilings prior to application of walls in accordance with ASTM C840.
 - .2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.
 - .2 Double-Layer Application:
 - .1 Install gypsum board for base layer and exposed gypsum board for face layer.
 - .2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm.
 - .3 Apply base layers at right angles to supports unless otherwise indicated.
 - .4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.
 - .3 Type: Refer to drawings and schedules.
- .3 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.
- .4 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.
- .5 Install exterior gypsum sheathing board in accordance with AWCC manual, ASTM C1280 and manufacturer's printed instructions. Install sheathing with gold side out. Use maximum possible lengths to minimize number of joints. Locate edge joints parallel to and located on framing. Stagger intermediate end joints of adjacent lengths sheets. Fixing: Single screw,

screws at maximum 200 mm o.c. over supports. Set screws slightly below surface and not closer than 9 mm to edges.

- .6 Do not install damaged or damp boards.
- .7 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.3 INSTALLATION

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm on centre.
- .2 Install casing beads around perimeter of suspended ceilings.
- .3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated.
- .4 Install access doors to electrical and mechanical fixtures specified in respective sections. Rigidly secure frames to furring or framing systems.
- .5 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.
- .6 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 Levels of finish:
 - .1 Level 0: No tapping, finishing or accessories required.
 - .2 Level 1: Embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable. Use this finish in areas where the assembly will be completely concealed from view such as in ceiling spaces and behind solid wall and ceiling finishes.
 - .3 Level 3: Embed tape for joints and interior angles in joint compound and apply two separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges. Use this finish in areas where the assembly will receive a heavy or medium texture spray or heavy weight wall covering.
 - .4 Level 4: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges. Use this finish in areas where the assembly will be finished a flat paint finish or medium weight wall coverings are used.

- .5 Level 5: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges. Use this finish in areas where the assembly will be finished in a gloss, semi-gloss or egg shell paint finish. Use this finish in areas of severe lighting conditions such as long or large area walls receiving high levels of natural or artificial light.
- .7 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.
- .8 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.
- .9 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .10 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish
- .11 Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.
- .12 Mix joint compound slightly thinner than for joint taping.
- .13 Apply thin coat to entire surface using trowel or drywall broadknife to fill surface texture differences, variations or tool marks.
- .14 Allow skim coat to dry completely.
- .15 Remove ridges by light sanding or wiping with damp cloth.
- .16 Provide protection that ensures gypsum drywall work will remain without damage or deterioration at time of substantial completion.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 05 50 00 – Metal Fabrications: Miscellaneous metal to be painted.
- .2 Section 09 29 00 – Gypsum Board: Gypsum wallboard surfaces.

1.2 REFERENCES

- .1 The Master Painters Institute (MPI) Architectural Painting Specification Manual, 1997

1.3 SUBMITTALS

- .1 If requested by the Departmental Representative, provide for approval a 300 x 300 mm sample of each colour on the actual base material. Colours shall be exact shade, texture and gloss value.
- .2 Submit qualification documentation indicating adherence to the Quality Assurance requirements.

1.4 QUALITY ASSURANCE

- .1 The painting Subcontractor must have a minimum of five (5) years satisfactory experience in related work. Maintain a qualified crew of painters throughout the duration of the work to fully satisfy the requirements of this specification. Provide qualification documentation to the Departmental Representative when requested.

1.5 MOCK-UP

- .1 Before proceeding with final paint application, finish one (1) room in each approved colour scheme in actual finish texture materials and workmanship for review by the Departmental Representative.
- .2 After approval, this mock-up area to serve as the standard of quality for all work throughout the building.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING.

- .1 Deliver paint materials to job site in sealed original labelled containers bearing the manufacturer's name, type of paint, brand name, colour designation and instructions for mixing and/or reducing.
- .2 Store paint materials at a minimum ambient temperature of 7°C in a well ventilated and heated single designated area.
- .3 Take all necessary precautionary measures to prevent fire hazards and spontaneous combustion. Maintain an operational 10 kg capacity CO2 fire extinguisher in each storage area.
- .4 Where toxic materials and both toxic and explosive solvents are used, appropriate precautions and no smoking must be taken as a regular procedure.

1.7 SITE CONDITIONS

- .1 Temperatures, moisture content of the surfaces, lighting and ventilation shall conform to the following:
- .2 Wallboard: Maximum moisture content 12%.
- .3 Concrete/Concrete Block: Maximum moisture content 12% for solvent type paint, 18% for water base paint. Masonry surfaces shall be tested for alkalinity and shall have been installed a minimum of 28 days.
- .4 Wood: Maximum moisture content 15%.
- .5 Temperatures: Do not execute painting work if temperatures on the surfaces, or the air in the vicinity of the painting work are below 10°C.
- .6 Provide minimum of 323 lx [30 foot candles] lighting on surfaces to be painted.
- .7 Provide adequate continuous ventilation and sufficient heating facilities to maintain temperatures above 10°C for 24 hours before and after paint application.
- .8 Apply paint only to dry, clean, properly cured and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect the quality of finished surfaces.

1.8 SCHEDULING

- .1 Schedule painting operations to prevent disruption of and by other trades

1.9 INSPECTION

- .1 Provide regular inspection reports to the Departmental Representative.
- .2 The cost of the inspection shall be included in the Contract Price.
- .3 If the maintenance bond option is used, provide a letter of consent from a surety licensed to do business in Canada prior to award of the painting subcontract.

Part 2 Products

2.1 ACCEPTABLE MATERIALS

- .1 Except as specified herein, paint, varnish, stain, enamel, lacquer, and fillers shall be of a type and brand listed under "Product Listings" as covered in the MPI Manual, latest edition, for specific uses.
- .2 Paint materials such as linseed, oil, shellac, turpentine, and any of the above materials not specifically mentioned herein but required for work with the finish specified shall be highest quality product of an approved manufacturer and in accordance with CGSB standards as a minimum.
- .3 Where required, paints and coatings shall meet the flame spread requirements of local authorities having jurisdiction

- .4 New and Existing Concrete Block required Block Filler for areas specified for Resinous Wall Coating.
 - .1 Sherwin Williams heavy duty block filler B42W46, or equivalent.
 - .1 Application: 3 thin coats.
 - .2 Surface Preparation:
 - .1 New: refer to SSPC-SP13/NACE 6.
 - .2 Existing: refer to SSPC-SP13/NACE 6, Reference Section: 01 74 00 Cleaning and Special Cleaning Procedures. If Block is contaminated with oils, grease, chemicals, etc., they must be removed by cleaning with a strong detergent. Refer to ASTM D4258.

2.2 GLOSS

- .1 Paint gloss is defined as the sheen rating of applied paint, in accordance with the following values:
 - .1 Gloss Level 1: Flat or matt: max. 5 units @ 60 degrees to a maximum of 10 units @ 85 degrees.
 - .2 Gloss Level 2: High Sheen Flat (Velvet-like): max. 10 units @ 60 degrees to a maximum of 10 - 35 units @ 85 degrees
 - .3 Gloss Level 3: Eggshell: max. 10 - 25 units @ 60 degrees to a maximum of 10 - 35 units @ 85 degrees.
 - .4 Gloss Level 4: Satin-like Finish: max. 20 - 35 units @ 60 degrees to a minimum of 35 units @ 85 degrees.
 - .5 Gloss Level 5: Semi-gloss Finish: max. 35 - 70 units @ 60 degrees.
 - .6 Gloss Level 6: Gloss Finish: max. 70 - 85 units @ 60 degrees.
 - .7 Gloss Level 7: High Gloss Finish: More than 85 units @ 60 degrees.

2.3 FINISHES

- .1 The Departmental Representative has selected Products and colours to base final colour schemes upon. Unless otherwise approved by the Departmental Representative, paint materials shall be supplied in accordance with colour schedules provided.
- .2 Mock-ups of paint finishes will be required for items scheduled to be painted prior to finishing complete areas. Make adjustments to final colour schemes as requested by the Departmental Representative. Do not mix paints until final colour schemes are approved by the Departmental Representative.
- .3 Unless otherwise shown on the drawings or scheduled generally paint as follows:

- .1 Paint doors, frames and door trim generally the same colour, but a different colour than walls.
- .2 Paint access doors, registers, radiators and covers, prime coated butts, prime-coated door closers and exposed sprinkler and service piping, ductwork and electrical conduit and suspensions with colour, texture and sheen to match adjacent surfaces.
- .3 Back prime and paint plywood service panels to match painted wall.
- .4 Paint the inside of light valences gloss white.

2.4 MIXING

- .1 Paints shall be ready-mixed unless otherwise specified, except that any coating in paste or powder form, or to field-catalysed shall be field-mixed in accordance with the directions of its manufacturer. Pigments shall be fully ground and shall maintain a soft paste consistency in the vehicle during storage that can and shall be dispersed readily and uniformly by paddle to a complete homogeneous mixture.
- .2 The paint shall have good flowing and brushing properties and shall dry or cure free of streaks or sags, to yield the desired finish specified.

Part 3 Execution

3.1 INSPECTION

- .1 Inspect all surfaces and materials to receive painting before commencing work. Notify the Departmental Representative in writing of any defects or conditions affecting the proper application of the work of this section.
- .2 Obtain necessary information from other trades on compatibility of their primers and finishes with work of this section.
- .3 Do not proceed with painting work until defects have been corrected.

3.2 PREPARATION OF SURFACES

- .1 Existing Surfaces to Be Re-painted: Examine existing surfaces to be re-painted to assess condition and remedial action. Prepare, clean, wash, patch and make good existing surfaces in accordance with MPI manual to suit level of surface deterioration exhibited.
- .2 Refer to the MPI Manual and MPI Repaint Manual for surface preparations not included in the following:
 - .1 Mildew Removal: Scrub with solution of TSP and bleach, rinse with clear water and allow surface to dry completely.
 - .2 Drywall: Remove contamination, prime surface to show defects if any. Apply paint only after defects have been remedied.
 - .3 Galvanized Steel: Remove surface contamination, wash metal with xylene solvent and apply coat of an approved etching type primer.

- .4 Concrete and Masonry Surfaces: Remove dirt, loose mortar, scale, powder and other foreign matter. Oil and grease to be removed by solution containing TSP, rinse and let dry. Remove concrete stains caused by weathering of corroding metals with solution of sodium metasilicate after being thoroughly wetted with water. Let dry.
- .5 Structural Steel: See MPI Manual, for conditions that may apply.
- .6 Wood, Plywood and Millwork: All wood surfaces shall be clean and dry with a moisture reading of less than 15%. Wipe off dust and grit prior to prime coat; knots, pitch streaks and sappy sections shall be spot coated with sealer. Fill all nail holes and fine cracks after primer has dried and sanded between coats. Back prime interior and exterior woodwork.
- .7 General: Protect other surfaces from paint and damage and make good any damage caused by failure to provide suitable protection.
- .8 Drop Cloths: Furnish sufficient drop cloths, shields and protective equipment to prevent spray or dropping from fouling surfaces not being painted and in particular, surfaces within the storage and preparation area.
- .9 Removal of Combustible Rubbish: Place cotton waste, cloths and material which may constitute a fire hazard, in closed metal containers and removed daily from site.
- .10 Hardware: Remove all electrical plates, surface hardware, fittings and fastenings, prior to painting operations. Carefully store, clean and replace on completion of work in each area. Do not use solvent to clean hardware that will mar the finish on these items.

3.3 APPLICATION

- .1 Method of paint application shall be generally by the accepted trade method for the building locale and as approved by the Departmental Representative.
- .2 Painting coats specified are intended to cover surfaces satisfactorily when applied in strict accordance to recommendations.
- .3 For surfaces that are scheduled to receive a deep hue, provide three finish coats.
- .4 Apply each coat at the proper consistency.
- .5 Each coat of paint shall be slightly darker than preceding coat unless otherwise approved.
- .6 Sand lightly between coats to achieve required finish.
- .7 Do not apply finishes on surfaces that are not sufficiently dry.
- .8 Each coat of finish should be dry and hard before a following coat is applied unless the manufacturer's directions state otherwise.

- .9 Tint filler to match wood when clear finishes are specified; work filler well into the grain and before it has set, wipe the excess from the surface. Apply filler before application of finishes.
- .10 .Back prime interior woodwork which is to receive a paint or enamel finish upon arrival at the job site with enamel under coater paint.
- .11 Top and bottom edges of metal doors shall be primed with under coater.

3.4 SCHEDULES

- .1 Refer to drawings and painting schedules for the extent of finishing required and MPI Schedules.
- .2 Mechanical and electrical pipes, conduit, hangers, ducts and equipment shall be finished in rooms scheduled to be painted. Pipes shall finished to colour schedule specified in Division 22, 23 and all other items painted out to match ceiling colour. Confirm extent of finishing and colour schemes for exposed ceilings with the Departmental Representative prior to application.
- .3 Where space behind louvers is illuminated such as washroom valences paint space gloss white.
- .4 The schedules refer to the MPI architectural painting specification manual.
- .5 Where an item is shown on the drawings to be painted but the item is not specifically scheduled, the item shall be finished in accordance with the applicable MPI finishing system for premium grade work except where the schedule covers custom grade work only. In the case where there are several painting systems available for the item, use the system best suited for the intended use and consistent with other finishes used on the project.
- .6 New Work- Exterior Painting and Finishing Schedule - as scheduled and specified herein. Reference Chapter 2, Section 2, MPI Manual. Refer to the Finish List and Colour Schedule and the Door and Frame Schedule for MPI Schedules.
- .7 New Work - Interior Painting and Finishing Schedule - as scheduled and specified herein. Reference Chapter 3, Section 2, MPI Manual. Note for surfaces that are scheduled to receive deep hues, provide three finish coats. Refer to the Finish List and Colour Schedule and the Door and Frame Schedule for MPI Schedules.
- .8 Existing Painting and Finishing Schedule:
 - .1 The drawings indicate the general extent of existing surfaces requiring repainting. The drawings and specifications do not necessarily indicate or describe the entire and complete extent of the work. On the basis of the general extent indicated, described or implied re-finish all work required for the proper execution and completion of the work.

- .2 The MPI Repainting Manual specifies the preparation work required for existing surfaces and lists schedules applying to refinishing existing surfaces. Refinish existing surfaces using materials of the same quality and gloss as for new surfaces specified above.
- .3 Conform to Section 01 35 00 - Alteration Project Procedures regarding patching, matching and extending existing work.
- .4 Interior Painting and Finishing Schedule - as scheduled, reference Chapter 3, Section 2, MPI Repaint Manual.
- .9 Surface Preparation For Metal Doors and Frames:
 - .1 Wash with Greensolv Inc. #307, or equivalent. Spray on and saturate surface allowing 15 minutes dwell time, wipe dry with dry rag and air dry with forced air.

3.5 FIELD QUALITY CONTROL

- .1 Painting surfaces will be considered to lack uniformity and soundness if any of the following defects are apparent:
 - .1 Runs, sags, hiding or shadowing by inefficient application methods.
 - .2 Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
 - .3 Damage due to touching before paint is sufficiently dry or any other contributory cause.
 - .4 Damage due to contamination of paint due to airborne particles.

3.6 PROTECTION

- .1 Protect all newly painted exterior surfaces from rain and snow, condensation, contamination, dust, salt spray and freezing temperatures Until paint coatings are completely dry. Curing periods shall exceed the manufacturer's recommended minimum time requirements.
- .2 Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work area as required.

3.7 CLEANING

- .1 Promptly as the work proceeds and on completion of the work, remove all paint where spilled, splashed or spattered using methods that are not detrimental to affected surfaces.
- .2 Keep the premises free from any unnecessary accumulation of tools, equipment, surplus materials and debris.
- .3 Remove combustible rubbish materials and empty paint cans each day and safely dispose of same in accordance with requirements of authorities having jurisdiction.

- .4 Clean equipment and dispose of wash water/solvents as well as all other cleaning and protective materials (ie. Rags, drop cloths, masking papers) paints, thinners paint removers/strippers in accordance with the safety requirements of authorities having jurisdiction.
- .5 At the conclusion of the work, leave the premises neat and clean.

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 Stantec Consulting Ltd.
- .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 Review the existing fire suppression systems throughout the buildings including:
 - .1 Wet sprinkler systems in all heated areas
 - .2 Electric fire pumps, jockey pumps, controllers and transfer switches
- .6 Provide all Testing, Adjusting and Balancing; Commissioning; Identification; Insulation; for all fire suppression systems as described in the associated specification Sections.
- .7 Revise the sprinkler layout in the mechanical rooms to suit the mechanical equipment and ductwork revisions.

1.3 Related Work

- .1 The following fire suppression systems and related work are specified in the noted Sections:
 - .1 Fire Suppression Sprinkler Systems - Section 21 13 00
 - .14 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, 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, fire suppression standpipes, clean agent suppression systems, and other fire suppression or fire extinguishing systems.
 - 1. Sprinklers shall be referred to on drawings, submittals, and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval.
- .6 Submit hydraulic calculations for all water based fire suppression sprinkler and standpipe systems.

- .7 Submit 'Schedule C-B: Assurance of Professional Field Review and Compliance' in accordance with the National Building Code of Canada 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 signed and sealed copies of Record Drawings, Final Design Drawings and / or As-built Drawings as requested by the Departmental Representative, Certified Professional (C.P.), Authority Having Jurisdiction or the Departmental Representative.
- .14 Submit shop drawings as noted below.
- .15 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 grooved joint couplings.
 - .3 Fire department connections.
 - .4 Backflow preventers.
 - .5 Fire pumps, jockey pumps, controllers and transfer switches.
 - .6 Fire pump test headers.
 - .7 Fire hose valves and cabinets.
 - .8 Alarm, dry pipe, preaction and deluge valves.

- .9 Air compressors.
- .10 Supervisory switches.
- .11 Flow switches.
- .12 Pressure switches.
- .13 Sprinklers and escutcheon plates.
- .14 Fire extinguishers and cabinets.
- .15 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 Occupancy Documentation

- .1 The contractor shall submit the following documentation to the Departmental Representative a minimum of 5 working days prior to the project occupancy site walk-through or occupancy date, whichever is scheduled first. The dates will be established by the Departmental Representative, project manager or Certified Professional. It is the contractor's responsibility to provide all documentation to the Departmental Representative in a timely manner. If all documentation is not received, the Departmental Representative may not be able to issue their associated Schedule C-B in support of the building occupancy application and any associated consequences shall become the responsibility of the contractor.
- .2 Fire Suppression system letters of assurance Schedules B-1 Assurance of Professional Design and Commitment for Field Review; Schedule B-2 Summary of Design and Field Review Requirements; and Schedule C-B Assurance of Professional Field Review and Compliance from the contractor's fire suppression engineer.
- .3 Fire Suppression system Contractor's Material and Test Certificates for Aboveground Piping and for Underground Piping systems per NFPA-13.
- .4 A copy of the Fire Alarm Verification Certificate for components related to the fire suppression system devices.
- .5 Backflow Prevention Assembly Test Reports for each backflow prevention device, signed by the tester.
- .6 Letter confirming that all penetrations of rated assemblies have been firestopped in conformance with CAN4-S115, on the firestopping installing agencies letterhead.
- .7 Heat trace megger test reports for each circuit, on the manufacturer's representative's letterhead.
- .8 Maintenance manuals for fire suppression systems.

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 [2"] 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.
- .3 All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
- .4 All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

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.
- .3 Include sprinklers above and below suspended architectural ceiling panels.
- .4 Include sprinklers in concealed spaces containing exposed combustible construction including exposed wood beams, exposed wood framing and exposed wood ceiling materials.

1.13 Clean Up

- .1 Leave systems operating with work areas clean to satisfaction of the Departmental Representative.

1.14 System Demonstrations

- .1 The fire suppression contractor's Professional Engineer and their licensed journeyman sprinkler fitter shall attend all demonstrations of the fire suppression systems to the Municipal officials, the Fire Department and Stantec Consulting Ltd. This may require multiple site visits and multiple demonstrations depending on the scheduling and sequence of demonstrations as may be established by the Departmental Representative or General Contractor.
- .2 The fire suppression contractor's Professional Engineer and their licensed journeyman sprinkler fitter shall demonstrate all devices to Stantec Consulting Ltd. including all tamper switches, all flow switches, all test 'n drain assemblies, all dry pipe valves, all pre-action system devices including detection and activation devices.
- .3 Demonstrations to Municipal officials and / or the Fire Department shall not alleviate the requirement to provide an additional demonstration of all devices and components to Stantec Consulting Ltd. Partial demonstrations in lieu of full demonstrations shall be at the sole discretion of Stantec Consulting Ltd.
- .4 The fire suppression contractor's Professional Engineer and their licensed journeyman sprinkler fitter shall coordinate to have the electrical contractor and / or their fire alarm system contractor present and to provide all necessary walkie-talkies, ladders, smoke canisters etc to provide complete system demonstrations.
- .5 The fire suppression contractor's licensed journeyman sprinkler fitter shall rectify any deficiencies and subsequently drain all dry system piping, reset all devices and leave the systems in a fully operating condition.

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 Pipe Routing

- .1 Install piping to maximize headroom in all areas, including areas without ceilings where the piping is exposed, without interfering with other systems.
- .2 Do not route piping through electrical or communications rooms or closets, elevator machine rooms, or other similar locations without express permission from the electrical consultant. Limit the piping to branch lines that serve those specific rooms where such rooms are required to be sprinklered.

3.2 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.

3.3 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.

3.4 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 [12"] sleeve for a nominal 200 mm [8"] 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 [2"] 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.

3.5 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.

3.6 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 X-ray all concrete walls, partitions, shafts, slabs and other concrete or concrete block assemblies prior to coring. The cost of x-raying shall be included in the cost of the Work. Repairs to existing services damaged as a result of core drilling is included in this section of the Work.
- .4 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 consultant. Repairs that may be required to existing services damaged as a result of core drilling is included in this Section of the work.

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 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 [60 miles] of the City of 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 connections and fire pump test header lines shall also be hydrostatically tested.

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 Fire pumps and jockey pumps.

1.3 Quality Assurance

- .1 Review the existing 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.
- .2 Revise sprinkler head locations in mechanical room to suit the mechanical equipment and ductwork revisions.

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 Departmental Representative 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 whether or not they are indicated on the Departmental Representative'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.
 - .1 Sprinklers shall be referred to on drawings, submittals, and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval.
- .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 Pipe, valves, fittings and grooved joint couplings.
 - .2 Test and drain assemblies.
 - .3 Sprinklers including all sprinkler types.

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.

1.7 System Demonstrations

- .1 Refer to Section 21 05 00 re system demonstration requirements.

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 12 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 Departmental Representative 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 [175 psi] 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 [6"] diameter and minimum Schedule 30 steel pipe for 200 mm [8"] 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, short-pattern with flow equal to standard pattern fittings. Fittings, couplings and gaskets shall be of one manufacturer and shall provide a rigid joint. Grooving tools shall be of the same manufacturer as the grooved components. Acceptable Product: Victaulic FireLock™.
- .5 Branch connections may be provided by bolted, mechanical branch connections complete with synthetic rubber gaskets approved for line service. Acceptable Products: Victaulic Style 920920N and 922.

Victaulic 922 outlet tees shall have cast upper and lower housings and may be used for up to 25 mm [1"] branch outlets and individual sprinklers.

- .6 Victaulic "Pressfit System" utilizing Schedule 5 pipe and cold drawn carbon steel fittings with integral synthetic O-ring is **not** acceptable for this project.
- .7 Grooved joint couplings shall consist of two ductile iron housing segments conforming to ASTM A536, pressure responsive gasket to ASTM D2000, and zinc electroplated steel bolts and nuts.
 - .1 Rigid Type: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with NFPA-13. Couplings shall be fully installed at visual pad-to-pad offset contact. (Tongue and recess type couplings, or any coupling that requires exact gapping of bolt pads on each side of the coupling at specified torque ratings, are not allowed.)
 - .1 32 mm [1-1/4"] through 100 mm [4"]: Installation-Ready, for direct stab installation without field disassembly. Victaulic Style 107.
 - .2 Victaulic FireLock™ Style 005 or Zero-Flex Style 07.
 - .2 Flexible Type: For use in locations where vibration attenuation and stress relief are required, and for seismic applications. Victaulic Installation-Ready Style 177 and Style 75 / 77.
 - .3 For dry pipe systems, use a FlushSeal® coupling gasket in rigid and flexible couplings where required by NFPA 13. Acceptable Products: Victaulic Style 005 Firelock and Style 75.
- .8 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 Valves

- .1 Test and Drain Valves - 1210 kPa [175 psi] - ULC listed
 - .1 25 mm and 50 mm [1" through 2"]: Forged brass or cast bronze construction, tapped 6 mm [1/4"] gauge outlet, and integral sight glass. Victaulic TestMaster II or NFE model A61
- .2 All valves shall be ULC listed for fire suppression systems.
- .3 Where working pressure exceeds 1035 kPa [150 psi] provide 2060 kPa [300 psi] valves.
- .4 Required air pressure for dry valves shall be 90 kPa [13 psi].
- .5 All grooved end valves shall be of one manufacturer. Acceptable products: Victaulic.
- .6 Valves shall be externally resettable.
- .7 Valve internal components shall be replaceable without removing the valve from the installed position.

- .8 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.

2.3 Sprinklers

- .1 Sprinkler body shall be glass bulb type, with a die-cast body. The body shall be integrally cast with a hex-shaped wrench boss to reduce the risk of damage during installation.
 - .1 Wrenches shall be provided by the sprinkler manufacturer that directly engage the hex-shaped wrench boss in the sprinkler body. Victaulic FireLock Series, or equivalent.
- .2 Sprinklers with rubber O-rings are not permitted,
- .3 Upright – plain brass, quick response, glass bulb in unfinished mechanical and service rooms without ceilings.
- .4 Upright – chrome plated, quick response, glass bulb in finished rooms and spaces without ceilings such as atriums, skylights and sprinklered exterior covered areas.
- .5 Recessed Pendent – recessed, quick response, glass bulb, chrome plated finish on sprinklers and escutcheons in all finished areas with ceilings except noted below.
- .6 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.
- .7 Acceptable Products: Reliable, Grinnell, Victaulic, Viking, or equivalent.
- .8 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 4 mm [1/4"] 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.
- .9 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.
- .10 Escutcheons and guards shall be listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.
- .11 All sprinklers shall be ULC listed for use in the occupancies in which they are to be installed.

- .12 All sprinklers shall be quick response unless stated otherwise.
- .13 All sprinklers shall be for commercial applications unless stated otherwise. Residential sprinklers are only permitted in residential areas of residential buildings.

3 EXECUTION

3.1 Fire Suppression Sprinkler Systems

- .1 Revise fire suppression sprinkler systems serving the mechanical rooms, in accordance with the listed codes, bylaws, standards and approvals including NFPA-13 and the National Building Code of Canada.
- .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.
 - .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 Engineer.
- .6 Install piping to maximize headroom in all areas, including areas without ceilings where the piping is exposed, without interfering with other systems.
- .7 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 Departmental Representative. Coordinate the sprinkler layout with architectural, structural, electrical and mechanical HVAC ceiling elements.

- .8 Do not install sprinklers that have been dropped, damaged, or show a visible loss of fluid. Never install sprinklers with cracked bulbs.
- .9 Sprinkler bulb protector shall be removed by hand after installation. Do not use tools or any other device(s) to remove the protector that could damage the bulb in any way.
- .10 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.
- .11 Submit to the Departmental Representative a completed Contractor's Material and Test Certificate for all fire suppression systems, and provide a copy in the project Mechanical Operation and Maintenance Manuals. All sections of the forms must be filled in completely and accurately and signed by the applicable persons. In addition to their signatures, their names must be legibly printed on each form.

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 [8"] diameter and larger, and at valve stations and fire department connections.
- .3 Provide ULC listed expansion joints or flexible joint fitting assemblies at building expansion joints, building earthquake joints, building firewalls and all other locations as necessary.
- .4 All grooved end components including valves, fittings, gaskets and couplings shall be of one manufacturer and shall be installed in accordance with the manufacturer's instructions.
- .5 The grooved coupling manufacturer's factory trained representative shall provide on-site training for the contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review that the contractor is following their recommended practices in grooved product installation. Roll and cut grooves shall be made in conformance with the fitting manufacturer's written Standard Groove Specifications and within the listed dimensional tolerances. The contractor shall measure the groove dimensions and adjust the grooving machine rollers and cutters on a regular basis to ensure all grooves are within the manufacturer's written dimensional tolerances.
- .6 Victaulic Pressfit (or equivalent) 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.

- .7 Tie rods shall only be used in conjunction with fittings possessing integral tie lugs.
- .8 Tie rods complete with their associated nuts and bolts shall be coated with two coats of asphaltic paint after installation.

END OF SECTION

Part 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, Amendments and Mechanical General Requirements shall govern the plumbing sections of the work. Read in conjunction with the Instructions to Tenderers or Bidders.
- .3 Provide domestic cold water, domestic hot water, sanitary drainage, sanitary venting, storm drainage, natural gas, compressed air and all other piping, fixtures and equipment as specified below or as shown on the drawings.
- .4 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 Not used.

1.3 CODES, STANDARDS AND APPROVALS

- .1 Installation, workmanship and testing shall conform to the following standards:
 - .1 National Building Code of Canada 2010
 - .2 National Plumbing Code 2010
 - .3 Authority Having Jurisdiction
 - .4 ULC and FM Standards for applicable products
 - .5 CSA Standards for applicable products

1.4 SHOP DRAWINGS AND SAMPLES

- .1 Submit shop drawings in accordance with Division 1.
- .2 Shop drawings are required for:
 - .1 Pipe, fittings and couplings
 - .2 Valves

- .3 Floor drains and trap primers
- .4 Cleanouts, access panels and access doors
- .5 Firestopping system and product data sheets
- .6 Pipe insulation
- .7 Pipe identification and valve tags
- .8 Submit samples for:
 - .1 A 300 mm to 450 mm length of each type of pipe material for each system, both above ground and below ground.
 - .2 A 90 deg. fitting (and a coupling where applicable) for each type of material and for each type of piping system.
 - .3 Valves up to 50 mm [2"] nominal size.
 - .4 Pipe identification for each system, and two valve tags.
- .9 All other system components and accessories

1.5 MAINTENANCE DATA

- .1 Provide maintenance data summarized below for incorporation into the Mechanical Operating and Maintenance Manual.
- .2 Include detailed instructions for the normal maintenance of all installed equipment including operational procedures, frequency of operational checks, service instructions and troubleshooting instructions.
- .3 Local source of supply for each item of equipment indicating company, location, manufacturer's representative, phone number and e-mail address.
- .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 catalogue data sheets including a copy of the reviewed shop drawings of each component plus 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 Operating electrical switchgear schedule indicating location of equipment.

- .10 Lubrication schedule indicating the recommended lubricants and grades (grease or oil) for all lubricated equipment components.
- .11 Test reports for all sections of piping.

1.6 RECORD DRAWINGS

- .1 Comply with requirements contained in Division 1.
- .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.
- .3 The set of white prints will be provided to the contractor by the Departmental Representative at the contractor's cost.
- .4 The marked-up set of prints will be reviewed on site by the Departmental Representative during the construction process. This review may form a requirement for approval of the monthly progress claim.
- .5 Backfilling shall not occur until underground services are surveyed.
- .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 piping, fixtures, drains, clean-outs, rough-in, etc. above and below grade inside and outside the building and including dimensioned locations of buried piping from building walls and gridlines.
 - .2 Location of back flow preventers.
 - .3 Location of water hammer arrestors.
 - .4 Location of trap primers.
- .7 CAD Drafting:
 - .1 Refer to Section 23 05 93 for additional requirements to those listed below.
 - .2 Include all details from revision drawings, addenda, and change orders. Label each drawing in the lower right corner in letters of at least 12mm high as follows:

"AS BUILT DRAWINGS", Contractors name and date.
 - .3 Provide one set of check prints for review by the Departmental Representative.
 - .4 Upon review of the drawings by the Department Representative, provide computer CAD files on a CD and two sets of hard copy plots.

1.7 SUBSTANTIAL PERFORMANCE REQUIREMENTS

- .1 Before the Department Representative is requested to make a field review for substantial performance of the work:
 - .1 Submit signed test forms for all sections of the piping.
 - .2 Submit completed marked up Record Drawings.
 - .3 Submit a letter on the Contractor's letterhead certifying that all work is complete.

1.8 DEFICIENCY HOLDBACKS AND DEFICIENCY FIELD REVIEWS

- .1 Work under this Division which is still outstanding when substantial performance is determined 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 required that outstanding work be completed in an expeditious manner and the entire holdback sum may be retained until the requirements for Total Performance of Division 22 work have been met and verified.

1.9 OCCUPANCY REQUIREMENTS

- .1 Before the Department Representative is requested to submit their Schedule C-B as related to the occupancy permit, the contractor shall submit at least of the following documentation:
 - .1 All shop drawings.
 - .2 Piping system test certificates.
 - .3 Firestopping certificate.
 - .4 Seismic engineer's Schedules B-1, B-2 and C-B.
 - .5 Mechanical maintenance manual.
 - .6 As-built drawings.

1.10 CONNECTION FEES

- .1 There are no municipal connection fees related to this project work.

1.11 TEMPORARY USAGE OF PLUMBING SYSTEMS AND EQUIPMENT

- .1 Plumbing systems and equipment shall not be used without the written permission of the Departmental Representative and in no circumstances shall be used prior to testing and inspection.

1.12 CHROMIUM PLATED PIPING

- .1 Use only strap wrenches on chromium plated pipe or fittings. Surfaces damaged by wrench marks shall be replaced. Joints shall be threaded or slip joints.

1.13 ACOUSTICAL TREATMENT

- .1 General
 - .1 This project includes special acoustical requirements to ensure low noise levels in noise sensitive areas. The contractor shall in particular give careful consideration to equipment selection and 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 requirements for plumbing systems have been met before the walls or ceilings have been closed in.
- .2 General Scope of Work
 - .1 All plumbing systems located in any walls or within 2 metres [6½'] 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 Mechanical service spaces between cells.
 - .2 Mechanical attic services spaces above cells.
 - .3 Raised floor spaces in the Control Room.
 - .4 Ceiling spaces above offices.
- .3 Summary of Requirements
 - .1 Drain, Waste and Vent Stacks and Rainwater Leaders:
 - .1 Cast iron pipe and mechanical joint fittings shall be used. Plastic, copper and aluminum DWV piping are unacceptable. Waste piping over sound sensitive areas shall be provided with a minimum 150 mm long section of minimum 12 mm thick 50 durometer closed cell neoprene insulation, bearing on a minimum 150 mm long preformed galvanized steel load distribution shields at each pipe hanger.
 - .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 spaces shall be lagged with 25 mm [1"] preformed glass fiber pipe insulation.

- .4 Rainwater leader chases shall be airtight and contain non-compressed RSI 2.11 [R-12] glass fibre insulation where installed in the stud cavities.
- .2 Domestic Water Operating Parameters:
 - .1 The maximum flow velocity in copper pipes in the supply and recirculating system shall be 1.5 metres [5 feet] per second for cold water and 1.2 metres [4 feet] per second for hot water.
- .3 Pipe Sizes:
 - .1 The minimum pipe size to faucets or mixing valves of each fixture shall be 12 mm [$\frac{1}{2}$ "]. The use of 9 mm [$\frac{3}{8}$ "] pipes is strictly prohibited.
- .4 Plumbing Fixtures and Trim:
 - .1 Back-to-back fixtures: Drain lines and water supply lines shall be individually connected to risers. Tee takeoffs serving back-to-back fixtures are not permitted.
 - .2 Quick Acting Valves: All flush valves, 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 concrete, concrete block, framing, stud or wall surface; or any other conduit, electrical fixture or ventilation duct 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 Riser clamps shall be isolated from the structure using an approved resilient material between the support collar and the floor structure (Vibro-Acoustics type SN, 30 durometer, 57 mm x 57 mm [$2\frac{1}{4}$ " x $2\frac{1}{4}$ "] in size, or an approved equal). An alternate method is to wrap the pipe with neoprene prior to clamping.
 - .4 Pipe hangers shall be oversized to suit the insulation thickness and shall have a preformed galvanized steel load distribution shield between the insulation and the hanger.
- .6 Clearance Around Pipes:
 - .1 All pipe (bare or insulated) shall be clear of contact with concrete, concrete block, studs or gypsum wallboard.
 - .2 Pipes in acoustically critical walls shall be wrapped with a minimum thickness of 6 mm [$\frac{1}{4}$ "] 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 Penetrations by Pipes:

- .1 Pipes penetrating slabs or rated concrete or concrete block wall shall be mineral fiber wrapped prior to firestopping.
- .2 Gypsum wallboard or plaster wall pipe penetrations shall be 3 mm [$\frac{1}{8}$ "] to 6 mm [$\frac{1}{4}$ "] oversized with the pipe centred in the hole and the gap caulked with silicone or other non-hardening sealant for unrated separations, and firestopping for rated separations.
- .3 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 [R-12] batt insulation in the following proportions:
 - .1 Ceiling plenum - 80% of area.
 - .2 Chases - 100% of all four vertical surfaces.
 - .3 Walls - 50% of space containing pipe, and 100% of adjacent stud space.

1.14 COLD WEATHER PROTECTION

.1 Roof penetrations:

- .1 All vent penetrations of the roof structure shall be 100 mm [4"] minimum size.

1.15 SEISMIC PROTECTION

- .1 Supply and install sway-bracing hangers on the following systems:
- .2 This shall apply to all cross-mains including loops, 50 mm [2"] and larger, and shall apply to feed mains including risers. Horizontal piping shall be 2-way bracing and vertical piping shall include 4-way bracing at the tops of the risers. Spacing of horizontal 2-way sway braces shall not exceed 12 metres [40']. On floor loops sway-braces are also required at the corners of the loops.
- .3 Restraints shall meet the requirements of the National Building Code of Canada 2005.
- .4 Arrange and pay for the services of a B.C. Registered Professional Engineer. This seismic engineer shall provide all required engineering services related to seismic restraints of non-vibration isolated plumbing equipment and piping. The seismic engineer shall provide assistance to the contractor as necessary during the course of restraint of equipment and piping. The seismic engineer shall provide field reviews of the work during construction and the completed seismic installation.
- .5 Submit signed and sealed Schedules B-1 and B-2 to the Department Representative at the beginning of the project and Schedule C-B at completion of the project, a minimum of 10 working days prior to Occupancy.

1.16 BUILDING OPERATION DURING CONSTRUCTION

- .1 In order to minimize operational difficulties for the existing building and the staff, the Contractor must cooperate with the Departmental Representative throughout the entire construction period and particularly ensure that noise is minimized.
- .2 Minor inconvenience and interruption of services will be tolerated, provided advance notice is given to the Departmental Representative, but the Contractor will be expected to coordinate their work, in consultation with the Departmental Representative, so the operation of the existing facility can be maintained as nearly normal as possible.

1.17 EXISTING SERVICES

- .1 Protect all existing services encountered and be responsible for any damages to existing systems by the work of this contract. Obtain instructions from the Departmental Representative when existing services require relocation or modifications, other than those already indicated in the Contract Documents.
- .2 Arrange work to minimize shutdowns of existing services. Where shutdowns are unavoidable, obtain the Departmental Representative's written approval of the timing, and work to minimize any interruptions.
- .3 In order to maintain existing services in operation, temporary relocations, temporary valves and/or bypasses of piping may be required.
- .4 The Departmental Representative reserves the right to withhold permission for a reasonable period with respect to any shutdown, if the shutting off of a service will interfere with important operations.

1.18 CONNECTION TO EXISTING SYSTEMS ON THIS SITE

- .1 These documents include work that will require connections of piping systems to existing systems including the natural gas connection at the existing gas line and meter upgrade. See site plan for details.
- .2 Provide all necessary excavation, coring, piping adjustments and offsets as required to connect to those services. Report any major discrepancies to the Departmental Representative.
- .3 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 and coordination of piping connections to produce a complete workable system whether shown on the drawings or not.
- .4 Coordinate with the gas utility company for upgrade of gas meter station if required. Provide a lamicoid label on the main isolation valve to the new building labeled in accordance with the requirements of the Departmental Representative.

1.19 FIRESTOPPING

- .1 Provide firestopping for all plumbing penetrations of rated separations to CAN4 S-115.

Part 2 Products

2.1 GENERAL

- .1 All materials shall be new and of the condition as originally manufactured free of defects.

2.2 NON-SECURITY ACCESS DOORS

- .1 Design:
 - .1 Plaster or wet wall construction: 1.70 mm [14 gauge] thick bonderized steel flush with wall or ceiling type with concealed flange. - Acceptable Product: Acudor PS-5030, or equivalent.
 - .2 Masonry or drywall construction: 1.35 mm [16 gauge] thick for 400 mm [16"] x 400 mm [16"] and smaller, 1.70 mm [14 gauge] thick for 450 mm [18"] x 450 mm [18"] and larger bonderized steel face of wall type with exposed flange. - Acceptable Product: Acudor UF-5000, or equivalent.
 - .3 Water resistant finished walls, tile, ceramic tile, water resistant dry wall, plaster or wet wall construction in washrooms and other special areas: 1.80 mm [14 gauge] thick stainless steel flush with wall or ceiling type with concealed flange. - Acceptable Product: Acudor PS-5030 stainless, or equivalent.
 - .4 Acoustical tile ceiling and similar block materials: 1.70 mm [14 gauge] thick bonderized steel recessed ceiling type. - Acceptable Product: Acudor AP-5010 or AT-5020, or equivalent.
 - .5 Feature wall construction: Recessed wall type that is selected to complement and conform with the architectural module, treatment, or paneling. The size shall conform to adjacent finishes.
- .2 Minimum Requirements:
 - .1 Materials:
 - .1 Concealed hinges.
 - .2 Adjustable anchoring straps or lugs to suit construction.
 - .2 Finish:
 - .1 Prime coat bonderized steel types.
 - .2 Brushed stainless steel for stainless steel types.

- .3 Size:
 - .1 300 mm x 300 mm [12" x 12"] for cleanout or hand access.
 - .2 600 mm x 600 mm [24" x 24"] for entry access
 - .4 Locking devices:
 - .1 Screwdriver cam locks.
 - .2 Allan key cam locks
 - .5 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, or equivalent).
 - .6 Submit shop drawings.
 - .7 Supply and locate all access doors under this section of work. Installation shall be by the General Contractor or their designated other subtrades.
- .3 Acceptable Products: Acudor, Can-Aqua, Mifab, Milcor, Nystrom, Van-Met, or equivalent.

2.3 CLEANOUTS

- .1 In all inmate accessible areas, cleanouts shall have a tamper proof stainless steel cover with tamper proof screws.
- .2 Cleanouts shall be full size for pipe sizes up to 100 mm [4"] and not less than 100 mm [4"] on larger sizes. Cleanouts in inside finished areas shall all be round.
- .3 Cleanouts passing through a waterproofed floor or a slab on grade subject to hydrostatic pressure shall possess a clamping collar which shall be clamped to the floor membrane or lead flashing. Refer to Section 15401, 'Safes, Flashings and Vent Terminals'.
- .4 Pipe manufacturers' cleanouts are acceptable for vertical installation at the base of soil and waste stacks or rainwater leaders only.
- .5 Make cleanouts with a Barrett type fitting that has a bolted coverplate and gasket, fittings that have a threaded plug, or a cleanout ferrule that is installed in a wye or extended wye.
- .6 Outside area cleanouts shall be of heavy duty construction. - Acceptable Product: Zurn Z1400, Jay R. Smith, Ancon, Mifab, or equivalent.
- .7 Unfinished concrete area cleanouts shall be of heavy duty construction and have a fully exposed scoriated cover. - Acceptable Product: Zurn Z1400, Jay R. Smith, Ancon, Mifab, or equivalent.
- .8 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, Ancon, Mifab, or equivalent.

- .9 Ceramic tile floor area cleanouts shall have a fully exposed scoriated cover. - Acceptable Product: Zurn ZN 1400 or ZN 1400-T, Jay R. Smith, Ancon, Mifab, or equivalent.
- .10 Carpet area cleanouts shall be fully concealed with a small raised marker. - Acceptable Product: Zurn ZN 1400-CM, Jay R. Smith, Ancon, Mifab, or equivalent.

2.4 HANGERS AND SUPPORTS

- .1 Hanger Supports:
 - .1 Carbon steel construction.
 - .2 Adjustable for proper grading.
 - .3 Rods shall be cadmium plated with continuous thread in accordance with ANSI B-31. - Acceptable Products: Grinnell Fig 146, Myatt Fig 434, or equivalent.
 - .4 Hanger types:
 - .1 Up to 25 mm [1"]. - Acceptable Products: Grinnell Fig 269, Myatt Fig 120, or equivalent.
 - .2 2 30 mm [1¼"] and larger. - Acceptable Products: Grinnell Fig 260 or 65, Myatt Fig 122 or 124, or equivalent.
 - .3 Hangers for metallic non-ferrous pipe shall be plated and plastic dipped or the pipe shall be wrapped for a minimum 150 mm length centered on the hanger with Polyken tape.
- .2 Wall Supports:
 - .1 Horizontal pipes adjacent to walls: Angle iron wall brackets with specified hangers.
 - .2 Vertical pipes adjacent to walls:
 - .1 Exposed pipe wall guide. - Acceptable Product: Grinnell Fig 235 or 236, or equivalent.
 - .2 Channel type supports. - Acceptable Product: Brundy, Canadian Strut, Cantress Unistrut, or equivalent.
- .3 Floor Supports:
 - .1 Vertical pipe.
 - .1 Risers where they pass through floors shall be standard riser clamps. - Acceptable Products: Grinnell Fig 261 or Myatt Fig 182 (Grinnell Fig CT-121 for copper pipe), or equivalent.
 - .2 Base of risers where they are adjacent to and above floor slabs shall be

adjustable fabricated steel floor supports.

- .3 Provide load bearing plates below riser clamps c/w factory mounted neoprene rubber to minimize noise transmission.
- .4 Inserts, Anchors and Beam Clamps:
 - .1 Select for the application and load.
 - .2 Do not use explosive type inserts unless permitted by the Structural Engineer.

2.5 PIPE SLEEVES AND ESCUTCHEONS

- .1 Non-combustible pipe penetrations through fire separations that are required to have a fire resistance rating shall be firestopped to ULC/CAN4 S-115.
- .2 Combustible pipe penetrations through fire separations that are required to have a fire resistance rating shall be as follows:
 - .1 Intumescent firestopping material contained in a metal housing that is certified per ULC/CAN4 S-115 for firestopping use. Installation shall be implemented in full compliance with the certified installation procedures. - Acceptable Products: FGC Fireguard Corp. DONUT Firestop for flat surfaces; 3M Brand (Intumescent) Fire Barrier, Dow Corning Fire Stop Intumescent Wrap for Q-deck; or equivalent.
- .3 Pipe penetrations through separations that are not required to have a fire resistance rating shall be as follows:
 - .1 Interior concrete or block wall sleeves and floor slab sleeves in dry areas shall be steel pipe or removable plastic pipe and sealed with silicone.
 - .2 Floor slab sleeves in wet areas, outside wall sleeves and roof slab sleeves shall be steel pipe and sealed with silicone.

2.6 MISCELLANEOUS METAL RELATED TO PLUMBING SYSTEMS

- .1 Frames shall be of welded construction consisting of angle iron sections with 8 mm [5/16"] locating strips and anchoring lugs at a minimum of 900 mm [36"] centres.
- .2 Backing Plates shall be adequate to support the use intended and shall be a minimum 4.8 mm [3/16"] in thickness.

2.7 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 [6"] below the 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.

2.8 SANITARY WASTE PIPING

- .1 Install minimum 150 mm [6"] diameter sanitary piping from all water closets.
- .2 Minimum 1.5% slope on all sanitary piping.
- .3 Install offsets in nominally horizontal pipe utilizing a 1 meter long section of pipe between successive 45 degree changes of direction, to minimize blockages. Do not install a wye and 45 degree fitting or two 45 degree fittings in close succession.
- .4 Install cleanouts generally in secured areas.

Part 3 Execution

3.1 PIPING INSTALLATION

- .1 General:
 - .1 Install piping straight, parallel and close to walls and ceilings.
 - .2 Install sanitary piping with a slope of not less than 1.5% for gravity piping below grade, not less than 1% for all other gravity piping 100 mm and larger, and not less than 2% for all other gravity piping 75 mm and smaller.
 - .3 Provide a slope to drain cocks, fixtures or equipment for all water supply and pressure piping unless otherwise indicated on drawings.
 - .4 Install groups of piping parallel to each other; spaced to permit application of insulation, identification, and service access, on trapeze hangers.
 - .5 Where sizes differ from pipe sizes to equipment connection sizes, install reducing fittings close to the equipment. Reducing bushings are not permitted.
 - .6 Brass and copper pipe and tubing shall be free from surface damage. Replace damaged pipe or tubing.
 - .7 Ream ends of pipe and tubes before installation.
 - .8 Lay copper pipe and tubing so that it is not in contact with dissimilar metal or in direct contact with concrete, and will not be crimped or collapsed.
 - .9 All joints on cast or ductile iron pressure service piping shall be made electrically conductive.
 - .10 Install flanges or unions to permit removal of equipment and serviceable components without disturbing piping systems.
 - .11 Clean the ends of pipes or tubing and the recesses of fittings to be jointed. Assemble joints without binding.
 - .12 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.

- .13 Plug or cap pipe and fittings to keep out debris during construction.
- .14 Jointing of pipe shall be compatible with type of pipe used.
- .15 Non-corrosive lubricant or teflon tape shall be applied to the male thread of threaded joints.
- .16 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 drains.
- .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 free from clay, snow, ice, organic matter or stones.
 - .2 Do not lay pipe in water or when conditions are unsuitable.
 - .3 Comply with Worker's Compensation Board requirements regarding safety and working conditions.

3.2 ACCESS DOORS

- .1 Install access doors at all concealed cleanouts, traps, unions, expansion joints, valves, control valves, air vents, water hammer arrestors, trap primers, vacuum breakers and any other equipment for which subsequent periodic access will be required during the life of said equipment or components.
- .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 inmate areas, feature walls or ceilings or at the high spaces without the prior approval of the Department Representative. Extend piping and components over and locate in service areas and storage rooms wherever possible.

3.3 CLEANOUTS

- .1 Install cleanouts at the following locations:
 - .1 Building drain leaving the building on the downstream side of the exterior wall.

- .2 Changes of direction of more than 45 degrees in drainage piping.
- .3 Nominally horizontal branches or building drains at intervals of not more than 7.5 metres [25'] for pipe sizes 65 mm [2½"] and less, 15 metres [50'] for 75 mm [3"] and 100 mm [4"] pipe sizes, and 26 metres [85'] for pipe sizes larger than 100 mm [4"].
- .4 Fixture drains from kitchen sink piping at intervals not exceeding 7.5 metres [25'] for pipe all sizes.
- .5 Base of soil or waste stacks and rainwater leaders, both interior and exterior.
- .6 As called for by the B.C. Plumbing Code 2012.
- .7 Install cleanouts which are located low on walls at 75 mm [3"] minimum above the top of the baseboard or minimum 200 mm [8"] above finished floor level where there is no baseboard.
- .8 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.
- .9 Extend cleanouts to the finished floor or wall unless exposed in a basement room or ceiling space.
- .10 Cleanouts in wet floor areas shall extend above the floor in walls or be provided with gasketed waterproofed tops.
- .11 Cleanouts on outside drains shall be brought to grade and anchored in a concrete collar.

3.4 HANGERS AND SUPPORTS

- .1 On insulated piping larger than 25 mm [1"] diameter where the insulation possesses a continuous vapour barrier, install oversized hangers and insulation protection shields of thickness and length as recommended by the manufacturer. On insulated piping 25 mm [1"] diameter and less protect contact between pipe and hanger and fit insulation tightly around hanger rod penetration through insulation.
- .2 Maximum hanger spacing: (maximum spacing for cast or ductile iron is 1.5 metres [5']).

Pipe Size Mm [in.]	Rod Dia. Mm [in.]	Steel m [ft.]	Copper m [ft.]	PVC m [ft.]
To 18 [¾]	9 [⅜]	1.5 [5]	1.5 [5]	1.05 [3½]
25-30 [1-1¼]	9 [⅜]	2.1 [7]	1.8 [6]	1.2 [4]
40-50 [1½-2]	9 [⅜]	2.7 [9]	2.4 [8]	1.2 [4]
65-75 [2½-3]	12 [½]	3.3 [11]	3.0 [10]	1.2 [4]

100-125 [4-5]	15 [$\frac{5}{8}$]	4.2 [14]	3.6 [12]	1.2 [4]
150 [6]	20 [$\frac{3}{4}$]	5.2 [17]	1.2 [4]	
200-250 [8-10]	22 [$\frac{7}{8}$]	5.8 [19]	1.2 [4]	

- .3 Do not support horizontal piping runs from the floor unless specifically indicated.

3.5 PIPE SLEEVES AND ESCUTCHEONS

- .1 Sleeves shall be concentric with the pipe and shall be sized to allow for the continuity of insulation.
- .2 Extend sleeves 50 mm [2"] above floor slabs in wet areas. Wet areas include equipment rooms, janitor's rooms, utility rooms and plumbing service chases.
- .3 Extend sleeves through outside walls to 12 mm [1/2"] beyond the exterior face and caulk with flexible caulking compound.
- .4 Where removable plastic sleeves are used they shall be removed prior to pipe penetration and the resulting hole shall be then classified as the sleeve.
- .5 Install chrome plated escutcheon plates on exposed piping passing through walls, floors and ceilings in finished areas.

3.6 CORE DRILLING AND CUTTING

- .1 The work of this contract shall include for all required coring to accommodate the plumbing works, where sleeves have not been provided in a timely manner.
- .2 Arrange and pay for the cost of all core drilling and cutting for plumbing systems in this section of the work.
- .3 Coring and cutting of structural building components shall only take place upon the receipt of specific written approval of the Structural Engineer. Repairs to existing services damaged as a result of core drilling is included in this section of the work.
- .4 Penetrations up to 150 mm [6"] nominal pipe size in precast concrete may be cored on site. Larger penetrations shall be located and arranged for in precast work with precast manufacturer prior to shipping to construction site.

3.7 MISCELLANEOUS WORKS 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, all steel covers or cages to protect exposed piping subject to mechanical damage is part of this section of the work.
- .2 Prime coat after fabrication with two coats of red primer.
- .3 See separate division of specification for finish painting requirements.
- .4 Provide blocking at all fixture stops and anchor the supply lines using dog ear elbows.

3.8 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 supply and recirculation piping where required.

3.9 TESTING AND INSPECTION

- .1 Give written 72 hour notice to the Departmental Representative of dates for tests.
- .2 Do not conceal work until tested and reviewed. Follow the construction schedule and arrange for tests.
- .3 Conduct tests in the presence of the Departmental Representative or their representative. Arrange for the Departmental Representative to be present at their discretion.
- .4 Bear all costs for testing including retesting and making good.
- .5 Provide notification to the Authority Having Jurisdiction and ensure work is reviewed by the in accordance with their requirements prior to backfilling.
- .6 Test all sanitary waste and storm drainage piping systems with hydraulic pressure of 1500 mm to 3000 mm for 8 hours.
- .7 An air test may be used during freezing conditions where permitted by the Authority Having Jurisdiction.
- .8 Provide copies of written reports for all sections of the work as it is tested, and retain a copy of all test reports on site.
- .9 Furnish all labour, materials, instruments, etc. necessary for all required tests.
- .10 All leaks shall be corrected by remaking the joints. The systems shall be retested until no leaks are observed.
- .11 If any plumbing system or part thereof is covered before being inspected or approved, it shall be uncovered upon the direction of the Authority Having Jurisdiction at no additional cost to the Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 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.
- .2 Interior storm drainage piping and exterior rainwater leaders shall be provided as depicted on the drawings from roof drains and gutters that will discharge storm drainage or clear unpolluted waste water and shall be connected to discharge to the exterior storm building service as depicted on the drawings.

1.3 QUALITY ASSURANCE

- .1 Perform all work in compliance with the National Building Code of Canada 2010 and local bylaws.
- .2 All work is to be performed by qualified tradespersons holding a valid Trade Qualification T.Q. card for the applicable work being performed. Retain these cards on site for each worker and submit copies of these to the Departmental Representative upon request.

1.4 SHOP DRAWINGS AND SAMPLES

- .1 Submit shop drawings for all system components including pipe, fittings, couplings, cleanouts, solvent cements, drains and trap primers.
- .2 Submit to the Departmental Representative 2 at 450 mm long samples of each type of pipe complete with the CSA reference number clearly stamped on the pipe samples, two 45 or 90 degree fittings, and two compatible couplings along with the shop drawings.

Part 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 conforming to CAN/CSA B70.
 - .2 Solid core Acrylonitrile-Butadiene-Styrene (ABS) Drain, Waste and Vent Pipe and Pipe Fittings conforming to CAN/CSA B181.1.
 - .3 Polyvinyl Chloride (PVC) Drain, Waste and Vent Pipe and Pipe Fittings conforming to CAN/CSA B181.2.

- .4 Schedule 40 Cellular Core 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 conforming to CAN/CSA B70 up to 250 mm diameter.
 - .2 DWV copper drainage pipe conforming to ASTM B42 with cast brass or wrought copper drainage pattern fittings with 50/50 Sn/Pb recessed solder joints up to 50 mm diameter.
 - .3 ABS and PVC pipe and fittings are not permitted above ground.
- .3 Trap primer piping:
 - .1 Wirsbo AquaPex cross linked polyethylene piping listed for potable water service. No underground joints are permitted.
- .4 Additional requirements:
 - .1 Plastic (PVC or ABS) piping where used underground shall adapt to approved non-plastic material prior to penetration above the building slab or such that a transition coupling is installed immediately at the floor slab with no section of ABS or PVC pipe exposed above the slab.
 - .2 Class 4000 mechanical joint cast iron soil pipe and mechanical joint couplings shall be of one manufacturer.
 - .3 Copper to cast iron joints shall be male brass adaptors to tapped fittings.
 - .4 Nipples shall be cast iron or heavy brass.

2.2 FLOOR DRAINS

- .1 Floor drains shall include trap primer tapping connections.
- .2 Floor Drain FD-1: (funnel for unfinished and mechanical room areas).
 - .1 Cast iron floor drain with secondary drainage flange and 100 mm diameter adjustable cast iron strainer with 90 mm x 230 mm cast iron oval funnel. Cast iron non-plated parts to be coated for rust prevention. Trap primer connection.
 - .2 Acceptable Products: Zurn Z-415-BFP, Ancon, Jay R. Smith, or equivalent.

2.3 CLEANOUT COVERS

- .1 Zurn Series Z-1500 epoxy coated cast iron cleanout covers in all exterior and service locations including mechanical rooms and service closets; or equivalent.
- .2 Zurn Series ZN-1500 epoxy coated cast iron cleanout covers with nickel bronze covers in all interior finished locations including staff areas; or equivalent.

- .3 PVC or ABS cleanout covers are not acceptable.
- .4 Acceptable Products: Zurn, Ancon, Jay R. Smith; or equivalent.

Part 3 Execution

3.1 PIPING

- .1 Install piping generally as shown on the drawings.
- .2 Install the upstream ends of sanitary runs at invert elevations shown on the drawings or if not specifically shown, then at a depth sufficient that future sanitary piping from the most remote locations of the building could be installed and routed at 1% slope and connect into the sanitary piping being installed under this scope of work.
- .3 Slope piping for positive flow at a minimum 2% slope on piping up to 75 mm and at a minimum 1.5% slope on piping 100 mm and larger, with no dips or low points.
- .4 Sanitary drainage piping from water closets shall be minimum 150 mm diameter for all piping located below grade or concealed.
- .5 Provide a minimum one meter length of drainage pipe between successive 45 degree fittings on all changes of direction of sanitary piping located below grade, to minimize blockages at changes of direction.
- .6 Work performed within excavations and trenches shall be done in accordance with Worker's Compensation Board requirements regarding shoring or sloping of the excavation.
- .7 Install piping in trenches on minimum 150 mm layer of compacted sand bedding and backfill as specified in Division 2.

3.2 FLOOR DRAINS

- .1 Install floor drains set at low points in the floors low to provide proper surface drainage.
- .2 Piping from trap primers to floor drains is to be installed with no joints either in the slab or below grade.

3.3 FLASHING AND VENT TERMINALS

- .1 Supply and fix 25 kg/m² sheet lead flashings to all cleanouts and drains. Securely fix the flashing material to the flashing clamps and extend 300 mm beyond the edge of the cast iron fittings.
- .2 Chloraloy 240 lining material may be used as an alternate to lead at floor drains and cleanouts where compatible with the adjacent membrane materials. Materials shall be solvent welded to the manufacturer's installation instructions.

3.4 TESTING AND INSPECTION

- .1 Tests on the sanitary waste and storm drainage systems shall consist of hydraulic pressure testing of 1500 mm to 3000 mm for 8 hours.
- .2 An air test in accordance with the B.C. Plumbing Code 2010 may be used during freezing conditions where permitted by the Authority Having Jurisdiction.
- .3 Complete all tests prior to backfilling.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SCOPE OF WORK

- .1 Connect to the existing gas main downstream of the meter on site and install main upgrade as shown on drawings. Provide an isolation valve at the connection point, on the line serving this project, complete with an identification tag to suit the valve tag numbering or labeling system in place at the institution.
- .2 Interior natural gas piping shall be connected to receive natural gas supply from the exterior natural gas piping as depicted on the drawings, and distributed to all natural appliances and equipment that require natural gas service.
- .3 Refer to the HVAC drawings and specification Sections for associated natural gas fired equipment information.

1.3 PROVINCIAL GAS INSPECTION DEPARTMENT

- .1 Provide all work in accordance with CSA B149.1 Natural Gas and Propane Installation Code and the requirements of the local Authority Having Jurisdiction.
- .2 Submit to the Provincial Gas Inspection Department, drawings, applicable sections of specifications and detailed equipment drawings as required to obtain a permit and approval for the gas piping system installation.
- .3 Permits and approvals must be received prior to commencing work.

1.4 PAINTING AND COLOR CODING

- .1 Painting of all piping, equipment and material installed in this Division of work shall be included under this Division of the specifications according to the colour schedule shown in Section 23 05 53.
- .2 Color coding identification of the natural piping as required by the gas code shall be provided in this Division of work.
- .3 Apply one coat of Rust-Oleum 769 damp proof red primer (or equivalent), one coat of Rust-Oleum 960 zinc chromate (or equivalent) and one finish coat of Rust-Oleum yellow paint (or equivalent) to CGSB 1-GP-12C Color Coding System Schedule to all above grade piping throughout the building, both inside and outside piping.

1.5 SHOP DRAWINGS AND SAMPLES

- .1 Submit shop drawings for all system components including pipe, fittings, couplings, valves, pressure regulators and all other materials and components.

- .2 Submit to the Departmental Representative 2 at 450 mm long samples of each type of pipe including underground and above ground pipe, and two 90 degree fittings along with the shop drawings.

Part 2 Products

2.1 BELOW GRADE EXTERIOR PIPING

- .1 Not applicable.

2.2 ABOVE GROUND PIPING

- .1 Raise the pipe above grade and enter the exterior wall of the building through a wall sleeve of one nominal pipe size larger than the gas service pipe. Provide silicone caulking, neatly finished, between the gas pipe and the sleeve to provide a weather tight seal.
- .2 Schedule 40 seamless carbon steel pipe to ASTM A53.
- .3 Gastite flexible corrugated stainless steel tubing (CSST) system complete with a yellow polyethylene jacket and self-flaring brass fittings to CSA standards within the mechanical room only on low pressure piping at the appliances.

2.3 FITTINGS

- .1 Screwed:
 - .1 Malleable iron threaded end to ANSI/ASME Standard B16.3.
 - .2 Dielectric type fittings where a buried service enters and connects to building piping.
- .2 Welded:
 - .1 Forged steel - same weight as the connecting pipe.
 - .2 All branch connections (except those less than half the diameter of the main) welding tees or sweepolets.
 - .3 Acceptable Products: Bonny Forge Thredolets or Weldolets.
- .3 Unions:
 - .1 Malleable iron, ground joint type.

2.4 JOINT MATERIALS

- .1 Screwed - approved thread lubricant or Teflon paste. Teflon tape is unacceptable.
- .2 Flanged - approved full faced gasket materials, flanged steel weld neck, raised face type, carbon steel (ASTM A307) square headed bolts with hexagon nuts, bolts full diameter of bolt holes.

2.5 VALVES

- .1 Provincial Gas Department approved and suitable for temperature to which they are exposed. - Acceptable Products: Homestead 601, DeZurik 45 with RS-49 plug seals, Emco, Mueller, Rockwell, or equivalent.

Part 3 Execution

3.1 PIPE JOINTING

- .1 Interior natural gas service - screw or weld up to 50 mm [2"], weld 65 mm [2½"] and larger.
- .2 Exterior natural gas service in unvented space, in supply or return air ceiling plenum, or operating at 35 kPa [5 psi] pressure - weld all sizes.
- .3 Exterior natural gas service - weld all sizes except for polyethylene pipe which shall have no joints other than those allowed in the Canadian Gas Association, CGA B149.1-00, Natural Gas and Propane Installation Code.
- .4 Remake all leaking joints.
- .5 Do not paint dielectric isolating couplings.
- .6 Heat shrink factory extruded polyethylene sleeves over bare metallic pipe at welds in underground steel piping.
- .7 Employ an independent testing agency to test the continuity of the polyethylene jacket, when metallic piping is buried, using a 12,000 volt Holiday Detector. Repair any breaks in the polyethylene jacket with two layers of polyken tape. Submit report from testing agency certifying continuity of the polyethylene jacket.

3.2 EQUIPMENT CONNECTIONS

- .1 Install unions or flanges at connections to all equipment, and specialty components such as pressure regulators, and locate downstream of the isolation valves.
- .2 Provide dirt pockets at the base of all pipe drops to equipment or appliances, and locate the dirt pockets downstream of the isolation valves.
- .3 Arrange piping connections to allow ease of access and for removal of equipment.
- .4 Align and independently support all piping connections to prevent piping stresses being transferred to equipment.

3.3 VALVES

- .1 Install gas shut-off valves complete with handles at the following locations:
 - .1 At the pipe connection at the main site gas meter set.
 - .2 At the service entry point to the building immediately prior to entry.

- .3 At each branch to an individual mechanical room, item of equipment or appliance.
- .2 All building isolation valves shall possess locking lugs.
- .3 Provide valve tags on all isolation valves and coordinate the valve tag numbers with valves provided on other systems.

3.4 VENT TERMINALS

- .1 Provide vent piping to the outdoors from all natural gas pressure regulators, regardless of the upstream or downstream system pressure.
- .2 Terminate vent piping outlets to atmosphere at the following minimum lateral distances:
 - .1 1.5 metres [5'] from any door, openable window or building opening.
 - .2 3.0 meters [10'] from any mechanical forced air intake.

3.5 BELOW GRADE EXTERIOR PIPING

- .1 Not applicable.

3.6 ABOVE GROUND PIPING

- .1 Allow for expansion with suitable anchors, guides and expansion loops to prevent undue stress on any part of the system. Such anchors and guides shall be rigidly fastened to structural members.
- .2 All piping shall be provided with approved flexible gas pipe connectors at the point of connection to gas fired equipment where called for on the HVAC drawings.

3.7 PIPING TESTS

- .1 In accordance with the CSA B149.1 Natural Gas and Propane Installation Code.
- .2 Submit signed copies of all pressure test reports to the Departmental Representative.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

- .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 23 and is intended only to supplement the requirements of Division 1.***
- .2 Coordinate with Division 7 for requirements/scope definition on security fasteners and calking.
- .3 Coordinate with Division 9 for requirements/ scope definition on painting.
- .4 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.
- .5 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. 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.
- .6 The most stringent requirements of this and other mechanical sections shall govern.
- .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.

1.2 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 HVAC – 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.

1.3 ADDITION OF ACCEPTABLE MANUFACTURERS

- .1 Material/products considered to satisfy the specification, but of a manufacturer other than those named in the Equipment Supplier Schedule may be submitted to the Departmental Representative for consideration not later than five (5) working days prior to closing of tender or of bid depository subtrade tender whichever is earlier.
- .2 Addition of manufacturer's names to the specifications will be by addendum only.

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 faxed, mailed or couriered to the Departmental Representative's office. No telephone questions will be answered.

1.5 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.

1.6 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.

- .3 Progress claims will not be certified nor payment made beyond 90% on the overall Mechanical (H.V.A.C.) contract and beyond 70% on the Control systems contract, until commissioning and verification of the systems are complete. (The 70% limit on Controls is included in the overall fig.). This procedure is to allow for any necessary deficiency holdbacks on items which do not become apparent until the systems are commissioned.

1.7 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 Control system installation.
 - .4 Air balancing
 - .5 Connection of electrical services to equipment by electrical contractor.
 - .6 Start-up of mechanical equipment and systems.
 - .7 Check-out of control systems.

1.8 RESPONSIBILITIES

- .1 Visit the site before tendering. Examine all local and existing conditions on which the work is dependent.
- .2 No consideration will be granted for any misunderstanding, of work to be done, resulting from failure to visit the site.
- .3 Ensure that equipment does not transmit noise and/or vibration to other parts of the building, as a result of poor installation practice.
- .4 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.

1.9 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 Departmental Representative, 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 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 Departmental Representative on completion of the work that all equipment installed can be properly, safely serviced and replaced, if and when required.

1.10 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.

1.11 CODES, REGULATIONS AND STANDARDS

- .1 Division 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 Bylaws
 - .1 Local Building Bylaws.
 - .2 Canadian Gas Association
 - .1 National Standard of Canada CAN/CGA-B149.1-00. - Natural Gas Installation Code.

- .3 Canadian Standards Association
 - .1 CSA Standard C22.1, Canadian Electrical Code, latest edition.
 - .2 CSA Standard B52-99 Mechanical Refrigeration Code.
- .4 National Research Council of Canada
 - .1 NRCC 23174 National Building Code of Canada 2010.
 - .2 NRCC 23175 National Fire Code of Canada 2010.
- .5 National Building Code of Canada
 - .1 NBC 2010, Division B, Parts 1 to 9 inclusive.
 - .2 National Fire Code, latest edition.
- .6 Province of British Columbia
 - .1 B.C. Safety Authority Power Engineers, Boiler, Pressure Vessel and Refrigeration Safety Regulation.
 - .2 B.C. Amendment to Canadian Electrical Code.
 - .3 B.C. Electrical Safety Branch Bulletins.
 - .4 B.C. Code Amendments, Gas Safety Act & Regulations.
 - .5 B.C. Industrial Health & Safety Regulations, Workers' Compensation Board of British Columbia.
- .7 SMACNA Publications
 - .1 H.V.A.C. Duct Construction Standards, latest edition.
 - .2 Fire, Smoke and Radiation Damper Installation Guide, latest edition.
 - .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.

1.12 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.

1.13 ENERGY CONSUMPTION

- .1 Departmental Representative may reject equipment submitted for approval or review on basis of performance or energy consumed or demanded.

1.14 ASBESTOS

- .1 All material / products installed shall be free of asbestos.

1.15 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.

1.16 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.

1.17 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.

1.18 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".

1.19 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.

1.20 SEQUENCE OF WORK

- .1 Before interrupting major services notify the Departmental Representative well in advance and arrange an acceptable schedule for the interruptions.
- .2 Before interrupting any services complete all preparatory work as far as reasonably possible and have all necessary materials on site and prefabricated (where practical) and work continuously to keep the length of interruption to a minimum.
- .3 Include for the cost of all work that may be required out of regular hours to minimize the period of service interruption when connecting into the existing systems.

1.21 BUILDING OPERATION DURING CONSTRUCTION

- .1 In order to minimize operational difficulties for the building staff, the various trades must cooperate with the Departmental Representative throughout the entire construction period and particularly ensure that noise is minimized.
- .2 Convenient access for the staff and public to the building must be maintained at all times. Minor inconvenience and interruption of services will be tolerated, provided advance notice is given, but the Contractor will be expected to coordinate his work, in consultation with the Departmental Representative, so the operation of the facility can be maintained as nearly normal as possible.

1.22 SHOP DRAWINGS/PRODUCT DATA

- .1 Process
 - .1 Shop drawings/product shall be submitted as listed in Section H.V.A.C. Equipment Schedule and on Drawing M105.

- .2 Shop drawings/product data shall be reviewed, signed and processed as described in the General Conditions, in Division 1.

.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 Advertising literature will be rejected.
- .6 The project shall be identified on each document.
- .7 Information shall be given in S.I. units.
- .8 The shop drawings/product data shall include:
 - .1 Dimensioned construction drawings with plans and sections showing size, arrangement and necessary clearances, with all equipment weight's and mounting point loads.
 - .2 Mounting arrangements.
 - .3 Capacity and performance characteristics indicated on performance curves for fans and pumps.
 - .4 Sound Power Data, where requested.
 - .5 Motor efficiencies on motors 1H.P. and larger.
 - .6 List of the manufacturers and figure numbers for all valves, traps and strainers.
 - .7 Detailed drawings of bases, supports and anchor bolts.
 - .8 Control explanation and internal wiring diagrams for packaged equipment.
 - .9 Electrical control system drawings.
 - .10 Interlock wiring and control schematic diagrams including details of all component parts in order that the function of each is displayed.
 - .11 A written description of control sequences relating to the schematic diagrams.

- .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 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 Representatives.
 - .2 Submit shop drawings and product data.
- .5 Keep one [1] copy of shop drawings and product data, on site, available for reference.

1.23 EQUIPMENT INVENTORY SHEETS

- .1 Equipment Inventory Sheets are attached at the end of this section. See sample sheet. Fill out inventory sheets and submit together with shop drawings.

1.24 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.

1.25 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.

1.26 ANCHOR BOLTS AND TEMPLATES

- .1 Supply anchor bolts and templates for installation by other divisions.

1.27 ACCESS DOORS (APPLIES ONLY FOR NOT SECURED AREAS)

- .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.
- .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, or equivalent.
 - .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, or equivalent.
 - .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, or equivalent.

- .5 Acoustical tile ceiling and similar block materials: 14 gauge bonderized steel recessed ceiling type.
 - .1 Acceptable Product: Acudor AP-5010 or AT-5020, or equivalent.
- .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, or equivalent.).
- .5 Standard of Acceptance: Zurn, Wade, Acudor, Can-Aqua, Milcor, Maxam, Van-Met, or equivalent.

1.28 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. The performance of actual cutting, patching, digging, canning and coring is specified under other Divisions. Be responsible for correct location and sizing of all openings required under Division 21, 22 and 23 including pipe sleeves and duct openings. Allow oversized openings for fire dampers and pipe penetrations where insulation is specified.
- .2 Be responsible for all cutting, patching, digging, canning and coring required to accommodate the mechanical services.
- .3 Openings through structural members of the building shall not be made without the approval of the Departmental Representative.

1.29 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, or equivalent.
 - .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, or equivalent 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, or equivalent stud anchor for concrete. (Do not use in seismic restraint applications).
 - .3 Hilti HDI or UCAN IPA, or equivalent drop-in anchor for concrete.
 - .4 Hilti or UCAN, or equivalent Sleeve Anchor (medium and light duty) for concrete and masonry.
 - .5 Hilti ZBP or UCAN Zamac, or equivalent pin bolt (light duty) for concrete and masonry.
- .3 Drilled, adhesive type:
 - .1 Hilti HVA or UCAN, or equivalent Adhesive Anchor consisting of anchor rod assembly with a capsule containing a two-component adhesive, resin and hardener.
 - .2 Hilti HY150, or equivalent 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, or equivalent Dust Vacuum System.

1.30 MISCELLANEOUS METAL

- .1 Be responsible for all miscellaneous steel work relative to Division 21, 22 and 23 of the Specifications, including but not limited to:
 - .1 Support of equipment - including cooling tower.
 - .2 Hanging, support, anchoring, guiding and relative work as it applies to piping, ductwork, heat exchangers, 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.

1.31 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-M95 standard 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.
- .5 At all fire dampers use ULC approved fire stop sealant to caulk all joints (Check with fire damper manufacturer to ensure that the application of fire stop sealant will not void the UL listing of the damper):
 - .1 Between fire damper sleeve angles and the sleeves and
 - .2 Between fire damper sleeve angles and the fire separation.

1.32 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.

1.33 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. 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.
 - .2 Pack future-use sleeves with mineral wool insulation and then seal with ULC approved fire stop sealant for rated fire separations.

1.34 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.

1.35 DUCT AND PIPE MOUNTED CONTROL EQUIPMENT

- .1 The following automatic control equipment will be supplied under Section 23 09 01 but installed by the appropriate trade sections of Division 23:
 - .1 Automatic control valves.
 - .2 Pressure tappings.
 - .3 Flow switches.
 - .4 Automatic control dampers.
 - .5 Static pressure sensors.
 - .6 Pressure switches.
 - .7 Pressure differentials.

1.36 ELECTRIC MOTORS

- .1 Provide motors for mechanical equipment as specified.
- .2 Unless noted otherwise, provide open drip-proof, ball bearing motors.
- .3 Motors shall be UL listed and CSA certified.
- .4 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.
- .5 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.
- .6 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.
- .7 All motors shall be designed and manufactured to operate with $\pm 10\%$ voltage and $\pm 5\%$ frequency variations of the nameplate ratings. Combined voltage and frequency variation shall not exceed $\pm 10\%$.
- .8 The noise level of each motor shall comply with NEMA standards, < 80 dBA at 1m.
- .9 Motors will be rated for a 1.15 service factor in a 40°C ambient environment.
- .10 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	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
20	90.2	91.0	90.2
25	91.0	92.4	91.7
30	91.0	92.4	91.7
40	91.7	93.0	93.0
50	92.4	93.0	93.0

- .11 All motors to be standard 1800 RPM unless specifically scheduled otherwise.
- .12 Provide all motors with terminal boxes, suitable for power connections.
- .13 Provide screw adjustable bases on all belt connected motors.
- .14 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.
- .15 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.

- .16 Submit data of test method used, with shop drawings, when motor efficiencies are called for.
- .17 Unless otherwise noted starters and protection devices will be included under the Electrical Division of the Specification.
- .18 Assist Division 26 to ensure proper connection, correct thermal overload protection and correct motor controls.
- .19 Where starters are included in this Division as an integral part of packaged equipment, they shall contain thermal overload protection in all ungrounded lines.
- .20 Equipment, which has more than one voltage rating, shall be fed from a single power source through a disconnect switch.
- .21 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.

1.37 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.

1.38 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.

1.39 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.

1.40 EQUIPMENT SUPPORTS

- .1 Provide stands and supports for equipment and materials supplied.
- .2 Lay out concrete bases and curbs required under Division 21, 22 and 23. Coordinate with respective division for all concrete work.
- .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.
- .7 Lay out laminated wood bases required under Division 21, 22 and 23, coordinate with respective division in rooms with wood structure floors. Bases shall be a nominal 100 mm [4"] thick unless otherwise directed. Wood members shall be securely spiked together and all corners shall be chamfered at 45 degrees.

1.41 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 or equivalent.

1.42 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.

1.43 PAINTING

- .1 Clean exposed bare metal surfaces supplied under Division 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 23, to match the original factory finish.
- .4 Coordinate with respective division for painting.
- .5 Painting of all equipment and materials, supplied under Division 21, 22 and 23, installed in mechanical equipment areas and inside finished areas of the building or exposed outside the building, is included under respective painting division of the Specification.
- .6 Painting by respective Division shall be in accordance with the following Colour Schedule for Mechanical Equipment Areas:

Item	Colour Finish
Condensers (uninsulated)	Blue
Ductwork, Plenums and Miscellaneous Steel	
• not galvanized	Grey
• galvanized	White
• plenum access doors and 200 mm around doors	Grey
Motors (electric)	To match associated equipment
Piping (uninsulated)	
• gas (natural)	Yellow

1.44 CLEAN-UP FOR PAINTING

- .1 Clean all exposed bare metal surfaces furnished under this Division by removing all dirt, dust, grease and millscale. Painting of all equipment and materials installed in mechanical equipment areas will be by others.
- .2 All miscellaneous metal work furnished under this Division shall be supplied with one shop coat of primer for finished enamel painting. After erection or installation, whichever is appropriate, apply one coat of undercoat in readiness for finish painting. Preparatory work on all surfaces, prior to painting, shall be in accordance with the recommendations of the paint manufacturer.

1.45 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 Furnace(s) started up and adjusted by manufacturer's representatives.
 - .5 All air filters installed.
 - .6 Fan drives properly aligned by a journeyman millwright.
 - .7 All mechanical equipment rooms, including plenums, vacuum cleaned.

1.46 SPARE PARTS

- .1 Provide spare parts as follows:
 - .1 One filter cartridge for each filter installed (pre and final filters).

1.47 CLEANING AND FINAL ADJUSTMENT

- .1 Clean mechanical systems daily.
- .2 Clean interior and exterior of all systems including strainers, and vacuuming of interior of ductwork, air handling units.
- .3 Clean and refurbish all equipment and leave in first class operating condition including replacement of all filters in all air and piping systems.
- .4 Balance and adjust all systems and each piece of equipment to operate efficiently.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP58.
- .2 Set inserts in position in advance of concrete work. Use grid system in equipment rooms.
- .3 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.
- .4 Do not suspend from metal deck.
- .5 Hangers for copper pipe shall be copper plated or plastic dipped unless pipe hangers bear on piping insulation (cold services).

Part 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, or equivalent.
 - .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, or equivalent.
- .2 Steel Beam (bottom flange):
 - .1 Cold piping NPS 2 and under: malleable iron C clamp - Grinnell/Anvil fig. 61, or equivalent.
 - .2 Cold piping NPS 2-1/2 and larger and all hot piping: malleable iron beam clamp - Grinnell/Anvil fig. 292, or equivalent.
- .3 Steel Beam (top):
 - .1 Cold piping NPS 2 and under: malleable iron "top of beam" C clamp - Grinnell/Anvil Fig. 61, or equivalent.

- .2 Cold piping NPS 2-1/2 and larger: steel jaw, hook rod with nut, spring washer and plain washer - Grinnell/Anvil fig. 227, or equivalent.
- .3 Steel Joist:
 - .1 Cold piping NPS 2 and under: steel washer plate with double locking nuts - Grinnell/Anvil fig. 60, or equivalent.
 - .2 Cold piping NPS 2-1/2 and larger: 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, or equivalent.
- .4 Steel Channel or Angle (bottom):
 - .1 Cold piping NPS 2 and under; malleable iron C clamp - Grinnell/Anvil fig. 86, or equivalent.
 - .2 Cold piping NPS 2-1/2 and larger: universal channel clamp - Grinnell/Anvil fig. 226, or equivalent.
- .5 Steel Channel or Angle (top):
 - .1 Cold piping NPS 2 and under: malleable iron "top of beam" C clamp - Grinnell/Anvil fig. 61, or equivalent.
 - .2 Cold piping NPS 2-1/2: steel jaw, hook rod with nut, spring washer and plain washer - Grinnell/Anvil fig. 227, or equivalent.

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, or equivalent.

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, or equivalent.
- .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, or equivalent.
- .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, or equivalent up to NPS 6 and Grinnell/Anvil fig. 171, or equivalent up to NPS 8 and larger.
- .4 Bottom supported hot piping, steel and copper: pipe roller stand - Grinnell/Anvil fig. 271,

or equivalent.

- .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, or equivalent.

2.4 RISER CLAMPS

- .1 Steel or cast iron pipe: galvanized carbon steel - Grinnell/Anvil fig. 261 or Myatt fig. 182, or equivalent.
- .2 Copper pipe: carbon steel copper finished - Grinnell/Anvil fig. CT-121, or equivalent.

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, or equivalent.
- .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, or equivalent.
- .3 Hot piping NPS 3 and under: insulation over pipe hanger.
- .4 Hot piping NPS 4 and over: protective saddle with insulation under saddle - Grinnell/Anvil fig. 160 to 166, or equivalent.

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, or equivalent.
 - .2 Channel type support - Burndy, Canadian Strut, Cantruss or Unistrut, or equivalent - (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.

Part 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 For Gas Piping refer to Gas Code CAN/CGA-B149.1.
 - .2 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.
 - .3 Within 300 mm [12"] of each horizontal elbow.
- .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]	
10, 12	22 [7/8]	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.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts. 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 National Building Code of Canada 2010, Division B, including 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 National Building Code of Canada 2005, Division B, Section 6.2.1.8. (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 engineer 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 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.
- .7 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.
- .8 Use ductile materials in all vibration and seismic restraint equipment.
- .9 Follow structural engineer's instructions for drilled inserts re: installation of anchors.
- .10 Coordinate with Section 23 33 00 "Duct Accessories" for all ductwork connections to fans or plenums.
- .11 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.
- .12 Coordinate with Division 26 for the provision of a minimum 180° hanging loop of flexible conduit for all electrical connections to isolated equipment.
- .13 Supply all isolators fully assembled and clearly labelled with full instructions for installation by the contractor.

Part 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 Engineers' 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" ($k_x/k_y = 1.0$ 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
 - .4 Or equivalent.

2.3 ISOLATORS - TYPE 2, RUBBER FLOOR MOUNTS

- .1 Rubber/neoprene-in-shear isolators designed to meet specified seismic requirements. Select isolators for a 4 mm [0.15"] minimum static deflection, and bolt to structure. In the case of rubber isolators, provide protection in the design of the isolator to avoid contact of

the rubber element to oil in the mechanical room.

.2 Standard of Acceptance

.1 Mason BR, maximum 50 durometer

.2 Or equivalent.

2.4 ISOLATORS - TYPE 3, SPRING FLOOR MOUNTS

.1 Spring mounts complete with levelling devices, selected to achieve 25mm deflection under load, Springs to incorporate a minimum 6 mm [1/4"] thick neoprene sound pad or cup having a 1.3 mm [0.05"] minimum deflection under load. Design isolator to meet specified seismic requirements.

.2 Standard of Acceptance:

.1 Mason SSLFH.

.2 Or equivalent.

2.5 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 Or equivalent.

2.6 ISOLATORS - TYPE 6, SEISMIC SNUBBERS.

.1 Seismic snubbers c/w minimum 3mm [1/8"] neoprene bushing and 6mm [1/4"] air gap. Snubber to act omni-directionally. Ensure bushing can easily be turned by hand after installation

.2 Standard of Acceptance:

.1 Manson Z-1225.

.2 Or equivalent.

2.7 CLOSED CELL FOAM GASKETS / NEOPRENE GROMMETS - TYPE 7

.1 20 mm [3/4"] thick continuous perimeter closed cell foam gasket to isolate base of package type equipment, AHU's, exhaust fans, etc. from concrete floors / roof curbs. Select width for nominal 3psi loading under weight of equipment and allow for 25% compression 5mm [3/16"]. Increase width of curb using steel shim if necessary to accommodate gasket. For light equipment such as exhaust fans, deflection should be a

minimum of 0.05". Contractor to check fire rating requirements specified for project.

.2 Standard of Acceptance:

- .1 American National Rubber-EPDM-SBR blend SCE 41 type neoprene.
- .2 Mason Industries Type HG Hemi-Grommets.
- .3 Or equivalent.

2.8 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.
- .3 Or equivalent.

Part 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 Under equipment mounted on Type3 mounts, which do not meet the seismic requirement, provide Type6 seismic snubbers.
- .7 Use Type 1 pads only where specified.

- .8 Isolate all floor or pier mounted equipment on Type 3 isolators, unless otherwise specified.
- .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 For equipment mounted on a slab on grade mount on type 2 isolators unless otherwise specified.
- .12 Select Type 4 spring hangers for a minimum static deflection of 25 mm [1"] for all ceiling hung fans.
- .13 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.
- .14 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.
- .15 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.
- .16 Protect neoprene isolator components from overheating or use type 8 mounts.
- .17 Be responsible for ensuring that flexible duct connections 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.

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

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 REGULATORY REQUIREMENTS

- .1 Restraints shall meet the requirements of the National Building Code of Canada 2010, Division B, Section 4.1.8.17., table 4.1.18.17.

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 Departmental Representative 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.

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.

Part 2 Products

2.1 GENERAL

- .1 Mason Type SCB (Seismic Cable Brace) slack cable restraints supplied by Vibra-Sonic Control, or equivalent.
- .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.

Part 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 NON-ISOLATED FLOOR MOUNTED EQUIPMENT

- .1 Bolt all non-isolated equipment and machinery, e.g. floor mounted tanks, 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 resonances, use a nominal 2.0g seismic force.

3.4 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 Vary adjacent spacing of restraints on a piping run by 10% to 30% to avoid coincident resonances.
- .4 Install restraints at least 50 mm [2"] clear of all other equipment and services.
- .5 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"].
- .6 Provide transverse and axial restraints as close as practical to a vertical bend.
- .7 At steel trusses, connect to top chords and follow truss manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 EQUIPMENT

- .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) and 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, heating coil HC-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

- .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 adjacent to valves and where valves are in series at no more than 2 m [6'-6"] intervals. Identify piping 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 Identify piping both sides where piping passes through walls, partitions and floors.
 - .4 Identify piping at point of entry and leaving each pipe chase and/or confined space.
 - .5 Identify piping accessible at each access opening.
 - .6 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; or equivalent.
 - .7 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; or equivalent.
- .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, steam trap 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).

1.4 DUCTWORK

- .1 Identify plenum access doors as to accessed items, e.g. Filter F-1, Supply Fan SF-1, Heating Coil HC-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

- .1 Secure 6 mm [1/4"] self adhesive coloured dots, (Brady Quik Dots or Avery Data Dots, or equivalent), 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 heat sensors	black
Fire, smoke and sprinkler equipment	red
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

- .1 Secure 50 mm [2"] high, Gothic style self-adhesive stick on-letters, (Letrasign or Brady Quick-Align, or equivalent) on duct access panels to identify their usage, according to the following schedule:

	Colour	Letters
Cleaning and service access	black	C.A
Controls including heat sensors	black	C
Dampers, (backdraft, balance and control)	black	D
Fire dampers	red	F.D.
Smoke dampers and detectors	red	S.D.

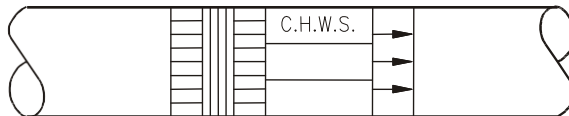
1.7 TAGGING IDENTIFICATION

- .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 Division 23.

1.8 PIPE IDENTIFICATION COLOUR SCHEDULE

Service	Identification Lettering	Primary Colour	Secondary Colour
Natural Gas (where applicable)	Gas	yellow	orange
Refrigerant Supply Line	R.S.L	green	
Refrigerant Return Line	R.R.L	green	

1.9 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

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.
- .2 Coordinate with controls contractor to adjust motorized damper settings for O/A and R/A. O/A dampers shall be adjusted to maximum and minimum positions. Maximum velocity through O/A louvres shall be 6.0 m/s (1200 fpm).

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 BALANCING - AIR SYSTEMS

- .1 Adjust duct and terminal balance dampers and adjust or change drive sheaves to balance supply, return and exhaust air systems to provide the design air quantities (within +/-10%) at each outlet and inlet and to maintain the design relationship between the supply and exhaust air system quantities.
- .2 Adjust air terminals to obtain the optimum air distribution pattern.
- .3 Permanently mark the final balance position on all balance dampers and adjustable air turning devices by means of permanent custom adhesive stickers across the balancing dampers to seal them in position.
- .4 Submit a report to the Departmental Representative indicating final fan r/min., motor operating amperages, system static pressure and final air quantities obtained.
- .5 Air systems shall be balanced with clean filters in place, at a total of 105% to 110% of specified total airflow rates.

1.4 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 Supply air system(s).
 - .2 Return air system(s).
 - .3 Exhaust air system(s).
 - .4 Outdoor air system (s).
 - .5 All other systems that are part of this project but not mentioned and need to be balanced and tested for proper operation to meet design intent.
- .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 's designated 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. 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 objectionable 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 "Pitot Tube" traverse of entire cross-sectional area of duct. Provide a pitot tube traversetest 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 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 should be adjusted and reported by the balancing agency for maximum and minimum flow conditions.
- .8 Controllers on air valves are to be checked by the controls contractor and the commissioning agent and they shall also verify that room thermostats / sensors are cycling valves 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 setpoint 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 The Balancing Agency shall include for [3] days of return visits for readjustment of systems after the Departmental Representative has moved in.
- .14 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.

1.5 COMMISSIONING AND DEMONSTRATION

- .1 Refer to Division 1 (Section 01 91 13) for additional general requirements to those listed below. Division 1 requirements are to supersede any of the requirements listed below in case of requirements discrepancy.
- .2 Be responsible for the performance and commissioning of all equipment supplied under Division 21, 22 and 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.
- .3 Provide the services of an approved independent specialist firm to coordinate the commissioning process specified under this division.
- .4 The commissioning shall be executed in accordance with the intent of ASHRAE Standard 1 "Guideline for Commissioning of HVAC Systems" and ASHRAE standard 0 "Total Building Commissioning".

- .5 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.
- .6 The cooperation of all trades is essential for an efficient and planned process. A team comprising the following is recommended:
 - .1 Commissioning Coordinator.
 - .2 General Contractor.
 - .3 Mechanical Contractor's Supervisor.
 - .4 Departmental Representative.
 - .5 Division 23 Trades: especially Controls Contractor & Balancing Agency.
- .7 Prepare a commissioning statement for each of the four [4] phases that the process is perceived to be worked through. In sequence, the phases are expected to be:
 - .1 PHASE 1 - System readiness.
 - .2 PHASE 2 - System start-up, testing, balancing etc.
 - .3 PHASE 3 - Verification of system performance.
 - .4 PHASE 4 - Demonstration & instruction.
- .8 Each phase is applicable to each major and/or separate system making up the work in Division 23 plus Division 26 interface as applicable.
- .9 Regular meetings shall be held during the commissioning process. Minutes of the meetings shall be issued to all contractors involved and the Departmental Representative.
- .10 Plan the work to be specific in respect of personnel, schedule, review and laboratory tests.
 - .1 Personnel: Assign direct overall charge of commissioning to a person (the commissioning coordinator) fully qualified through practical experience and a comprehensive knowledge of the interactive nature of building systems and their controls to understand the complete system and be available to carry the project through to total completion. This person shall be responsible for: Commissioning, Demonstration to the Departmental Representative and Certifications of Substantial and Total Performance.
 - .2 Schedule: Submit a schedule, as part of the construction schedules, 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 performance.

- .3 Timing of the various phases of the commissioning, testing, balancing and demonstration process.
- .3 Review: Within three [3] months of commencing with the project work, the person having direct overall charge of commissioning shall review design intent and intended commissioning procedures with the Departmental Representative. Six [6] months prior to the date of scheduled substantial performance, submit a detailed plan that addresses the entire approach to the commissioning process. The plan should be prepared specifically for the project at hand. The plan should include the following components:
 - .1 Name and qualifications of the commissioning coordinator.
 - .2 Itemized check lists for the readiness, start-up and operational verification of all equipment and systems.
 - .3 Outline of proposed method of notification and correction of interim operational deficiencies.
 - .4 Outline of proposed demonstration and operator training program.
- .4 Laboratory Tests: If the field tests indicate that equipment supplied to the project does not meet specifications, laboratory certification of the potentially deficient equipment may be requested [by the Departmental Representative]. In the event that equipment does not meet specifications, be responsible for the costs of:
 - .1 The above laboratory tests, and
 - .2 All subsequent testing and correction required.
- .11 The work included in each of the four phases shall be generally as follows:
 - .1 PHASE 1 System readiness
 - .1 Before starting any of the separate systems, provide a certificate stating that the specific system is ready for start-up and the following conditions have been met. (See also Section 23 06 02).
 - .1 All safety controls installed and fully operational (dry run test).
 - .2 Qualified personnel available to operate the plant.
 - .3 Permanent electrical connections made to all equipment.
 - .2 System readiness shall include, but not necessarily be limited to the following:
 - .1 Checking system physical completion, including all instrumentation.
 - .2 Flushing, chemical cleaning (as required), charging, fluid treating (as required).

- .3 Equipment lubrication and prestart checks.
 - .4 Rotational checks.
 - .5 Air system cleaning complete.
 - .6 All D.X. systems checked for pressure and leakage.
 - .7 Filter systems installed and sealed in place.
 - .8 Adjusting vibration isolation and seismic restraints.
 - .9 Alignment of drives (direct and belt).
 - .10 Control function checks, including all alarms.
 - .11 Self-diagnostic packaged control items checked.
 - .12 All deficiencies to be recorded and reviewed by the commissioning team and, subsequently, corrected before proceeding to PHASE 2.
- .2 PHASE 2 System startup, testing, balancing
- .1 System commissioning shall include, but not necessarily be limited to:
 - .1 Activation of all equipment and systems.
 - .2 Testing and adjustment of all equipment and systems.
 - .3 All deficiencies are to be recorded, reviewed by the commissioning team and, subsequently, corrected. The process, at the point of the deficiency, shall be repeated before proceeding to PHASE 3.
 - .2 Phase 2 is concluded when 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 all automatic control valves/dampers and automatic temperature control devices.
 - .6 Set up constant volume and variable volume fans.

- .7 Adjust air valves as necessary.
- .8 Plug all air pressure and flow measuring holes.
- .9 Adjust vibration isolators and earthquake restraints as necessary.
- .10 Verification and certification of the sealing of all HVAC penetrations through fire separations (rated & non-rated) and sound separations.
- .11 Verification of water tightness of all roof and exterior wall penetrations.
- .12 Verification that all coil drain pans operate.
- .13 Testing and debugging of B.A.S. (Building Automation System).
- .14 Set up and test all alarm protective devices.
- .15 Calibration and adjustment of the smoke venting.
- .16 Power failure test with emergency generator start-up.
- .3 Fine Tuning
 - .1 Setting up automatic controls for accurate response and precise sequencing.
 - .2 Correction of problems revealed by Balance Agency and change of fan speed and pitch as necessary.
- .4 Testing
 - .1 A detailed check by a person having direct overall charge of commissioning. This check to include all items and functions to be later demonstrated to the Departmental Representative.
- .3 PHASE 3 Verification of System Performance
 - .1 Verification of system performance by the Departmental Representative will not commence until PHASE 2 has been totally completed. Submit test procedure completion test certificates at the time of requesting the commencement of the verification procedure. The verification process will include the demonstration of the following:
 - .1 The ease of access that has been provided throughout for servicing coils, motors, drives, fusible fire damper links, 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 Proper response of all variable volume air valves to thermostats and volume adjustment controls.
- .5 Operability of randomly selected fire dampers.
- .6 Noise level from typical variable volume air valves under extreme operating conditions.
- .7 Operation of all equipment and systems, under each mode of operation including:
 - .8 Controls.
 - .9 D.X. systems.
 - .10 Split air-conditioners.
 - .11 Furnaces.
 - .12 Reheat coils.
 - .13 All other equipment that is part of this project, but not mentioned and listed above.
- .2 At the completion of Phase 3, the Contractor shall submit the following to the Departmental Representative:
 - .1 A letter certifying that all work specified under this contract is complete, clean and operational in accordance with the specification and drawings.
 - .2 A commissioning report which should include completed copies of all Phase 2 documentation outlined in the commissioning plan plus copies of start-up reports from specialty contractors and vendors and any other relevant information for inclusion in the operating & maintenance manuals.
 - .3 B.C. Boiler Inspection Dept. approval of boiler, pressure vessels and pressure piping installations.
 - .4 B.C. Gas Inspection Dept. approval of boiler on gas firing.
 - .5 Record drawings as specified, update to include changes resulting from commissioning.
 - .6 A statement confirming completion of B.A.S. acceptance test, Section 23 09 01.

.4 PHASE 4 Demonstration and Acceptance

- .1 Demonstration and acceptance shall not commence until the commissioning process PHASE 3 has been successfully completed.
- .2 The Demonstration process is a planned process requiring a preplan approval before commencement and a signed statement of satisfaction from the Departmental Representative upon completion.
- .3 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 Systems operation in the fire mode shall be demonstrated to the Authorities having jurisdiction. Obtain a written statement/certificate of approval.

.5 Post Substantial Performance Visits

- .1 Provide follow-up visits to the site at one month and six month after substantial performance for a minimum period of two days, to ensure that the systems are operating correctly and that they are being operated and maintained properly.
- .2 Submit a report to the Departmental Representative which documents any problems that have arisen and correction action required.

1.6 OPERATING AND MAINTENANCE MANUALS

- .1 Refer to Division 1 (Section 01 78 00, clause 1.3 "Interactive Operating and Maintenance Manual System") for additional or more stringent requirements to those listed below.
- .2 Employ an approved independent contractor specializing in operating and maintenance manuals to prepare instruction manuals covering the operation and maintenance of the mechanical systems and equipment installed under this contract.
- .3 Request the manufacturers brochures at the time of equipment purchase. Forward all necessary data including approved shop drawings and manufacturers brochures to the Agency for inclusion in the Manual.
- .4 Instructions shall be clearly written in language easily understood by the Operating and Maintenance personnel. Include only specific information pertinent to the equipment installed. Advertising literature and brochures of a general nature will be rejected.
- .5 A front title page shall identify the Project, the Owner and the Owner's consultants. In addition the names of the General Contractor, Mechanical, Sheetmetal, Control and Sprinkler Sub-Contractors, with addresses and telephone numbers shall be listed.
- .6 An index shall be provided and the manual shall be divided by index dividers including but not limited to the following major sections:

.1 Systems Description

- .1 Comprehensive description of the operation of each system including the function of each item of equipment within the systems and all reset schedules and seasonal adjustments.
- .2 Include a schematic drawing and component description for each major mechanical system including air handling systems, boiler and hot water heating piping distribution systems.
- .3 The schematic drawing shall identify each component with a letter designation corresponding to a description briefly explaining the purpose of each component and how it relates to the other components, and be presented in a current version of AutoCAD or similar computer aided drafting program.
- .4 Description of actions to be taken in event of equipment failure.

.2 Maintenance And Lubrication

- .1 Maintenance schedules including detailed servicing, maintenance and trouble-shooting instructions for each item of equipment including daily, weekly, monthly, semi-annual and annual checks and tasks.
- .2 Lubrication schedules, indicating recommended lubricants and grades (grease or oil) for all lubricated equipment components.
- .3 Manufacturer's technical literature for each item of equipment installed. Literature shall include: Operating instructions, Maintenance instructions, Wiring Diagrams, Parts list and Installation instructions, Ventilation requirements, Energy considerations, Automatic temperature control settings, Information regarding air filters and pressure drops for clean and dirty conditions., Trouble Shooting Procedure Guide in spreadsheet form with the most likely causes and recommended actions for all foreseeable problems. Trouble Shooting Procedure guides are required for all the major items of equipment including air handling systems, exhaust fans, circulating pumps, mechanical cooling equipment, etc., and Mechanical Equipment Starting Procedures.

.3 Equipment Suppliers

- .1 Local source of supply for replacement parts for each item of equipment.

.4 Balancing Reports

- .1 Air system balance report.
- .2 Water system balancing report.

- .5 Electrical Switchgear
 - .1 Electrical switchgear schedule, indicating circuit number, panel location and disconnect location for each item of equipment.
- .6 Shop Drawings
 - .1 Copies of all "reviewed" shop drawings including fan and pump performance data including performance curves with the operating point indicated. Shop drawings shall be c/w Departmental Representatives review form.
 - .2 Plumbing fixture brochure.
 - .3 In addition to the shop drawings provided for the various items of mechanical equipment, this section shall also include the Manufacturers' Literature on:
 - .1 Operating and maintenance instructions
 - .2 Spare parts lists
 - .3 Trouble Shooting information.
- .7 Schedules
 - .1 Belt schedule, indicating size and number of belts required.
 - .2 Labelling and identification schedules including colour coding.
 - .3 Valve schedule, including location, service, normal position and area served.
 - .4 Air filter schedule indicating model no, size, number of filters required and servicing instructions (i.e.) static pressure readings, etc. for each filter bank.
- .8 Guarantees, Certificates And Miscellaneous Reports
 - .1 Boiler Inspection - Certificate of Approval.
 - .2 Buried gas pipe covering test report.
 - .3 Back flow device test reports.
 - .4 Checklists for start-up (MF151, 152,153).
 - .5 Certificate of Testing and Balancing (MF170).
 - .6 Certificate of Duct Cleanliness (MF171).

- .7 Certificate of Fire Damper Installation (MF172).
- .8 Certificate of Penetrations through separations (MF173).
- .9 Certificate of Seismic Restraint Installation (MF174).
- .10 Certificate of Vibration Isolation Installation (MF175).
- .11 Checklists for Demonstrations (MF181, 182, 183).
- .12 Certificate of Substantial Performance (MF190).
- .13 Chemical cleaning and treatment report for piping systems.
- .14 Chlorination report for water mains.
- .15 Commissioning reports/checklists.
- .16 Duct leakage test reports.
- .17 Equipment performance test results.
- .18 Extended warranty certificates.
- .19 Gas Inspection - Certificate of inspection.
- .20 Sprinkler flushing certificates.
- .21 Sprinkler Contractor's materials and test certificate.
- .22 Plumbing inspection certificate.
- .9 Control Systems
 - .1 Descriptive sequence of operation of automatic control system, with "as- built" control schematics indicating the final settings.
 - .2 Control equipment maintenance bulletins.
 - .3 Interlock wiring diagrams.
 - .4 Refer to Controls specifications for supplemental information.
- .7 Submit a draft copy of the Manual to the Departmental Representative for approval, thirty [30] days prior to start-up of the systems and equipment.
- .8 After receiving approval of the draft copy, make any corrections as may be required and then furnish four [4] final copies to the Departmental Representative at least ten [10] days prior to the substantial performance inspection date. Provide more than one volume if the overall thickness of a single binder would exceed 100 mm [4"].

- .9 Printed hard cover manuals shall be supplied in three post hard back Acco expansion style "Fliplock" binders, with stamped lettering on the front cover and spine showing the following:
 - .1 Name of Project
 - .2 Name of Manual - "Operating and Maintenance Manual Mechanical Systems"
 - .3 Volume - "X" of "Y"
- .10 Digital manuals shall be supplied on three (3) CD-ROMs in digital format. The information shall be organized into sections in a user-friendly format that is easy to search for specific information. An indexing system shall be included that remains on an expandable portion of the screen and allows the end user to scroll through the manual information that appears on the main portion of the screen. The digital version content and organization for each manual shall be arranged in a manner identical to the hard copy version. The specific requirements are listed below:
 - .1 Utilize Adobe Acrobat 10.0 (or later) Portable Document Format (PDF).
 - .2 If there is more than one volume of manual, indicate "Volume X of Y" for each volume.
 - .3 The final Digital copies are to be copied to CD media with a custom CD label.
 - .4 The custom CD label shall include: Project Name, Location of Project, Date of Assembly, name of Mechanical Department Representative, and shall be titled "Operating & Maintenance Manual for Mechanical Systems".
 - .5 The Digital Manual shall be enhanced with the following features: Bookmarks, Internet Links, Internal Document Links and Optical Character Recognition (OCR). Refer to Scanning Requirements and Organizational Requirements listed below.
 - .6 Scanning Requirements:
 - .1 All pages contained within the hard copy manual are to be scanned and/or digitized to Adobe Acrobat 10.0 (or later) PDF.
 - .2 Provide a minimum 300 DPI for all scanned pages.
 - .3 All scanned shop drawings are to be scanned to a minimum 8.5"X11" size. If the original page size is 11"X17", the digital copy shall also be 11"X17".
 - .7 Organizational Requirements:
 - .1 Digital Manual shall be organized in the same manner as the approved Hard Copy Manual. (e.g. Tabs 1.1, 1.2, 1.3, 2.0, 3.0, etc)
 - .2 Bookmark all major tabs and subsections

- .3 Bookmark each set of shop drawings
- .4 Link the Table of Contents page to the referenced sections
- .5 Insert an introduction / summary page for all sections indicating major subsections. Link these pages to their referenced sections
- .8 It is the responsibility of the mechanical contractor to provide high quality documentation for scanning.
- .9 The digital version of the manuals and the hard cover version shall be prepared by the same company.
- .10 Digital Manual shall be reviewed by the Departmental Representative for content and layout prior to final submission.
- .11 All information within the hard copy manual shall be included within the Digital Manual. At the Departmental Representative's discretion the following exceptions may be made so that the manual may be available for use by the Departmental Representative at an earlier date:
 - .1 The final Balance Report may be provided as a later submission in Adobe Acrobat 10.0 (or later) Portable Document Format (PDF). In this case, Balance Report(s) may be kept separate from the Digital Manual.
 - .2 The final Commissioning Report may be provided as a later submission in Adobe Acrobat 10.0 (or later) Portable Document Format (PDF). In this case, the Commissioning Report(s) may be kept separate from the Digital Manual.
- .11 Manuals shall be supplied in 3 post Acco expansion style "Fliplock" binders, with clear window label insert on front cover and indicating Name of Project and Name of Manual.

1.7 MAINTENANCE PROGRAM

- .1 Employ the agency, which is preparing the operating and maintenance manuals, to prepare maintenance schedules suitable for inputting into the existing computerized maintenance program. Obtain from the Departmental Representative the format in which the schedules should be prepared.
- .2 Maintenance Schedules:
 - .1 The maintenance schedules shall detail preventative maintenance procedures and their required frequency (daily, weekly, monthly, quarterly, half yearly, yearly and seasonally) for each system.
 - .2 Major items of equipment, such as boilers, condensing units, AHU's, etc. shall be listed on individual schedules.

- .3 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.
- .4 After substantial performance has been declared, the agency shall visit the facility to explain and instruct the representative designated by the Departmental Representative on the use of the maintenance program.

1.8 RECORD DRAWINGS

- .1 Refer to Division 1 (Section 01 78 00, clause 1.6 “As Constructed drawings and samples”) for additional requirements to those listed below. 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.
- .2 The set of white prints will be provided to the contractor by the Departmental Representative at the contractors cost.
- .3 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.
- .4 Back filling shall not occur until underground services dimensions are marked on the prints,
- .5 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 all heat traced piping and associated controllers.
 - .4 Location of back flow preventers.
 - .5 Location of water hammer arrestors.
 - .6 Water lines: Invert elevations to be recorded at each junction, changes of direction and every 30 m [100 ft] run.
 - .7 Sanitary Sewers: Invert elevations and locations to be recorded at each clean-out.

- .8 Storm Drains & Sewers: Invert elevations to be recorded at each manhole, clean-out, changes of direction and every 30 m [100 ft] run.
- .9 Gas Lines: Invert elevations to be recorded at each junction, at building entry point and at changes of direction.
- .10 All services located below ground level and in or below a building slab.
- .11 All valve stations, trap stations, coils dampers and ductwork not easily accessible.
- .12 Location, tagging and numbering of all valves as specified in Section 23 05 53.
- .6 CAD Drafting:
 - .1 Obtain the services of the Department Representative or an approved CAD draftsman to transfer all changes to amend the CAD files in the latest version of AutoCAD.
 - .2 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.
 - .3 Provide one set of check prints for review by Departmental Representative.
 - .4 Upon acceptance by the Departmental Representative, provide computer CAD files and one set of plots [0.03 mm mylar sepia plots].
 - .5 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.

1.9 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, but not limited to:

- .1 Controls.
 - .2 DX system.
 - .3 Furnaces.
 - .4 Split-air conditioner
 - .5 Other mechanical equipment and systems
- .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.

1.10 SUBSTANTIAL PERFORMANCE REQUIREMENTS

- .1 Before the Department 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.
- .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 Department 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 Engineer's 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.

1.11 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 and 23 work have been met and verified.

END OF SECTION

Part 1 Mechanical Forms

1.1 MF 100 Check List – Submissions to Departmental Representative

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		
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 151 Check List - Start-up and Operation Requirements - Air Systems

System: _____

ITEM	CHECKED BY	DATE
<u>Prior To Start-Up</u> 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		
<u>During Start-Up</u> Qualified Operator In Charge Supply Ducts Blown Out Using Fans R.A. & Exhaust Ducts Blown Out Using Fans		
<u>During Subsequent Operation</u> Qualified Operator In Charge Ensure That The Building Has Remained Clean Equipment Maintained Lubrication Maintained & Logged		

NOTES:

.1 This is a brief check list 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 Departmental Representative.

.3 Submit completed copies of this form for each system with the certificate of substantial performance.

1.3 MF 153 Check List - Start-up and Operation Requirements – Refrigeration Systems

System: _____

ITEM	CHECKED BY	DATE
<u>Prior To Start-Up</u> Safety Controls Installed & Operational Permanent Electrical Connections Made Equipment Lubricated System Charged and Tested Operating & Maintenance Data Available Boiler Inspector Notified & Start-up Approved		
<u>During Start-Up</u> Qualified Operator In Charge Manufacturers Rep. Present		
<u>Prior to Operation</u> Inspectors Approval Obtained		
<u>During Operation</u> Qualified Operator In Charge Equipment Maintained Lubrication Maintained & Logged		

NOTES:

- .1 This is a brief check list 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 Departmental Representative.
- .3 Submit completed copies of this form for each system with the certificate of substantial performance.

1.4 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 21,22, 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 when requesting inspection of substantial performance.

1.5 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.

<u>FAN NO.</u>	<u>SYSTEM DESCRIPTION</u>
----------------	---------------------------

SIGNED _____
DATE _

NOTES:

- .1 This certificate must be submitted when requesting inspection of substantial performance.

1.6 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 when requesting inspection of substantial performance.

1.7 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 to the Departmental Representative when requesting an inspection.

1.8 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 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 when requesting inspection of substantial performance.

1.9 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 Division-15 has been satisfactorily completed.

SIGNED _____ DATE _

NOTES:

- .1 This certificate must be submitted when requesting inspection of substantial performance.

1.10 MF 180 Check List & Record – Items to be Handed to Departmental Representative

ITEM	RECEIVED	DATE
Chemical Test Kit		
Control Drawings (Framed/Plasticized)		
Fan Belts – Spare Sets		
Filters - Spare Sets (Panel and Final)		
Hydrometer & Specific Gravity Chart		
Identification Schedule (Framed)		
Maintenance Program (Schedules & Cards)		
Master Key For B.A.S. Field Panels		
Rated Access Door Keys		
Spare Chemicals		
Sprinkler Heads & Cabinet		
Test Thermometer		
Thermostat Keys		
Valve List (Framed)		
Water Cooler Spare Filters		
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 Departmental Representative with all items signed off when requesting inspection of substantial performance.

1.11 MF 181 Check List – Demonstration of Air Handling Systems

System: _____

	CONTRACTOR		DEPARTMENTAL REPRESENTATIVE	
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				
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 when requesting inspection for substantial performance. (See MF 190).
- .2 Departmental 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 Departmental Representative may elect to only witness sample items, but the person having charge of commissioning is expected to have checked all of them.

1.12 MF 183 Check List – Demonstration of Refrigeration System

System: _____

	CONTRACTOR		DEPARTMENTAL REPRESENTATIVE	
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 when requesting inspection for substantial performance. (See MF 190).
- .2 Departmental 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 Departmental Representative may elect to only witness sample items, but the person having charge of commissioning is expected to have checked all of them.

1.13 MF 188 Check List – Substantial Completion Submissions - HVAC

SECTION	ITEM	CHECKED
23 05 00	Gas Inspection Certificate	
23 05 00	Equipment Extended Warranties Certificates	
23 05 00	Equipment Inventory Sheets	
23 05 00	Lubrication of Equipment Checklist	
23 05 00	Penetrations through Separations Certificate (MF-173)	
23 05 93	Air Balancing Report	
23 05 93	Testing & Balancing Certificate (MF 170)	
23 05 93	Fire Damper Inspection Certificate (MF 172) and Checked Drawings	
23 05 93	Commissioning Report and Checklists	
23 05 93	Operating & Maintenance Manuals	
23 05 93	Record Drawings	
23 05 93	Maintenance Program	
23 05 93	Demonstration to Operating Staff agenda	
23 05 53	Identification Schedules	
23 05 48	Vibration Isolation Installation Certificate. (MF-175)	
23 05 49	Seismic Restraint Installation Certificate. (MF-174)	
23 23 00	Refrigeration System Start-up 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 Departmental Representative 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.
- .2 This list is also generic, meaning that if items listed in this listed in this form do not apply to this project, please disregard them.

1.14 MF 190 Certificate of Substantial Performance Division 15

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 Departmental Representative.

SIGNED _____DATE _

NOTES:

- .1 This certificate must be completed and submitted to the Departmental Representative when requesting inspection for 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.

1.15 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 Departmental Representative when requesting inspection for substantial performance.
- .2 Items arising out of this inspection will be added to the list by the Departmental Representative. Copies of the complete list will be circulated to the Departmental Representative 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 Departmental Representative.
- .4 The Contractor shall sign off each item as it is completed and submit the list monthly to the Departmental Representative. When all items are signed off the completed list shall be submitted with the certificate of total performance MF 192.

1.16 MF 192 Certificate of Total Performance – Division 15

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 Departmental Representative when requesting inspection for total 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, or equivalent.	-
ACCESS PANELS		
Ducts	Nailor, Ventlok, or equivalent.	-
AIR TERMINAL DEVICES		
Diffusers, Grilles	E.H. Price, Nailor, Titus, or equivalent.	X
Fire Rated Door Grilles	Air Louvres, E.H. Price, Nailor, or equivalent.	X
Thermafuser Diffusers	Acutherm, E.H. Price, or equivalent.	X
Louvres	Airolite, E.H. Price, or equivalent.	X
BACKDRAFT DAMPERS		
Light Duty	E.H. Price CBD, Nailor, Ruskin B02/A1, or equivalent.	X
Medium Duty	Airolite 625, Nailor, Penn CBD-6, Ruskin CBD-4, or equivalent.	X
Heavy Duty	Ruskin CBS7, or equivalent.	X
COILS		
DX, Liquid	Carrier, Lennox, Trane 4TXCB, or equivalent.	X
CONTROL DAMPERS		
Low Leakage Type	Arrow-Foil PBDAF & OBDAF, Honeywell Moduflow D642 & D643, Johnson Proportion/Aire D-1200 & D-1300, Ruskin CD51, Tamco 1000, Nailor 1010, or equivalent.	X
Not Low Leakage Type	Honeywell, Johnson, Ruskin CD35, Nailor 1012, or equivalent.	X
Round	Ruskin DCRS-25, Nailor 1090, or equivalent.	X
DUCT CONNECTORS FLEXIBLE	Duro Dyne "Durolon", Ventfabrics - "Ventlon", Dynair Hypalon, or equivalent.	-
DUCTWORK - SPIRAL	United Sheet Metal, B.C. Ventilating, Spiro-Lok, or equivalent.	

ITEM	ACCEPTABLE PRODUCTS / SUPPLIERS / MANUFACTURERS	SHOP DWG.
DUCTWORK FLEXIBLE		
Plain	Thermafex SLP10, Flexmaster FAB4, Wiremold 57, or equivalent.	X
Insulated – Acoustic	Thermafex MKE, Glassflex ABL-181, Wiremold WK, or equivalent.	X
Insulated - Thermal	Thermafex MKC, Micro-Aire JFLX SL, Glassflex D-181, Wiremold WGC, or equivalent.	X
EXPANSION JOINTS	Flexonics, Hyspan, Uniroyal, Keflex, Mason, Goodall, Victaulic, or equivalent.	
FURNACES AND CONDENSING UNITS	Carrier, Lennox, Trane, or equivalent.	X
FILTERS	AAF, Cambridge, Farr, or equivalent.	X
FILTER GAUGES	Dwyer, Cambridge, or equivalent.	
FIRE DAMPERS		
Folding Shutter Type	Controlled Air, Nailor, NCA, Ruskin, or equivalent.	X
Pivoted Blade Type	Controlled Air, Maxam, Pacwest, Ruskin FD35, Nailor, or equivalent.	X
Ceiling Type	Controlled Air, Kerr Hunt, Nailor, or equivalent.	X
Fire/ Smoke Combination	Controlled Air, Ruskin, Nailor, or equivalent.	X
Register / Fire Damper	E.H. Price VCS-4, Tuttle & Bailey 90A, Airvector, or equivalent.	X
INSULATION - DUCT	Fiberglas, Knauf, Johns-Manville, Atlas, PPG, Manson, Certainteed, or equivalent.	
LOUVRES	Airolite, Alumavent, Westvent, Ruskin, Greenheck, or equivalent.	X
SEISMIC ISOLATORS	Mason, USS Snubbers, or equivalent.	X
SPLIT AIR CONDITIONING SYSTEM	Mitsubishi, Trane, Daikin, or equivalent.	X
VIBRATION ISOLATORS	Mason, Korfund, or equivalent.	X

NOTE:

- .1 The design is based upon the equipment listed in the equipment schedules and/or underlined in the HVAC Equipment Supplier Schedules.
- .2 X Denotes required submission.

END OF SECTION

BALANCING:	K.D. ENGINEERING CO.
	WESTERN MECHANICAL SERVICES
	MDT SYSTEMS LTD.
	INLAND TECHNICAL SERVICES LTD.
COMMISSIONING:	K.D. ENGINEERING CO.
	INLAND TECHNICAL SERVICES LTD.
	AIRMEC SYSTEMS LTD.
	WESTERN MECHANICAL SERVICES
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.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 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 National Building Code of Canada 2005 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.
- .3 Adhesives shall meet VOC limits per SCAQMD Rule 1168.

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.

Part 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, or equivalent.

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, or equivalent.
- .2 Flexible Duct Liner
 - .1 Yellow or light coloured internal flexible glass fibre acoustical insulation with one face faced with non-woven fiberglass mat.
 - .2 Minimum sound absorption (NRC) of 0.60 as tested per ASTM C423 using type "A" mounting.
 - .3 Thermal Conductivity at 24 deg.C. - 0.040 W/m/deg.C.
 - .4 Acceptable Manufacturers:
 - .1 Certainteed Toughgard Duct Liner 50#, Manson Akousti-Liner, Knauf Duct LinerEM, Owens Corning Areomat Duct Liner, or equivalent.

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, or equivalent.
- .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, or equivalent.
- .3 Vapour Barrier Adhesive
 - .1 Bakelite 230-21, Childers CP-82, Epolux Cadoprene 400, Foster 85-20, 3M 4230, or equivalent.
- .4 Insulation Coating
 - .1 Bakelite 120-09, Childers CP-50, Epolux Cadalag 336, Foster 30-36, Robson White Lag, or equivalent.
- .5 Weather Coating - vapour barrier
 - .1 Bakelite 110-14, Childers CHIL-PRUF CP22/23/24, Foster 60-25, Insul-Mastic 15187, or equivalent.
- .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, or equivalent.
- .8 Fabric Adhesive
 - .1 Bakelite 120-18, Childers CP-52, Epolux Cadalag 336, Foster 30-36, or equivalent.
- .9 Fabric Coating
 - .1 Bakelite 120-09, Childers CP-50, Epolux Cadalag 336, Foster 30-36, or equivalent.

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*)”.

Service	Thickness	
	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 <u>less than or equal</u> 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 <u>greater than</u> 22.2°C [40°F].	50	[2]
Outdoor air ductwork (from intake to mixing plenum). (where applicable) (do internal liner where hatching shown)	50	[2]
Combustion air intake (where applicable)	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

Service	Thickness	
	mm	[ins]
<i>All ductwork plenums where indicated by cross hatching on the drawings.</i>	50	[2]
<i>All ductwork within mechanical room.</i>	50	[2]

Part 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 air tight.
- .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 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.

3.4 INTERNAL FLEXIBLE DUCT LINER APPLICATION

- .1 Adhere insulation with insulation adhesive applied to the whole of the metal surface, with the coating side of insulation exposed to the airstream.
- .2 Ducts 610 mm [24"] in width and less require no further adhesion.
- .3 Ducts sides and plenum panels greater than 610 mm [24"] in width shall also have metal clips or nylon pins adhered to the metal surface at 300 mm [12"] to supplement the adhesive. (Welding pins may be used provided a capacitor type gun is used.) Impale insulation or the pins or clips, with the coated side of the insulation exposed to the airstream and secured with holding washers. Cover holding washers with reinforcing membrane and insulation coating / sealer.
- .4 Seal all transverse joints, raw edges, and other points of penetration of the coating with reinforcing membrane and insulation coating/sealer.
- .5 Seal all longitudinal joints with insulation coating sealer.
- .6 No raw edges of internal insulation material shall be exposed to the moving airstream.
- .7 NOTE: duct size shown is dimension inside the insulation. Metal duct sizes shall be increased to allow for the internal acoustic insulation thickness.

3.5 DUCTWORK INSULATION FINISHES

- .1 "Concealed" ductwork insulation, in horizontal and vertical service spaces, will require no further finish.
- .2 "Exposed" ductwork insulation "inside" finished floor spaces, fan rooms, boiler room, valve rooms shall be finished with two coats of white, foil-finishing, insulation coating, and canvas jacket.
- .3 "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 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 2012 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 NRC Model National Energy Code of Canada for Buildings (MNECB).
- .3 Adhesives shall meet VOC limits per SCAQMD Rule 1168.

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.

1.6 Asbestos Insulating Materials

- .1 When insulating materials containing asbestos are being removed, the work shall be carried out in accordance with the authorities having jurisdiction, including Ministry of Environment and the Workers Compensation Board of British Columbia and by contractors experienced in this specialty.
- .2 All work performed on systems with asbestos insulation must be reported to W.C.B. before work commences.

1.7 Connections to Existing Piping

- .1 Make good all existing insulation disturbed or removed to facilitate alterations and additions to existing piping.

2 PRODUCTS

2.1 Preformed Pipe Covering

- .1 Flexible Foamed Elastomeric:
 - .1 Thermal Conductivity at 24°C - 0.040 W/m/deg.C.
 - .2 Acceptable Products:
 - .1 AP Armaflex, Rubatex R-180-FS, or equivalent.
- .2 Flexible Closed Cell:
 - .1 Thermal Conductivity at 24°C - 0.036 W/m/deg.C.
 - .2 Acceptable Products:
 - .1 Bondtex Polyethylene, Therma-Cel, or equivalent.

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 numbers: 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, or equivalent.

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 PVC Jacket and Fitting Covers:

- .1 PVC self-adhesive tape, plastic pop rivets, bonding cement.

.3 Adhesives:

.1 Flexible elastomeric and flexible closed cell insulation adhesive:

- .1 Armstrong 520, Therma-Cel 1590, RubatexR-373, Zipcoat 8A, or equivalent.

.2 Vapour barrier jacket adhesive:

- .1 Bakelite 230-39, Childers CP-82, Epolux Cadoprene 400, Foster 85-20, or equivalent.

.3 Fabric adhesive, to insulation pipe covering:

- .1 Bakelite 120-18, Childers CP-52, Epolux Cadalag 336, Foster 30-36, Robson White Lag, or equivalent.

.4 Finish Jackets:

.1 PVC Finishing Jacket (minimum 0.50 mm [0.02"] thick:

- .1 Proto PVC, Speedline PVC, Zeston PVC, or equivalent.

.2 Aluminum Jacket (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 equivalent.

.5 Flexible Insulation:

- .1 Manson Alley-Wrap, Owens Corning AF 300 Series, Knauf Plain Wrap, Johns Manville Microlite, Roxul Wrap (RW), or equivalent.

2.4 Scope of Insulation

- .1 Heating Pipe, Fittings and Valves:
 - .1 Not applicable.
- .2 Refrigerant piping, fittings and valves:
 - .1 Insulate and vapour seal the following systems, unless otherwise noted:
 - .1 Refrigerant suction piping for comfort cooling.
 - .2 Insulate and vapour seal the following fittings, if the pipe is insulated:
 - .1 Elbows, tees, reducers.
 - .2 Valves, (bodies and bonnets) except check valve covers.
 - .3 Strainers.
 - .4 Flanges.
 - .5 Unions.

2.5 Pipe Insulation Thickness Table - mm [ins]

Service	NOMINAL PIPE SIZE (NPS)					
	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]
Condensate (gravity)	100°C [212°F]	25 [1]	40 [1.5]	40 [1.5]	50 [2]	50 [2]

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 Cold Application 10°C [50°F] and Less

- .1 Not applicable.

3.4 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.

3.5 Pipe Insulation Finishes

- .1 "Concealed" insulation in horizontal and vertical service spaces will require no further finish.
- .2 "Concealed" pipe insulation in damp locations, e.g. pipe trenches shall have a vapour barrier jacket, vapour sealed.
- .3 "Exposed" flexible insulation shall be painted with a heavy brush coating of foam plastic white insulation coating.
- .4 "Exposed" insulation inside the building shall be finished as follows:
 - .1 Premium Finish:
 - .1 Over a factory applied integral all-service type jacket on the pipe insulation, apply PVC jacket.

- .2 Over insulated fittings apply PVC fitting covers. Over insulated valve bodies, valve bonnets, strainers and flanges apply purchased PVC covers or field fabricate from PVC sheeting secured with solvent bonding cement.
- .3 Finish fabric with one (1) coat of fabric coating.
- .2 "Exposed" outdoor insulation shall be finished as follows:
 - .1 Insulation shall have a vapour sealed vapour barrier jacket.
 - .2 Over the pipe insulation jacket apply aluminum weather protecting jacket. The longitudinal seam shall be located to shed water. Secure the jacket using necessary metal banding on approximately 250 mm (10") centres and at the overlaps. Screws are not permitted on cold operating systems, since they will penetrate the vapour barrier.
 - .3 Over insulated fittings, valve bodies, valve bonnets, strainers and flanges apply metal jacket or preformed metal fittings to provide a complete jacket system. Secure with necessary fastenings.
 - .4 Seal all outdoor jacketing watertight.

3.6 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 Install aluminum jacket for refrigerant piping exposed outdoors.

3.7 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.

3.8 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.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.
- .2 This section shall review the shop drawings of the fire alarm system as provided by Division 26, with respect to the devices affecting the mechanical control system (an integral part of the Fire Fighters Central Control Facility).

1.2 GENERAL

- .1 The control system is to be fully microprocessor based no pneumatic actuation will be permitted.
- .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 in the sequence of operation and as hereinafter specified.
- .3 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 manufacturer provided points 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.
- .4 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.
- .5 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.
- .6 When preparing shop drawings, review the proposed sequences, suggest improvements and review these with the Departmental Representative.
- .7 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.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Sections 01300 and 23 05 00.
- .2 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 Terminal cabinets, including termination listing.
- .6 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.
- .7 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 Schematics and schedules.
 - .4 Software and programming details.
- .8 Detailed block diagrams of transmission trunk routing and configuration.
- .9 Valve and damper schedules indicating size, configuration, capacity and locations.
- .10 If size varies greater than 10%, obtain approval of Departmental Representative.
- .11 Copies of all system graphics complete with system specific point labels.
- .3 When submitting the controls shop drawings arrange a time to review these in detail in the Departmental Representatives office.

1.4 OPERATING & MAINTENANCE MANUALS

- .1 Refer to Division 1 (Section 01 78 00, clause 1.4) for additional requirements to those listed below. Division 1 requirements are to supersede any of the requirements listed below in case of requirements discrepancy.
- .2 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.

- .3 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.
- .4 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 engineering personnel, 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 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.
 - .5 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.
- .5 Refer to Section 23 05 00 for additional requirements.

1.5 WARRANTY

- .1 Refer to General Conditions.
- .2 The system including all hardware 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 Departmental Representative.
- .3 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.
- .4 Repairs of a non-emergency nature shall be promptly repaired on the next normal business day.
- .5 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.
- .6 Use of installed equipment during construction shall not shorten or alter the warranty period as specified in the General Conditions.
- .7 Take note of and provide any extended warranties specified.

1.6 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.
 - .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:

- .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 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
- .3 Cable:
 - .1 Data transmission cable shall be minimum #18 gauge twisted pairs (shielding as per manufacturers recommendations).
- .4 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 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.

1.7 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 Static pressure sensors.
- .5 And other as called for in mechanical documents.
- .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.

1.8 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 if any equipment is not in the intended operating condition.

1.9 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.

1.10 SYSTEM COMMISSIONING AND CALIBRATION

- .1 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.
- .2 Upon completion of the installation, perform all necessary testing and debugging operations satisfactorily.
- .3 Perform all modifications and alterations as required to correct any deficiencies noted during these tests.
- .4 Check sensor calibration and control system operation during the first heating season and prior to the first cooling season.

1.11 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.

1.12 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 five 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 Elementary preventative maintenance.
 - .4 Report generation.
 - .5 Operator control functions.
 - .2 Second phase: this phase of training shall be conducted four to eight weeks after system acceptance for a period of three 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.

1.13 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 Check and/or calibrate each control device.
- .4 Minor Inspections: These inspections shall include but not be limited to the following:
 - .1 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.
 - .2 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.
 - .3 Records and Logs: records and logs shall be kept of each maintenance task.
 - .4 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.

END OF SECTION

Part 1 General

- .1 The control sequences contain a “general description” of the intent of the operation of the systems to be controlled and it shall be read in conjunction with manufacturer supplied control points list as a minimum. The Contractor shall review individual systems to ensure equipment and life safety interlocks are not overridden.
- .2 Consult with the Departmental Representative during the shop drawing stage to finalize the control sequences for each system to ensure that no control points or major control sequence strategies are missing required for meeting minimum system operation design intent.
- .3 Controls contractor shall coordinate damper setpoints with the HVAC air balancing contractor to achieve desired results. The O/A damper setpoint shall not allow more than 6.0 m/s (1200 FPM) velocity through the O/A louvers. In some cases, the maximum O/A damper setpoint during free cooling shall be less than 100% open, and respectively, the minimum R/A damper setpoint shall not be 100% closed. Minimum O/A damper setting shall be 20% (adjustable) of maximum air flow.
- .4 The controlled system shall be fully capable of operating the furnace, condensing unit, two stage burner, R/A and O/A dampers, and fan controls. Provide additional sensors, wiring, hardware, and control components as required.

Part 2 Products

- .1 Provide additional control hardware, wiring, sensors, actuators, equipment as required to fulfill the intended sequence.

Part 3 Execution

- .1 Provide data base for all hardware points required for system operation to meet specification operating sequences.
- .2 Update the general description below as required in shop drawings.

SEQUENCE OF OPERATIONS

Normal Operation:

- .1 On a call for heating, the furnace burner shall be enabled for first stage heating. Upon further heating demand, the burner shall advance to second stage heating as required. The DX cooling coil and condenser unit shall be disabled while the burner is active. O/A dampers shall modulate to their minimum position, and R/A dampers shall modulate to the equivalent opposite position to match the O/A position.
- .2 On a call for cooling, Free Cooling Operation shall be enabled prior to mechanical cooling when O/A temperatures allow. The furnace burner shall be disabled. Where free cooling is not achievable, the DX cooling coil and condensing unit shall be enabled. O/A dampers shall modulate to minimum position.

Free Cooling Operation:

- .1 On a call for cooling demand, free cooling operation may be enabled if O/A temperatures allow.
- .2 O/A dampers shall modulate to their maximum open position, and R/A dampers shall modulate to their equivalent minimum closed position.
- .3 O/A dampers maximum position shall be set to allow maximum velocity of 6.0 m/s (1200 fpm) through the O/A louvre.
- .4 R/A dampers minimum position shall be set to match the O/A louvres air flow quantity.

Schedule:

- .1 The system operation shall be programmed to match the operational times of the specific zones served. Coordinate final operational schedule with the Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.
- .2 Refer to Section 23 05 49 for required seismic restraint of ductwork.

1.2 SUBMITTALS

- .1 Submit a schedule indicating the ductwork standards to be used, including metal gauges, joints and reinforcements before construction of any ductwork.

1.3 REFERENCE STANDARDS

- .1 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.

1.4 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.

Part 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 - 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 flat oval ductwork in accordance with Section III including Table 3-4 and Fig. 3-6 of the SMACNA Duct Standards. Joints and seams shall be similar to those indicated for round ducts. Flat oval duct to be used for positive pressure application only.
- .8 Construct round and flat oval 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.
- .9 Adjustable elbows are not permitted.

2.7 DUCTWORK – ACOUSTICALLY LINED

- .1 Where rectangular ductwork is indicated to be acoustically insulated with flexible acoustic duct 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 with 25 mm [1"] thick flexible fibrous glass duct liner between the two ducts, the inner duct shall be suitable for the static pressure and shall be sealed airtight where it joins the adjacent ductwork.

2.8 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.

2.9 WIRE MESH SCREENS

- .1 Provide wire mesh screens in all air intake openings.
- .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.

Part 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.
- .10 Adjustment shall be accessible outside the duct with lockable quadrant operator or through the grille or register with key-operated worm gear mechanism.
- .11 Cross-break or bead all metal duct panels unless otherwise noted.
- .12 Do not cross-break duct panels on 750 Pa [3"] and greater static pressure systems.
- .13 Do not cross-break bottom duct panels when ductwork is handling moisture.
- .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 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.
- .17 Support duct risers at their base and at each floor and at not greater than 3.7 m [12 ft] intervals.
- .18 Arrange ductwork and plenums so that duct and plenum mounted equipment can be easily removed.
- .19 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.
- .20 During construction, protect openings in ductwork, from dust infiltration, by covering with polyethylene, and protect floor outlet duct openings with metal caps.
- .21 Where ductwork is required to pass through open web steel joists, coordinate with the joist fabricator before fabricating ductwork.
- .22 Where ducts penetrate roofs, install sleeves and roof curb c/w flashing and counterflashing. Pack sleeves in roof with fibreglass insulation.

- .23 Underslab ducts to be installed in accordance with Section 3.4 including Figs. 3-11 and 3-12 of the SMACNA Duct Standards.

3.2 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 plenums.
 - .2 All supply and return air ducts.
 - .3 All exhaust air ducts.
 - .4 Relief ducts.
 - .5 All outdoor 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, air terminals and air valves.

- .3 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.
- .4 The Cleaning Agency shall perform a full inspection of the duct interior.
- .5 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. If any ducts are found to be unclean, then they shall be recleaned.
- .6 Submit a report from the cleaning agency that certifies all specified air systems have been cleaned (complete Mechanical Form MF 171 in Section 23 06 02).

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 CERTIFICATION OF RATINGS

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 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, or equivalent.

2.2 BALANCING DAMPERS

- .1 Construction in accordance with SMACNA Duct Standards - Figs. 2-14 and 2-15.
- .2 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.
- .3 Provide balancing dampers at each run out to a grille or diffuser.

- .4 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).
 - .3 Minimum 1.14 mm [18 ga] thick stainless steel blades for fume exhaust ducts.
 - .4 Shafts and Bearings:
 - .1 Shaft diameters:
 - .1 6.4 mm [1/4"] for up to 300 mm [12"] damper diameter or length.
 - .2 9.5 mm [3/8"] for 330 mm [13"] to 457 mm [18"] damper diameter or length.
 - .3 12.7 mm [1/2"] for 480 mm [19"] to 1200 mm [48"] damper diameter or length.
 - .2 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 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.
- .6 Concealed Regulators:
 - .1 For all drywall ceilings which do not have access panels provide concealed balancing damper regulators embedded in the finished ceiling, mounted behind grilles, on or inside plenum slot diffusers and various types of diffusers. Concealed damper regulator to be connected to balancing damper by means of flexible Bowden cable and to be installed flush with ceiling. Coverplate to be held in place with 2 screws and to be easily removed for damper adjustment. Concealed damper regulator to be similar to Young Regulator Co. Model No. 270-301. Provide all necessary hardware including Young Regulator balance damper model 5020-CC, Bowden cable and Young Regulator Model 030-12 wrench.
 - .2 Drawing designation: D (CR).

2.3 DUCT AND PLENUM ACCESS

- .1 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 heat detectors (upstream from device)
- .8 smoke dampers (operator side)
- .9 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 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, or equivalent, 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.

2.4 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 Standard of Acceptance: Duro Dyne "Durolon", Dynair "Hypalon", Ventfabrics "Ventlon", or equivalent.
 - .4 Centrifugal fans with 900 mm [36"] diameter and larger fan wheels, use 150 mm [6"] long flexible connection.

2.5 DUCTWORK - FLEXIBLE - PLAIN

- .1 Provide factory fabricated plain, flexible air ductwork for the following applications:
 - .1 Connections to air terminals (only in administration area).
- .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.
 - .5 Installed lengths shall be limited to 6 times duct diameter but not longer than 1200 mm [4 ft].
 - .6 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.

- .7 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.
- .8 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.
- .9 Support clear of ceiling assembly, light fixtures and hot surfaces.
- .3 Standard of Acceptance: Flexmaster FAB4, Thermaflex SLP10, or equivalent.

2.6 DUCTWORK - FLEXIBLE - INSULATED

- .1 Provide factory fabricated insulated flexible ductwork for the following applications:
 - .1 Connections to air terminals (only in administration area).
- .2 Minimum Requirements:
 - .1 Flexible vinyl coated steel helix bonded to inner duct liner. Fibrous glass thermal insulation.
 - .2 Outer jacket of metalized fire-resistant vapour barrier.
 - .3 Suitable for up to 500 Pa [2" w.g.] positive static pressure and/or 250 Pa [1" w.g.] negative static pressure.
 - .4 UL or ULC labelled, Class 1, duct connector.
 - .5 Acoustically rated.
- .3 Standard of Acceptance: Glass-Flex ABL-181, Thermaflex M-KE, Wiremold WK, or equivalent.
- .4 Duct lengths shall be limited to 6 times duct diameter but not longer than 1200 mm [4 ft].
- .5 Connect to ductwork using two wraps of duct tape and stainless steel worm drive clamps or Panduit adjustable diameter clamps or Thermaflex duct strap.
- .6 Support with 25 mm x 0.76 mm [1" x 22 ga] galvanized steel straps or hanger wires attached to integral duct grommets.
- .7 Minimum centreline radius of flexible ductwork bends shall be 1.5 times the duct diameter.

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, or equivalent.
- .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 Fire dampers shall be "dynamic"; rated to close under airflow, and rated for use in HVAC systems that are operational in the event of a fire emergency.
 - .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 air flow.
 - .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 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, or equivalent.

Part 3 Execution

3.1 BALANCING DAMPERS

- .1 Identify the air flow direction and blade rotation and open and closed position.
- .2 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.
- .3 Where quadrant type operators are used, the lever shall be arranged parallel with the damper blade.

3.2 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 Section 23 09 01.
- .3 Under this section be responsible for receipt, handling, storage and installation of control dampers supplied under Section 23 09 01.
- .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.

3.3 DUCT AND PLENUM ACCESS

- .1 Seal frames airtight.
- .2 Install so as not to interfere with air flow.
- .3 Install to provide easiest possible access for service and cleaning.
- .4 Do not use sheet metal screws for attaching access panels to ductwork.
- .5 Round ducts 330 mm [13"] dia. and larger shall include a short collar for the installation of access panels.
- .6 Small rectangular ducts shall be transitioned to a minimum dimension across the duct of 330 mm [13"] for the installation of access panels.

3.4 DUCT CONNECTORS - VIBRATION ISOLATION

- .1 Ensure flexible duct connectors do not reduce duct free area on suction side of fans.

3.5 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 air flow.
- .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.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 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 00 for minimum motor efficiencies.

1.3 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.

1.4 GENERAL

- .1 Motors powered by variable speed drive controllers shall be manufactured by Baldor, General Electric, Reliance, Siemens, Toshiba, U.S. Electric Motors, Westinghouse, or equivalent. They 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.

Part 2 Products

2.1 AIR TERMINALS

- .1 General:
 - .1 Grilles, registers and diffusers shall be product of one manufacturer, if possible.
 - .2 Refer to drawings for sizes and air quantities.
 - .3 All air terminals must be checked for compatibility with ceiling types.
 - .4 Ceiling tee-bar modules are in soft conversion metric measurements unless where specifically noted otherwise.
 - .5 The manufacturer (other than the design listed) shall match performance data and indicate a specific comparison for each item, with the shop drawing submission.
 - .6 All ceiling mounted air terminals shall be provided with means for attachment of two seismic security wires at opposite corners of each air terminal.

- .7 Provide concealed baffles, where necessary, to direct air away from walls, columns or other obstructions within the radius of air terminal operation.
- .8 Provide auxiliary frames for diffusers located in drywall ceilings and grilles mounted in gyroc walls in public areas. In other areas the grilles should be attached to the ductwork, flanged to the outside of the wall opening.

2.2 FILTERS - GENERAL

- .1 Filter identification shall be clearly marked on each filter.
- .2 Provide two (2) sets of filters - one for installation and one for handover to the Departmental Representative as a spare. Obtain signed receipt.
- .3 All filter media used during "temporary heating" shall be replaced by new media on substantial completion.

2.3 FILTER SIZE

- .1 Refer to Equipment Schedule on Drawing M108.

2.4 HOODS - ROOF - RELIEF/INTAKE

- .1 Minimum Requirements:
 - .1 All aluminum construction.
 - .2 Shape as indicated.
 - .3 12 mm [1/2"] aluminum wire birdscreen mounted in removable U-frame.
- .2 Accessories:
 - .1 Roof curb.
 - .2 Backdraft damper.

2.5 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 louver.
 - .5 Anodized permanodic hard colour finish.

- .2 Specific:
 - .1 Drawing designation - type "L" .
 - .2 Frame 150 mm [6"] deep.
 - .3 150 mm [6"] deep blades inclined at 35 deg. to the horizontal.
 - .4 Blades at 90 mm [3-1/2"] on centres.
 - .5 Blades arranged with up-turned rain stops on trailing edges and drip channels on leading edges.
 - .6 Jamb drainage channels.
 - .7 Blades and frame 2 mm [12 gauge] thick extruded aluminum.
 - .8 Standard of Acceptance: Airolite K6776; Nailor 445DB; C/S A4097.

2.6 THERMOMETERS - DUCT/PANEL MOUNTED

- .1 Acceptable Manufacturers:
 - .1 Marsh, Moeller, Trerice, Weiss, Weksler, Winters, or equivalent.
- .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.

Part 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 Hand over door grilles to the General Contractor for installation.
- .7 Follow manufacturer's guidelines for installation of all terminals especially in "living units" area.

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.

3.3 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.

END OF SECTION

1 Halocarbons

- .1 Comply with all of:
 - .1 Federal Halocarbon Regulations, 2003;
 - .2 *Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems* (the Environment Canada “Refrigeration Code of Practice”) Cat. No.: En14-207/2015E-PDF. April, 2015.
- .2 Work on Halocarbon Systems includes installation, servicing, leak testing, charging and/or decommissioning of a refrigeration system or an air-conditioning system or doing any other work on the system that may result in the release of a halocarbon.
- .3 All work on Halocarbon Systems shall be carried out only by a “Certified Person” as defined by the Federal Halocarbon Regulations 2003.
 - .1 Provide copies of all technicians’ certificates to the Departmental Representative.
- .4 Halocarbons listed under Item 1 through 10 of Schedule 1 of Federal Halocarbon Regulations, 2003 (SOR/2003-289) are not acceptable refrigerants for any new installations.
- .5 Document **all** work on Halocarbon Systems using CSCs halocarbon form “**Information Required for Refrigeration Systems at Federal Correctional Facilities**”. Obtain the latest form from Departmental Representative. Affix the completed form to equipment, and submit a copy of the form to Departmental Representative.
- .6 Comply with the following timelines:
 - .1 Upon delivery of halocarbon-containing equipment to site, submit the following information to Departmental Representative within 24 hours of service;
 - .1 Equipment Location
 - .2 Make
 - .3 Model #
 - .4 Serial #
 - .5 Type of halocarbon

- .6 Halocarbon charging capacity of system (kg or lbs)
- .7 Factory Halocarbon Charge (kg or lbs)
- .8 Cooling capacity (kW, Btuh, or Tons)
- .2 Leak-test factory-charged halocarbon-containing equipment containing over 10kg of refrigerant in accordance with the Refrigeration Code of Practice within one week of equipment delivery to site.
- .3 Leak-test field-charged halocarbon-containing equipment in accordance with Section 4.4 of the Refrigeration Code of Practice at the time of field charging of system.
- .4 For all work on Halocarbon Systems, submit forms to Departmental Representative within 48 hours of work.
- .5 For release of halocarbons >10 kg and <100 kg, submit forms to Departmental Representative within 24 hours of discovery of release.
- .6 For release or potential release of halocarbons > 100 kg, submit forms to Departmental Representative **immediately**.
- .7 Conduct annual leak tests of halocarbon-containing equipment with 19kW (5.4 tons) or greater cooling capacity in accordance with the *Federal Halocarbon Regulations, 2003* until such time as Interim Certificate of Completion is issued.

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 Air Conditioning Unit – Ductless Split

- .1 General:
 - .1 Indoor unit and outdoor unit shall be of same manufacturer and shall be matched for performance.
 - .2 See Equipment Schedule on Drawing M108.

2.2 Forced Air Furnace (With Air Conditioning)

- .1 General:
 - .1 Up-flow, gas-fired furnace, supply fan, heat exchanger, two stage gas burner, air filter, custom economizer box with motorized dampers, DX cooling coil, outdoor condensing unit, thermostat, control hardware for integration with furnace components.
 - .2 See Equipment Schedule on Drawing M108.

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 engineer to set and adjust equipment for operation as specified.

3.3 Equipment Installation

- .1 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.
- .2 Condensate drain piping should be graded towards the plumbing drain at minimum 1:200 [1/16 inch per foot].
- .3 Provide flex connections to ductwork.
- .4 Provide vibration isolation hangers with seismic restraints.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS & SUMMARY

- .1 The General Conditions, Supplements and Amendments shall govern this Section (read in conjunction with Instructions to Tenderers / Bidders). This section covers items common to all Electrical sections and is intended only to supplement the requirements of Division 01.
- .2 Reference to "Electrical Divisions" shall mean all sections of Divisions 26 & 28 in the Master Format or the Canadian Master Specifications.
- .3 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.
- .4 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. Provide project management and on-site supervision to undertake administration, meet schedules, ensure timely performance, ensure coordination, and establish orderly completion and the delivery of a fully commissioned installation.
- .5 The most stringent requirements of this and other electrical sections shall govern.
- .6 All work shall be in accordance with the FVI Building F HVAC Upgrade Drawings and Specifications and their intent complete with all necessary components, including those not normally shown or specified, but required for a complete installation.
- .7 Provide seismic restraints for all required equipment and wiring systems.
- .8 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by the Owner. Uncrate equipment, move in place and install complete; start-up and test. Include all field assembly of loosely/separately packaged accessories

1.2 REFERENCES

- .1 Install in accordance with CSA C22.1 (current adopted edition) - except where specified otherwise.
- .2 Refer to CSA C22.1 Appendix A "Safety Standards for Electrical Equipment" for applicable codes and the related revisions
- .3 Refer to CSA C22.1 Pages xxix - xxxii for related 'Reference Publications'
- .4 Refer to NBCC Table 1.3.1.2 for applicable codes and the related revisions.
- .5 Comply with Local Electrical Bulletins and by-laws relating to the Authority having Jurisdiction.
- .6 Install overhead and underground systems in accordance with CSA C22.3 No.1 (current adopted edition) - except where specified otherwise.

- .7 Preferred Voltage Levels for AC Systems, 0-50,000V in accordance with CAN3-C235 (current adopted edition)

1.3 DEFINITIONS

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.4 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235- current edition
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.5 SUBMITTALS

- .1 Submittals to be in accordance with Division 01.
- .2 Product Data: submit WHMIS MSDS in accordance with Division 01 - Sustainable Requirements and Division 02- Hazardous Materials
- .3 Shop Drawings:
 - .1 Submit shop drawings, product data and samples in accordance with Division 01. The submission shall be reviewed, signed and processed as described in Division 01.
 - .2 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
 - .3 Where applicable, include wiring, line and schematic diagrams. Include wiring drawings or diagrams showing interconnection with work of other Sections.
 - .4 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 Advertising literature will be rejected.
 - .6 The project and equipment designations shall be identified on each document.

- .7 Information shall be given in metric units.
- .8 The shop drawings/product data shall include:
 - .1 Dimensioned construction drawings with plans and sections showing size, arrangement and necessary clearances, with all equipment weights and mounting point loads.
 - .2 Mounting arrangements.
 - .3 Detailed drawings of bases, supports and anchor bolts.
 - .4 Control explanation and internal wiring diagrams for packaged equipment.
 - .5 A written description of control sequences relating to the schematic diagrams.
- .4 Format
 - .1 PDF submitted via e-mail.
 - .2 Bill of Quantities for related components, identified by model number, listed on the front cover with item identification numbers.
- .5 Coordination
 - .1 Where electrical equipment requires support or backing by other trades or mechanical connections, the shop drawings shall also be circulated through the other "services" contractor(s) prior to submission to the Departmental Representative.
- .6 Keep one [1] copy of shop drawings and product data, on site, available for reference.
- .7 Quality Control: in accordance with Division 01 - Quality Control
 - .1 Provide CSA certified equipment and material. Where CSA certified equipment and/or material is not available, submit such equipment and/or material to the authority having jurisdiction for special approval before delivery to site.
 - .2 Submit test results of installed electrical systems and instrumentation.
 - .3 Submit, upon completion of Work, the electrical "load balance" report.
- .8 Permits and Fees:
 - .1 Submit to Electrical Inspection Department, Local Fire Authorities and Supply Authority the necessary number of drawings and specifications for examination and approval prior to commencement of work. Obtain all required permits and pay all fees.

- .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.

1.6 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Division 01 - Quality Control
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial and/or Territorial Act respecting manpower vocational training and qualification.
 - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
 - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
- .3 Site Meetings: in accordance with Division 01 - Construction Progress Schedule
 - .1 Site Meetings: as part of Manufacturer's Field Services: schedule site visits, to review Work, at stages listed below:
 - .1 At time of initial shop drawing submission to confirm any existing conditions and to coordinate with the project schedule and any cross discipline requirements.
 - .2 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
 - .3 During progress of Work at key schedule points as determined.
 - .4 At commissioning.
 - .5 Upon completion of Work, after cleaning is carried out.
 - .4 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 01 - Health and Safety Requirements.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Material Delivery Schedule: provide Departmental Representative with schedule within 4 weeks after award of Contract.
- .2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and/or recycling in accordance with Division 01 Construction/Demolition Waste Management and Disposal.

1.8 SYSTEM START-UP

- .1 Refer to Division 01, and as follows.
- .2 Instruct Departmental Representative and operating personnel in the operation, care and maintenance of equipment.
- .3 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components, where required in these specifications.
- .4 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

1.9 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.

1.10 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 - Construction/Demolition Waste Management and Disposal and with the Waste Reduction Work plan.
- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Place materials defined as hazardous or toxic waste in designated containers.

1.11 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.

1.12 PROJECT 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 electrical services. Where details are not shown on the drawings or only shown diagrammatically, the services 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 services in the ceiling shall be kept as tight as possible to beams or other limiting members at high level. All electrical services 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 and coordinate all work before fabricating, or installing any material or equipment. Where necessary, produce interference/coordination drawings showing exact locations of electrical systems or equipment within service areas, shafts and the ceiling space. Distribute copies of the final interference/coordination drawings to the Departmental Representative and all affected parties.
- .4 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 installing any material or equipment. Demonstrate to the Departmental Representative on completion of the work that all equipment installed can be properly, safely serviced and replaced, if and when required.

1.13 SPRINKLER PROOF REQUIREMENTS

- .1 All equipment and wiring systems shall be sprinklerproof standard where sprinkler fire protection systems are installed.
- .2 In rooms where electrical equipment is installed surface mounted, electrical equipment contained in these rooms to be protected by non-combustible driphoods, shields, and gasketed doors as applicable to inhibit water ingress into electrical equipment. Exposed conduits connected to equipment to utilize watertight connectors. Top entry to be avoided where possible

- .3 In particular all unit substations, transformers, switchgear, motor control and panelboard shop drawings shall be certified 'sprinkler proof' design.

1.14 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.

1.15 REUSED EQUIPMENT

- .1 Where existing equipment is being relocated and re-used, check and report on the condition to the Departmental Representative before reinstallation. Protect and carefully store equipment designated for reuse.

1.16 SEQUENCE OF WORK

- .1 Before interrupting major services notify the Departmental Representative well in advance and arrange an acceptable schedule for the interruptions.
- .2 Before interrupting any services complete all preparatory work as far as reasonably possible and have all necessary materials on site and prefabricated (where practical) and work continuously to keep the length of interruption to a minimum.
- .3 Include for the cost of all work that may be required out of regular hours to minimize the period of service interruption when modifying the existing systems.
- .4 All trades in this Division shall make allowance for the implications of having to totally complete all work in the new addition before proceeding with work in the existing building.

1.17 BUILDING OPERATION DURING CONSTRUCTION

- .1 In order to minimize operational difficulties for the existing building staff, the various trades must cooperate with the owner throughout the entire construction period and particularly ensure that noise is minimized.
- .2 Convenient access for the staff and public to the building must be maintained at all times. Minor inconvenience and interruption of services will be tolerated, provided advance notice is given, but the Contractor will be expected to coordinate his work, in consultation with the owner, so the operation of the facility can be maintained as nearly normal as possible.

1.18 EXISTING SERVICES

- .1 Protect all existing services encountered. Every effort has been made to show the known existing services. However, the removal of concealing surfaces may reveal other existing services. Work with the Departmental Representative staff to trace the originating source and points served. Obtain instructions from the Departmental Representative when existing services require relocation or modifications, other than those already indicated in the Contract Documents.

- .2 Arrange work to avoid shutdowns of existing services. Where shutdowns are unavoidable, obtain the Departmental Representative approval of the timing, and work to minimize any interruptions.
- .3 Shutdowns, to permit connections, to be coordinated with the maintenance staff.
- .4 In order to maintain existing services in operation, temporary relocations and wiring may be required.
- .5 Be responsible for any damages to existing systems by this work.
- .6 The interruption of utility services to permit tie-ins shall be arranged through the Departmental Representative. Application must be received in writing at least seven (7) calendar days prior to the date required for the shutdown. Service shutdowns shall only be carried out by Physical Plant and will normally be scheduled to occur during evenings or weekends. The Owner reserves the right to withhold permission for a reasonable period with respect to any shutdown, if the shutting-off of a service interferes with essential building operations.

1.19 SALVAGE

- .1 All conduit, wiring and equipment which becomes redundant and is no longer required due to the work in this Contract shall be completely removed.
- .2 All existing items which need to be removed, and which have a reasonable salvage value, shall be carefully removed and handed over to the Departmental Representative. Handing over to the Departmental Representative includes moving to Departmental Representative's designated storage place on site. These items shall not become the property of the Contractor. Obtain a written receipt from the Departmental Representative detailing each of the items handed over.
- .3 Remove all redundant material not required by the Departmental Representative from the site.

1.20 WARRANTY

- .1 Use of installed equipment during construction shall not shorten or alter the warranty period as specified in the Division 01.
- .2 Take note of any extended warranties specified.
- .3 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.
- .4 Promptly investigate any electrical or control malfunction, and repair or replace all such defective work and all other damages thereby which becomes defective during the time of the warranty.

1.21 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 considered valid or issued by the Departmental Representative's office during tender. All tender queries may be faxed, mailed or couriered to the Departmental Representative's office. No telephone questions will be answered.

1.22 EXAMINATION

- .1 Examine the documents for details of work included. Obtain a written clarification in the event of conflict within the specification, between the specification and the drawing, or in the drawing. Obtain written clarification from the Departmental Representative if work affecting the installation is not clear. Where this is not done in advance, allow in the tender sum for providing the more costly alternative.

1.23 RESPONSIBILITIES

- .1 Ensure that equipment does not transmit noise and/or vibration to other parts of the building, as a result of poor installation practice.
- .2 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.
- .3 Protect equipment and material from the weather, moisture, dust and physical damage.
- .4 Cover equipment openings and open ends of conduit, piping and pullboxes as work progresses. Failure to do so will result in the Trade being required to adequately clean or replace materials and equipment at no extra cost to the Departmental Representative.
- .5 Protect all existing services encountered. Obtain instructions from the Departmental Representative when existing services require relocation or modification.
- .6 Refinish damaged or marred factory finish to factory finish.
- .7 The specifications and drawings form an integral part of the Contract Documents. Neither the drawings nor the specifications shall be used alone. Work omitted from the drawings but mentioned or reasonably implied in the specifications, vice versa, shall be considered as properly and sufficiently specified and shall be provided. Misinterpretation of any requirement of either plans or specifications shall not relieve this Contractor of the responsibility of properly completing his trade to the approval of the Departmental Representative.

1.24 PROGRESS CLAIM AND CHANGEORDER BREAKDOWNS

- .1 Submit price breakdowns ten (10) days after the award of contract,

- .2 In particular cases more detail may be necessary to properly assess a change order or progress claims. This additional information could include all suppliers and all sub-contractors when requested by the Departmental Representative. Provide details for each section of the electrical work listed for each separate electrical change order item exceeding \$10,000.00.
- .3 Mark-up information is required for change orders but is optional on the original tender price.
- .4 Progress claims will not be certified nor payment made beyond 90% of the overall Electrical contract until commissioning and verification of the systems are complete. This procedure is to allow for any necessary deficiency holdbacks on items which do not become apparent until the systems are commissioned.

1.25 PROJECT CLOSE-OUT REQUIREMENTS

- .1 Refer to detailed specifications in each section for detailed requirements. Record drawings to be submitted to Departmental Representative and all life safety systems must be operational, verified and tested and demonstrated to Departmental Representative prior to issuance of Schedule C.

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 is complete for the intended use, operational, clean and all required submissions have been completed.
 - .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 Operating and Maintenance Manuals completed.
 - .3 "As Built" Record Drawing ready for review.
 - .4 Systems Commissioning has been completed and has been verified by Departmental Representative.
 - .5 All demonstrations to the owner have been completed.

- .3 Departmental Representative's Letters of Assurance will not be issued until the following requirements have been met:
 - .1 All items listed in .1 above have been completed or addressed.
 - .2 Certificate of Penetrations through separations.
 - .3 Provincial or City Electrical Inspection - Certificate of inspection.
 - .4 Seismic Engineer's letter of Assurance and final inspection report (As required).
 - .5 Certificate of Substantial Performance.
 - .6 Signed off copy of Departmental Representative's final inspection report.
 - .7 Fire alarm verification.

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 26, 27, 28, 33 (electrical) work have been met and verified.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with Division 01 and as follows.
- .2 Material and equipment to be CSA certified. Where CSA certified material or equipment is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval.
- .3 Where equipment or materials are specified by technical description only, they are to be of the best commercial quality available for the intended purpose.
- .4 Factory assemble control panels and component assemblies.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Provide all power and control wiring, conduit, wire, fittings, disconnect switches, motor starters, for all mechanical equipment unless otherwise specified.
- .2 Ground all motors to conduit system with separate grounding conductor in flexible conduit or bonding conductor in the flexible conduit.
- .3 Connections shall be made with watertight flexible conduit with watertight connectors.

- .4 Control wiring and conduit standards are specified in the Electrical Divisions. Refer to Mechanical Divisions for scope of work and particular details.

2.3 WIRING TERMINATIONS

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

2.4 EQUIPMENT IDENTIFICATION

- .1 Identify all electrical equipment including but not limited to starters, disconnects, remote ballasts and controls with nameplates and labels as follows:

- .2 Nameplates:

- .1 Lamicoid 3 mm [0.125"] thick plastic engraving sheet, white face, black core, self adhesive unless specified otherwise. Provide white face, red core for all essential distribution equipment.

- .2 Nameplate Sizes:

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

- .3 Typical Labelling:

- .1 Panelboard & CDP – 5 lines

- .1 Line 1 – Panel/CDP designation – Size 4 lettering
- .2 Line 2 – eg 225A, 120/208V, 3 phase 4W – Size 2 lettering
- .3 Line 3 – Feeder: eg 4#3 – 35mm C – Size 2 lettering
- .4 Line 4 – Origin eg: Main Elect. Room – Size 2 lettering

- .2 Distribution Circuit Breakers – 4 lines

- .1 Line 1 – Main Circuit Breaker – Size 4 lettering
- .2 Line 2 – Feeder: eg 4#3 – Size 2 lettering
- .3 Line 3 – Origin: eg K1 Sub-station – Size 2 lettering

- .3 Label colours unless otherwise indicated:
 - .1 120/208V labels: white letters on black base.
 - .2 347/600V labels: Black letters on white base.
- .4 Wording on nameplates to be approved prior to manufacture.
- .5 Allow for average of twenty-five (25) letters per nameplate.
- .6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .7 Terminal cabinets and pull boxes: indicate system and voltage.
- .8 Transformers: indicate capacity, primary and secondary voltages.
- .3 Labels:
 - .1 Identify each outlet, starter, disconnect and all items of fixed equipment with the appropriate panel and circuit number origin by means of a small but good quality vinyl, self-laminating label such as T & B E-Z Code WSL, Dymo Letratag or Brother P-Touch equivalent printable markers. Embossed Dymo or any labels with edges and corners that are prone to lift will be rejected. Confirm location of labels with Departmental Representative before installing. Circuit numbers to agree with Record Drawings.
- .4 Provide plastic covered panel directory with circuits and areas served typed in, and mounted on inside of door. Directory to conform to Record Drawings.

2.5 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 code: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.6 CONDUIT, CABLE AND PULLBOX IDENTIFICATION

- .1 Colour code conduits, metallic sheathed cables, pullboxes and junction boxes.
- .2 Code with 25 mm plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor and at 15 m intervals.
- .3 Colour coding to be as follows unless otherwise specified:

SYSTEM	MAJOR BAND	MINOR BAND	CHARACTERS
347/600V Normal	Dark Blue		
120/208V Normal	Light Blue		
Ground	Dark Green		GR
Fire Alarm	Red		FA
Emg Voice Paging	Red	Dark Green	EP
Computer/Data	Light Green		COM
Telephone	Light Green	Black	TEL
General Intercom	Light Green	Yellow	IC
Low Level Paging	Light Green	White	PA
Building Alarm	Purple	White	BA
BAS (Digital)	White	Green	BCD
BAS (110V)	White	Black	BCH
BAS (LV)	White	Blue	BCL
PLC (Digital)	White	Brown	PLC
Low Voltage Control	White	Yellow	LVC

2.7 FINISHES

- .1 Shop finish metal enclosure surfaces by removal of rust and scale, cleaning, application of rust resistant primer inside and outside and at least two coats of finish enamel.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original finish.
- .3 Clean and prime paint exposed hangers, racks, fastenings to prevent rusting. Finish painting shall be provided by Division 09.
- .4 Paint outdoor electrical equipment "equipment green" finish.
- .5 Paint indoor switchgear and distribution enclosures light gray unless otherwise indicated in particular specification sections for specialised or emergency power equipment.

2.8 ANCHOR BOLTS AND TEMPLATES

- .1 Supply anchor bolts and templates for installation by other Divisions.

2.9 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 conduit racks 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, or equivalent.
 - .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.
 - .2 Drilled, mechanical expansion type:
 - .1 Hilti HSL or UCAN LHL, or equivalent 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, or equivalent stud anchor for concrete. (Do not use in seismic restraint applications).
 - .3 Hilti HDI or UCAN IPA, or equivalent drop-in anchor for concrete.
 - .4 Hilti or UCAN Sleeve Anchor, or equivalent. (medium and light duty) for concrete and masonry.
 - .5 Hilti ZBP or UCAN Zamac, or equivalent pin bolt (light duty) for concrete and masonry.
 - .3 Drilled, adhesive type:
 - .1 Hilti HVA or UCAN, or equivalent Adhesive Anchor consisting of anchor rod assembly with a capsule containing a two-component adhesive, resin and hardener.
 - .2 Hilti HY150 or equivalent 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; or equivalent.

2.10 EQUIPMENT SUPPORTS

- .1 Provide stands and supports for equipment and materials supplied.
- .2 Lay out concrete bases and curbs required under Electrical Divisions. Coordinate with Concrete Divisions.
- .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 equipment base, 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 25mm [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; or equivalent.
- .5 Construct equipment supports of structural steel. Securely brace. Employ only welded construction. Bolt mounting plates to the structure.
- .6 Support ceiling hung equipment with rod hangers and/or structural steel.

2.11 MISCELLANEOUS METAL

- .1 Be responsible for all miscellaneous steel work relative to Electrical Divisions of the Specifications, including but not limited to:
 - .1 Support of equipment.
 - .2 Hanging, support, anchoring, guiding and relative work as it applies to wiring raceways and electrical equipment.
 - .3 Earthquake restraint devices - refer also to "Seismic Restraint" sections
 - .4 Bridle rings - secure to structure or steel supports.
- .2 All steel work shall be primed and undercoat painted ready for finish under the related Division.

2.12 MAINTENANCE MATERIALS AND CABINET

- .1 Provide maintenance materials in accordance with Division 01 and specified in appropriate Sections.

2.13 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into maintenance manual specified in Division 01 and as follows.
- .2 Include in operations and maintenance data:
 - .1 Details of design elements, construction features, component function and maintenance requirements, to permit effective operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
 - .2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.
 - .3 Wiring and schematic diagrams.
 - .4 Names and addresses of local suppliers for items included in maintenance manuals.
- .3 Include in the manual the following major sections:
 - .1 Title page (in plastic cover).
 - .2 Comprehensive description of the operation of the systems, including the function of each item of equipment within the system.
 - .3 Detailed instructions for the normal maintenance of all systems and equipment installed including procedures and frequency of operational checks and service and troubleshooting instructions.
 - .4 Local source of supply for each item of equipment.
 - .5 Wiring and control diagrams.
- .4 The manual information shall be bound in a three "D-ring" hard back reinforced vinyl covered ("bar lock" post type where more than 50mm [2"] rings required) binder c/w index tab separators to divide the different sections. The binder cover shall be black with white lettering. Printing of the binder cover shall be completed before the binder is manufactured and the wording shall be approved by the Departmental Representative before printing.
- .5 Submit a draft copy to the Departmental Representative for review thirty (30) days prior to start up of the systems and equipment.
- .6 Submit three (3) copies in the final approved form.

2.14 PROJECT RECORD DRAWINGS

- .1 Provide project record documents as specified in Division 01 as further called for in this Division.

- .2 During the construction period, keep on Site a clean set of drawings marked up to reflect the "As-Built" state, for examination by the Departmental Representative on a regular basis. Include elevations and detailed locations of buried services, empty conduit systems and junction and pull boxes.
- .3 At the time of "substantial performance" CAD files will be provided by the Departmental Representative. The Electrical Division shall include all associated costs to obtain and complete the CAD Record Drawings including retaining the services of an approved CAD draftsman to transfer all changes to amend the CAD files in the latest version of AutoCAD. Include all revisions and change orders.
- .4 Submit the "Record Drawing" CAD files and one set of plots to the Departmental Representative prior to Total Performance of the contract.
- .5 Note: The Contractor will be required to sign a standard Stantec / 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.

Part 3 Execution

3.1 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

- .1 Ensure manufacturers nameplates and CSA labels to be 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"].
- .2 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.
- .3 Install roof jacks where conduit and cables penetrate roofs. Apply sealant after installation.
- .4 All cables and conduits to be installed concealed in finished areas.

3.4 COORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to the required values and settings to provide a fully coordinated system.

3.5 FIELD QUALITY CONTROL

- .1 Load and Balance:
 - .1 Measure voltage and phase & neutral currents to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .2 Conduct and pay for the following tests:
 - .1 Circuits originating from branch distribution panels.
 - .2 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .3 Systems: fire alarm system for all affected devices.
 - .4 Main ground resistance (at all grounding locations).
 - .5 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
- .3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .4 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports.
 - .2 Furnish manufacturer's certificate or letter conforming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
 - .3 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.
 - .4 Schedule site visits to review Work.

- .5 Reports:
 - .1 Provide written reports in a timely manner upon completion of the testing and load balance. Indicate test hour and date.

3.6 CLEANING

- .1 Do final cleaning in accordance with Division 01.
- .2 At time of final cleaning, clean lighting reflectors, lenses and other lighting surfaces that have been exposed to construction dust and dirt.
- .3 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .4 Clean and prime paint exposed non-galvanised hangers, racks, fastenings to prevent rusting. Coordinate finish painting with Division 09.

3.7 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.

3.8 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 equipment and conduit, as the 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.

3.9 PROTECTION OF ELECTRICAL EQUIPMENT

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark live parts, e.g. "LIVE 120 VOLTS".
- .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

3.10 CONCEALMENT

- .1 Conceal wiring and conduit in partitions, walls, crawlspace and ceiling spaces, unless otherwise noted.
- .2 Do not install wiring and conduit on outside walls or on roofs unless specifically directed.

3.11 SERVICE PENETRATIONS IN RATED FIRE SEPARATIONS

- .1 All cabling, wiring, conduits, cable trays, etc. passing through rated fire separations shall be smoke and fire stopped to a ULC or cUL tested assembly system, in accordance with CAN4-S115-95, that meets the requirements of the Building code in effect.
- .2 Fire resistance rating of installed firestopping assembly shall not be less than fire resistance rating of surrounding assembly indicated on Architectural drawings. Where this is not indicated assume a minimum of one hour for walls and two hours for floors.
- .3 Install firestopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions. The Applicator shall be approved, licensed and supervised by the manufacturer in the installation of firestopping and are to follow the requirements of a rated system as detailed above.
- .4 Contractors are expected to submit system information detailing firestopping product, backing, penetrant, penetrated assembly, Fire (F) and Temperature (T) rating, and ULC or cUL system number.
- .5 Provide fire stopping material and system information in the maintenance manuals and via labels at major penetrations that are likely to be repenetrated.
- .6 Allow openings for 100% capacity of raceway or 200% capacity of J-hooks.
- .7 Provide split systems where existing cables are involved.
- .8 Provide Firestopping approval certificate including a Building Code / By-Law Schedule B-1, B-2 & C-B signed by a BC registered Professional Engineer. Submit a letter certifying that all work is complete and in accordance with this specification.

3.12 SERVICE PENETRATIONS IN NON-RATED SEPARATIONS

- .1 All cabling, wiring, conduits, cable trays, 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 caulking or silicon sealant to prevent the passage of smoke and/or transmission of sound.

3.13 CONDUIT SLEEVES

- .1 Provide conduit sleeves for all conduit and wiring passing through rated walls and floors. Sleeves to be concentric with conduit or wiring.
- .2 Except as otherwise noted conduit sleeves are not required for holes formed or cored in interior concrete walls or floors.

- .3 Conduit sleeves shall extend 50 mm [2"] above floors in unfinished areas and wet areas and 6 mm [1/4"] above floors in finished areas.
- .4 Conduit sleeves shall extend 25 mm [1"] on each side of walls in unfinished areas and 6 mm [1/4"] in finished areas.
- .5 Conduit sleeves shall extend 25mm [1"] beyond exterior face of building. Caulk with flexible caulking compound.
- .6 Sleeve Size: 12 mm [1/2"] clearance all around, between sleeve and conduit or wiring.
- .7 Paint exterior surfaces of ferrous sleeves with heavy application of rust inhibiting primer.
- .8 Packing of Sleeves:
 - .1 Where sleeves pass through foundation walls and perimeter walls the space between sleeve and conduit shall be caulked with waterproof fire retardant non-hardening mastic.
 - .2 Pack future-use sleeves with mineral wool insulation and then seal with ULC approved fire stop sealant for rated fire separations.

3.14 ACCESSIBILITY AND ACCESS PANELS

- .1 Install all equipment, controls and junction boxes so as to be readily accessible for future modification, adjustment, operation and maintenance as appropriate.
- .2 Provide access panels where required in building surfaces. Do not locate access panels in panelled or special finish walls, without prior approval of the Departmental Representative.
- .3 Access panels in U.L.C. fire separations and fire walls shall have a compatible fire rating and U.L.C. label. Acquire approval in writing from the local fire authority if required.
- .4 Access panels shall be painted with a primer coat if applicable and then with a finish coat, colour and type to the Departmental Representative's approval.
- .5 Locate equipment and junction boxes in service areas wherever possible.

3.15 EQUIPMENT INSTALLATION

- .1 Provide means of access for servicing equipment.
- .2 CSA identification and equipment labels to be clearly visible after installation.

3.16 CUTTING, PATCHING, DIGGING, CANNING , CORING & CONCRETE

- .1 Lay out all cutting, patching, digging, canning and coring required to accommodate the electrical services. Coordinate with other Divisions. The performance of actual cutting, patching, digging, canning and coring is specified under other Divisions.

- .2 Be responsible for all cutting, patching, digging, canning and coring required to accommodate the electrical services.
- .3 Be responsible for correct location and sizing of all openings required under Electrical Divisions, including piped sleeves.
- .4 Verify the location of existing and planned service runs and structural components within concrete floor and walls prior to core drilling and/or cutting. Repairs to existing services and structural components damaged as a result of core drilling and cutting is included in this section of the work.
- .5 Openings through structural members of the building shall not be made without the approval of the Structural Engineer.
- .6 Openings in Concrete:
 - .1 Be responsible for the layout of all openings in concrete, where openings are not left ready under previous contract.
 - .2 All openings shall be core drilled or diamond saw cut.
 - .3 Refer to structural drawings for permissible locations of openings and permissible opening sizes in concrete floors and walls.
 - .4 Refer to structural drawings for locations of steel reinforcing.
 - .5 Be responsible for repairing any damage to steel reinforcing.
- .7 Openings in building surfaces other than concrete:
 - .1 Lay out all openings required.
- .8 Poured concrete for duct encasements, pole bases, transformer pads and housekeeping pads shall be provided by other Divisions, coordinated and supervised by the Electrical Divisions.
- .9 Precast concrete items such as transformer pad bases, pull boxes and light pole bases to be provided and installed by the Electrical Divisions unless otherwise specified.
- .10 Excavation and backfilling will be provided by other Divisions. This Division to superintend the work and provide all layouts and parameters.

3.17 PAINTING

- .1 Clean exposed bare metal surfaces supplied under the Electrical Divisions 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 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 the Electrical Divisions, to match the original factory finish.
- .4 Coordinate with Division 09.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Division 01 Sustainable Requirements: Construction.
- .2 Do verification requirements in accordance with Division 01 Sustainable Requirements: Contractor's Verification.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 – Construction / Demolition Waste Management And Disposal and with the Waste Reduction Workplan.
- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Place materials defined as hazardous or toxic waste in designated containers.

1.4 PCB (POLYCHLORINATED BIPHENYLS)

- .1 Carefully remove any electrical items containing PCB's (eg light fixture ballasts) from equipment or fixtures to be renovated or demolished. Removed items (containing PCB's) to be catalogued and stored on site in approved labelled storage containers in accordance with regulations.

1.5 SCOPE

- .1 The Electrical Division to take note that the demolition and renovation will be done in an occupied building that is normally occupied during the day. Maintain electrical and communication systems as required to minimize services disruption.
- .2 The Electrical Division to also take note of the dust containment requirements as outlined in the architectural and front end specification.
- .3 Electrical tender documents do not show all existing luminaires, wiring devices, conduit, boxes or wire. Conduit routing and wire grouping is not known. During demolition, the Electrical trade(s) are to deactivate all existing electrical and communication systems affected in such a manner that complete systems are not deactivated and system circuits affected in party wall partitions to be reactivated immediately on a temporary or permanent basis as site conditions dictate.
- .4 Any discrepancies appearing on the drawings or in this specification are to be brought to the attention of the Departmental Representative who will provide instruction.

- .5 Where devices are not shown on the new plans in walls that are not being removed, such devices are to be reinstated and remain.

1.6 SCHEDULING

- .1 Refer to Prime Consultant divisions.

1.7 EXAMINATION

- .1 Refer to Prime Consultant divisions.

1.8 PHASING

- .1 Refer to Prime Consultant divisions.

1.9 PROTECTION

- .1 Refer to Prime Consultant divisions.

Part 2 Products

2.1 STANDARDS

- .1 Refer to applicable material standards in other specification sections and/or as detailed on drawings.

Part 3 EXECUTION

3.1 DEMOLITION

- .1 Demolition to be carried out in strict conformance to provincial, local and municipal authorities and Part 8 of the B.C. Building Code current edition.
- .2 All redundant electrical components in the areas of demolition excluding those specifically identified in the following clauses shall become the property of the Electrical Division and shall be removed from site.

3.2 DISRUPTION TO OPERATIONS

- .1 Contractor to issue a scheduled shutdown time and coordinate installation of the new equipment as appropriate. All equipment installed and modified requires testing before start-up.
- .2 Contractor to provide temporary connections to all required equipment for temporary power during the installation of any new equipment.

3.3 REUSE OF EXISTING COMPONENTS

- .1 Existing components may be reused only where so specifically indicated on the drawings or in the specifications, however in all cases all wiring shall be new and no splicing shall be permitted at any location.

3.4 DISTRIBUTION OF CIRCUITS

- .1 Circuit: power, voice/data, fire alarm, control etc. which are disrupted during demolition and are essential, to be made good immediately. The Electrical Trade(s) to identify these circuits to the Departmental Representative. Specific tasks involving the demolition of essential circuits will require that the contractor to obtain permission from the Owner before proceeding.

3.5 ABANDONED CONDUIT, WIRE AND EXISTING CIRCUITS

- .1 All abandoned conduit and wire to be removed and disposed of by the Electrical Divisions.
- .2 Remove all accessible (eg. Surface) wiring and cables back to source.
- .3 Remove abandoned outlets and raceway, even if in or behind drywall, where they are located behind millwork or in locations unsuitable for reuse i.e. not at standard heights for switches or outlets.
- .4 All remaining circuits to be rerouted as required and suitably secured to the building structure.
- .5 Any cabling, including voice/data wiring, presently resting on any suspended ceiling system to be removed as part of the renovation process and shall be neatly bundled, protected and permanently secured to building structure. No cabling is permitted to rest on the ceiling system.

3.6 EXCAVATION AND CUTTING DAMAGE

- .1 Circuits disrupted by floor cutting or drilling (ie. buried cables) to be brought to the attention of the Departmental Representative. Obvious systems disturbed because due care and attention was not followed, shall be repaired immediately at no additional cost to owner.

3.7 FIRE ALARM SYSTEM

- .1 Construction/demolition activities in existing building may require that certain fire alarm devices are protected from construction dust, damage etc. Coordinate with the Departmental Representative as required to protect components of the fire alarm system to prevent nuisance operation and alarms.
- .2 Provide, install and test temporary heat detectors in the area of construction where the construction area is not protected by an active supervised fire protection sprinkler system. The "construction" detectors to be removed and discarded at the end of the project.
- .3 Provide temporary replacement of smoke detectors with heat detectors including interim programming and testing and final re-verification to minimize false alarms and to ensure other occupants of the building are protected.

- .4 Maintain existing fire alarm system in areas under construction where practical. Relocate, rewire and provide interim connections as required while installing the new system to replace the existing. Provide temporary fire alarm devices and audible signals to suit any temporary EXITing provisions.
- .5 Contractor to check in with the Departmental Representative at the start and end of each working day to confirm the fire alarm status in the area of work. Arrange for the related fire alarm zone card or area to be deactivated either to suit the progress of the work and/or where dust will be present on a day to day basis. Bag and protect fire detectors in dusty areas during construction. Remove any bagging at the end of the work day. Any existing detectors subject to construction dust to be immediately vacuumed and marked to be replaced at the end of the project. Any fire alarm devices subject to moisture to be replaced immediately.
- .6 The fire alarm system is to be fully functional in the area of construction when the contractor is neither on site nor after the contractors normal work hours. (ie overnight, holidays, weekends)

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.
- .2 Refer to Division 27 & 28 for particular Communications, Electronic Safety & Security wiring systems and types.

1.2 TERMS OF REFERENCE

- .1 Typically use insulated 98% conductivity copper conductor wiring enclosed in EMT (steel) conduit for the general wiring systems unless otherwise indicated. Refer to "Site Services" Section for allowable site conduits as an alternative to steel.
- .2 Teck cable may only be used where specifically indicated on the drawings or in the specifications. Where permitted, Teck wiring up to 750 system volts to be PVC jacketed armoured cable, multi-copper conductor type Teck90 1000 volt having a PVC jacket with FT-4 flame spread rating. Tech cable may be used for exterior condensing unit feeders, cables to be routed using existing pathways where possible.
- .3 Flexible armoured cabling (BX) shall not be used for the general wiring system other than final drops to recessed light fixtures in concealed locations.
- .4 Provide all control wiring except HVAC controls as specified in Mechanical Divisions.
- .5 Refer to Mechanical Schedule(s) for detailed responsibilities.
- .6 Non-metallic sheathed wiring is not to be used on this project.

1.3 PRODUCT DATA

- .1 Provide product data in accordance with Division 01.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 – Construction / Demolition Waste Management And Disposal and with the Waste Reduction Workplan.
- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Place materials defined as hazardous or toxic waste in designated containers.

Part 2 Products

2.1 WIRING & CABLES – GENERAL

- .1 Conductors: stranded for 10 AWG and larger. Minimum size #12 AWG.
- .2 Insulation to be 600 volt RW90XLPE (X link) for the general building wiring in conduit.

- .3 Use RWU90XLPE for underground installations.
- .4 Armoured (BX) cable may only be utilized for recessed tee bar luminaire drops from ceiling mounted outlet boxes. "Tite Bite" connectors and their counterparts of other manufacturers shall not be used. Use anti-short connectors. Cable from luminaire to luminaire is discouraged. Allow nominally 900mm [3'] extra cable looped and supported in the ceiling space to permit fixture relocations of one tile space.
- .5 Conductors to be colour-coded. Conductors No.10 gauge and smaller shall have colour impregnated into insulation at time of manufacture. Conductors size No.8 gauge and larger may be colour-coded with adhesive colour coding tape, but only black insulated conductors shall be employed in this case, except for neutrals which shall be white wherever possible. Where colour-coding tape is utilized, it shall be applied for a minimum of 50 mm at terminations, junctions and pullboxes and conduit fittings. Conductors not to be painted.

2.2 TECK 90 CABLE

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Conductors: copper and sized as indicated.
- .3 Insulation: Chemically cross-linked thermosetting polyethylene rated type RW90XLPE,600V
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: flat galvanized steel.
- .6 Overall covering: PVC jacket with FT-4 flame spread rating. PVC flame retardant jacket over armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No. 0.3 with maximum flame travel of 1.2 m.
- .7 Fastenings:
 - .1 One (1) hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two (2) or more cables.
 - .3 Threaded rods: 6 mm dia. to support suspended channels.
- .8 Connectors: Watertight approved for TECK cable

2.3 ARMOURED CABLE (BX)

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90 600 V rated.
- .3 Armour: interlocking type fabricated from galvanized steel.
- .4 Anti-short connectors.

2.4 ALUMINUM SHEATHED CABLE

- .1 Conductors: insulated copper, size as indicated.
- .2 Insulation: type RA90 rated 600 V.
- .3 Sheath: aluminum applied to form continuous smooth or corrugated seamless sheath.
- .4 Outer jacket of PVC applied over sheath for direct burial and wet locations.
- .5 Fastenings for aluminum sheathed cable:
 - .1 One hole aluminum straps to secure surface cables 25 mm and smaller. Two hole steel straps for cables larger than 25 mm. Use aluminum strap only with single conductor cable.
 - .2 Channel type supports for two or more cables.
 - .3 Threaded rods: 6 mm dia. to support suspended channels.

2.5 LOW VOLTAGE CONTROL CABLES

- .1 Type LVT: soft annealed copper conductors, with thermoplastic insulation, outer covering of thermoplastic jacket. Minimum size #18 AWG.
- .2 Unless otherwise specified wiring to be multicore individually identified and colour coded with grey sheath enclosed in conduit or (EMT).

2.6 WIRE & BOX CONNECTORS

- .1 Pressure type wire connector current carrying parts to be copper and sized to fit conductors used.
- .2 Fixture type splicing connector current carrying parts to be copper sized to fit conductors 10 AWG or less.
- .3 Bushing stud connectors to EEMAC 1Y-2 and suitable for stranded copper conductors
- .4 Clamps or connectors for armoured cable, flexible conduit, as required.

Part 3 Execution

3.1 INSTALLATION

- .1 Install all cables and wiring.
- .2 Conductor length for parallel feeders to be identical. Provide permanent plastic nametag indicating load fed.
- .3 Group Teck, Armoured, MI & Sheathed cables on channels wherever possible.

- .4 Lace or clip groups of feeder conductors at all distribution centres, pullboxes, and termination points.
- .5 Wiring in walls should typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls should be avoided unless indicated.
- .6 All grounding conductors and straps to be copper. All bonding conductors to have green insulation jacket.
- .7 Colour coding to be strictly in accordance with Section 16010 [26 05 00].
- .8 Provide sleeves where cables enter or exit cast concrete or masonry.
- .9 Power wiring up to and including No.6 gauge shall be spliced with nylon-insulated expandable spring-type connectors. Large conductors shall be spliced using split-bolt or other compression type connectors wrapped with cambric tape then PVC tape.
- .10 Wires shall be sized for 2% maximum voltage drop to farthest outlet on a loaded circuit. Increase home run cable size to meet these requirements.
- .11 All branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .12 Install all control cables in conduit.
- .13 Provide numbered wire collars for all control wiring. Numbers to correspond to control drawing legend. Obtain wiring diagram for control wiring of other Divisions.

3.2 VOLTAGE REGULATION

- .1 The drawings are diagrammatic and indicate the general routing of conduit runs and not exact routing, either horizontally or vertically.
- .2 Branch circuit conductor sizes shall be #12 AWG or larger based on the Canadian Electrical Code CSA 22.1 Section 8, which allows a maximum 3% voltage drop for branch circuits.

3.3 WIRE & BOX CONNECTORS

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65
 - .2 Install fixture type connectors and tighten. Replace insulating cap.
 - .3 Install bushing stud connectors in accordance with EEMAC 1Y-2

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 – Construction / Demolition Waste Management and Disposal and with the Waste Reduction Workplan.
- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Place materials defined as hazardous or toxic waste in designated containers.

1.3 REFERENCE STANDARDS

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
- .2 Transformer grounding shall comply with CSA C22.2 No.41.
- .3 All grounding conductors to be stranded soft annealed copper unless otherwise noted.
- .4 Install complete grounding and bonding system in accordance with Canadian Electrical Code and local inspection authority requirements.

1.4 TESTING REQUIREMENTS

- .1 Perform ground continuity and resistance tests using method appropriate to site conditions.
- .2 Any third party testing agency costs for the testing and reporting shall be included in the Electrical Division base tender and shall be carried out by a pre-approved testing agency.

1.5 ADDITIONAL SCOPE

- .1 Refer to drawings for extent of grounding in addition to code requirements.

Part 2 Products

2.1 MATERIALS

- .1 Grounding equipment to: CSA C22.2 No.41.

2.2 EQUIPMENT

- .1 Clamps for grounding of conductor, size as required.
- .2 System and circuit, equipment, grounding conductors, bare stranded copper, soft annealed, sized as indicated. Insulation where specified or required to be green.

2.3 INSTALLATION GENERAL

- .1 Expand existing complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories to suit new equipment.
- .2 Provide ground wire in EMT conduits installed in grade or below slabs.
- .3 Install connectors in accordance with manufacturer's instructions.
- .4 Protect exposed grounding conductors from mechanical injury.
- .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 end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit. Provide a ground conductor in all flexible conduit and secure to system grounding lugs at both the equipment and source.
- .8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .9 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .10 Bond single conductor, metallic armoured cables to cabinet at supply end and provide non-metallic entry plate at load end.
- .11 Provide a bonding conductor appropriately sized within each raceway routed within the building.
- .12 All bonding and grounding connections to be compression type unless noted otherwise.
- .13 Expand existing system as required to provide complete grounding and bonding system as indicated and as required by Canadian Electrical Code and the local electrical inspection authorities.
- .14 All components shall be securely and adequately bonded and where required to accomplish this, bonding jumpers, grounding studs and bushings shall be used.
- .15 Ensure that all raceways, terminal panels, etc. for fire alarm, etc. are securely and adequately bonded and provide grounding conductor to main ground bus where called for or when required.
- .16 All interior metallic gas piping which may become energized to be made electrically continuous and to be bonded in accordance with requirements of Canadian Electrical Code.
- .17 Bond all low tension equipment with #6 AWG bonding conductor.

- .18 All metallic conduits longer than 1m in length, containing a single grounding or bonding conductor, shall be bonded as per the Canadian Electrical Code.

2.4 EQUIPMENT GROUNDING OR BONDING

- .1 Install grounding or bonding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, UPS, control panels, building steel work, generators, elevators, distribution panels and outdoor lighting.

2.5 MECHANICAL EQUIPMENT GROUNDING

- .1 Provide a #2 ground conductor from the mechanical room ground bus to each MCC.
- .2 Provide a #6 ground conductor from the mechanical room ground bus to each VFD
- .3 Ground wires to be installed in all conduit serving motor feeder circuits and to extend to ground screws on junction and outlet boxes for bonding.

2.6 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions.
- .3 Carry out all tests required by the Electrical Inspection Authority and provide all required reports and copied to the Departmental Representative. Include all associated costs.
- .4 Ensure test results are satisfactory before energizing the electrical system.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 – Construction / Demolition Waste Management and Disposal and with the Waste Reduction Workplan.
- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Place materials defined as hazardous or toxic waste in designated containers.

1.3 REFERENCES

- .1 All conduits and accessories to be manufactured and certified by the related CSA standard.

1.4 SCOPE

- .1 Drawings do not show all conduits. Those shown are in diagrammatic form only.
- .2 Conceal all conduits where possible in finished areas. Conduits may be surface mounted either only where indicated or in service areas accessible only to authorized personnel.
- .3 If a finished area is concrete (existing) or concealment is not practical, obtain ruling from Departmental Representative where exposed wiremold may be substituted.
- .4 Note particular requirements for routing of conduits where detailed.
- .5 Provide polypropylene pull cord in all “empty” conduits.

Part 2 Products

2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No.45 Galvanized Steel.
- .2 Electrical Metallic Tubing (EMT): to CSA C22.2 No.83.

2.2 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 41mm [1.5”] and smaller. Use two hole steel straps to conduits larger than 41mm [1.5”].
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits.
- .4 10mm [3/8”] threaded rods to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings manufactured for use with conduits specified. Coating same as conduit.
- .2 Provide factory "ells" where 90 degree bends are required for 27mm [1"] and larger conduits.
- .3 EMT couplings and connectors shall be steel, or Regal Die-cast zinc alloy. Couplings used on conduit containing fire-rated cable shall be steel. Regular die-cast alloy fittings and couplings are not acceptable. Provide plastic bushings (insulated throat) for all connectors unless there is no chance of burrs. Provide water-tight connectors in damp or wet locations and for surface equipment (e.g. Panelboards, MCC's, etc) in rooms that are fire sprinkler protected.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable linear expansion.
- .2 Water-tight expansion fittings: with integral bonding jumper, suitable for linear expansion and 21mm [3/4"] deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel as required.

2.5 RIGID P.V.C. CONDUIT

- .1 Conduit: rigid non-metallic conduit of unplasticized polyvinyl chloride as manufactured C.G.E. "Sceptre" or equal.
- .2 Fittings: threaded male or female solvent weld connectors and solvent weld couplings, as supplied by conduit manufacturer.
- .3 Solvent: as recommended by conduit manufacturer.

2.6 OUTLET AND CONDUIT BOXES IN GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm [4"] square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped. Do not use sectional boxes.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347V outlet boxes for 347V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.
- .7 Bushing and connectors with nylon insulated throats.
- .8 Knock-out fillers to prevent entry of foreign materials.

- .9 Conduit outlet bodies for conduit up to 35 mm[1.25"]. Use pull boxes for larger conduits.
- .10 Double locknuts and insulated bushings on sheet metal boxes.

2.7 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 [3" x 2" x 1.5"] or as indicated. Larger 102 mm square x 54mm deep [4"x 2"] outlet boxes (No. 52151 or 52171) to be used when more than one conduit enters one side. Provide extension and plaster rings as required.
- .2 For larger boxes use GSB solid type as required.
- .3 Boxes for surface mounted switches, receptacles, communications, telephone to be 100mm square No. 52151 or 52171 with Taylor 8300 series covers; or equivalent.
- .4 Lighting fixture outlets: 102 mm [4"] square outlet boxes (No 52151, 52171 or 72171) or octagonal outlet boxes (No 54151 or 54171).
- .5 102 mm [4"] square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster and/or tile walls.

2.8 CONCRETE BOXES

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

Part 3 Execution

3.1 CONDUIT - GENERAL

- .1 Generally use electrical metallic tubing (EMT) in the building interior and in above grade slabs except where subject to mechanical injury or where otherwise indicated.
- .2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass. Set out the work and coordinate with other services prior to installation. Maintain access to junction and pull boxes.
- .3 Where practical conceal conduits.
- .4 Any conduit exposed in finished areas to be free of unnecessary labels and trade marks.
- .5 All conduit ends to be reamed to ensure a smooth interior finish that will not damage the insulation of the wiring.
- .6 Ensure grounding continuity in all conduit systems.
- .7 Surface conduits are acceptable in mechanical and electrical service rooms and in unfinished areas or where indicated.

- .8 Use rigid galvanized steel (RGS) threaded conduit where the installation is subject to mechanical injury. In any event, use RGS conduit for surface installations up to 1.5m [5'] above the finished floor.
- .9 Field threads on rigid conduit shall be sufficient length to draw conduits ends together.
- .10 Unless otherwise noted and where practical, all conduits to be routed through the ceiling space rather than in, or below, slabs or floor structures to facilitate future changes.
- .11 Conduits in walls should typically drop (or loop) vertically from above to better facilitate future renovations. Generally conduits from below and horizontal conduits in walls and concrete structures should be avoided unless indicated.
- .12 All branch circuit conduit, home-runs and communication/data conduits to be minimum 21 mm [3/4"] diameter unless otherwise indicated.
- .13 Generally use Rigid PVC conduits in or below ground level slab unless otherwise noted. Transition to RGS conduit in exposed locations: eg where conduits emerge from ground level slab.
- .14 Conduits are not permitted in terrazo or concrete toppings.
- .15 Cap turned up conduits to prevent the entrance of dirt or moisture during construction.
- .16 Locate conduits more than 75mm [3"] parallel to steam or hot water lines with a minimum of 25mm [1"] at crossovers.
- .17 Bend conduits cold, so that conduit at any point is not flattened more than 1/10th of its original diameter. Conduits bent more than this or kinked to be replaced.
- .18 Provide polypropylene pull cord in empty conduits to facilitate pulling wiring in future.
- .19 Where conduits become blocked, the use of corrosive agents is prohibited. Remove and replace blocked section.
- .20 Damaged conduits to be repaired or replaced.
- .21 Dry conduits out thoroughly before installing wiring. Swab out conduit and thoroughly clean internally before wires and cables are pulled.
- .22 Conduits shall not pass through structural members except as indicated.
- .23 Conduit sizes indicated on drawings are minimum only. Increase sizes as required to suit alternative wiring types or to comply with Code.
- .24 Conduits and ducts crossing building expansion joints shall have approved conduit expansion fittings to suit the type of conduit used.
- .25 Seal conduits with approved sealant where conduits are run between heated and unheated areas.

- .26 Seal openings with approved sealant where conduits, cables, or cable trays pierce fire separations.
- .27 Where conduits pass through walls, they shall be grouped and installed through openings. After all conduits are installed, wall openings shall be closed with material compatible with the wall construction and/or to meet any fire separation integrity.
- .28 Where drawings show conduit designations, these conduits shall be identified at each point of termination with Thomas & Betts "Ty-Rap" No. TY532M labels, or equivalent.
- .29 Use "Condulet" fittings for power and telephone type conduit terminations in lieu of standard boxes where box support is not provided.
- .30 Provide necessary roof jacks or flashing where conduits pass through roof or watertight membranes. Apply approved sealant to maintain membrane integrity.
- .31 Use liquid tight flexible metal conduit for connection to motors, and other vibrating equipment and transformers.

3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with minimum 1.5m [5'] clearance.
- .3 Conduits to be run in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended and/or surface channels.
- .5 Surface conduits will not be accepted in finished areas unless detailed.

3.3 SURFACE RACEWAYS

- .1 Where practical provide regularly spaced device outlets and factory pre-cut raceway covers and cover plates. Field install outlets where factory installation is not possible due to delivery issues or irregularly spaced outlet requirement. In this event covers may be field cut with proprietary factory cover shear equipment with sharp blades.
- .2 Raceways shall be free of burrs inside and out.
- .3 Covers to be matching colour, smooth, free of burrs and parallel with no gaps.
- .4 Preserve and organize the space within the wireway to facilitate multiple wiring runs and future additions. In finished areas and where practical, conduit to feed the surface raceway from a box recessed behind and via grommetted openings to the back of the surface raceway. Maintain pullbox access as required by the Canadian Electrical Code.

3.4 BOXES INSTALLATION

- .1 Support boxes independently of connecting conduits.

- .2 Ceiling outlet boxes to be provided for each surface mounted fixture or row of fixtures installed in other than T bar ceilings with removable tiles.
- .3 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of construction material. Remove upon completion of work.
- .4 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm [0.25"] of opening.
- .5 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers not to be used.
- .6 All outlet boxes to be flush mounted in all areas, excluding mechanical rooms, electrical rooms, and above removable ceilings.
- .7 Adjust position of outlets in finished masonry walls to suit masonry course lines. Coordinate cutting of masonry walls to achieve neat openings for all boxes. All cutting of masonry work for installation of electrical fittings to be done using rotary cutting equipment.
- .8 No sectional or handy boxes to be installed.
- .9 Provide vapour barrier wrap or boots behind outlets mounted in exterior walls. Maintain integrity of the vapour barrier and insulation to prevent condensation through boxes.
- .10 Coordinate location and mounting heights of outlets above counters, benches, splash-backs and with respect to heating units and plumbing fixtures. Coordinate with architectural details.
- .11 Outlets installed back to back in party stud walls to be off-set by one stud space.
- .12 Refer to wiring device and communication specification sections and to architectural layouts for mounting heights of outlet boxes.
- .13 Back-boxes for all communications systems equipment to be provided in accordance with specific manufacturer's recommendations and as specified in the communications sections of these specifications.
- .14 Separate outlets located immediately alongside one another to be mounted at exactly the same height above finished floor. Similarly, outlets mounted on a wall in the same general location at varying heights to be on the same vertical centre-line unless otherwise noted.
- .15 Where outlet boxes penetrate through a fire separation, ensure that the boxes are externally tightly fitted with an approved non-combustible material to prevent passage of smoke or flame in the event of a fire.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 – Construction / Demolition Waste Management and Disposal and with the Waste Reduction Workplan.
- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Place materials defined as hazardous or toxic waste in designated containers.

Part 2 Products

2.1 BREAKERS

- .1 All breakers to be bolt on type, moulded case, non adjustable and non interchangeable trip, single, two and three pole, 120/208(240)V or 347/600V and with trip free position separate from "On" or "Off" positions.
- .2 Two and three pole breakers to have common simultaneous trip and able to be located in any circuit position within the panelboard. Minimum interrupting rating of breakers to be as follows:
 - .1 347/600V panelboards - 14,000 Amps at 347 volts.
 - .2 120/208V panelboards - 10,000 Amps at 250 volts.
- .3 Main breaker to be separately mounted at top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Provide circuit breakers with indicated trip ratings as shown in the panelboard schedules.

2.2 PANELBOARD IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00.
- .2 Nameplate for each panelboard size 5 (2 line) engraved as indicated and include panel designation and voltage/phase.
- .3 Complete circuit directory with typewritten card(s) located in slide-in plastic pocket(s) fixed to the back of the related door. Directory card to indicate the panel designation, mains size, voltage/phase and the location and load controlled of each circuit. Include a "letter sized" paper copy of each directory in the project maintenance manual.
- .4 Provide a plasticized typewritten information card fixed to the back of the each panel door. Information card to indicate the panel designation and location, feeder type and size and locations of any controlling contactors and feeder pullboxes. Include a "letter sized" paper copy of each information card in the project maintenance manual.

Part 3 Execution

3.1 INSTALLATION

- .1 Connect loads to circuits as indicated.
- .2 Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.
- .2 Provide and locate safety disconnect switches to isolate individual items of equipment in accordance with Canadian Electrical Code CSA 22.1 whether indicated on not on the contract drawings.

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 HEALTH AND SAFETY

- .1 Do construction occupational health and safety in accordance with Division 01- Health and Safety Requirements.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 – Construction / Demolition Waste Management and Disposal and with the Waste Reduction Workplan.
- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Place materials defined as hazardous or toxic waste in designated containers.

1.5 PRODUCT DATA

- .1 Submit product data in accordance with Section 26 05 00.

Part 2 Products

2.1 DISCONNECT EQUIPMENT

- .1 “Heavy Duty” class, enclosed manual air break switches in non-hazardous locations: to CSA C22.2 No.4
- .2 Fuseholder assemblies to CSA C22.2 No.39.
- .3 Fusible and non-fusible disconnect switch in CSA enclosure.
- .4 Provision for padlocking in off switch position.
- .5 Fuses as indicated. Allow for Class J or L for general circuits, Class RK5 for transformer, motor or other high inrush current circuits

- .6 Fuseholders in each switch suitable without adaptors, for type of fuse as indicated.
- .7 Quick-make, quick-break action.
- .8 ON-OFF switch position indication on switch enclosure cover.
- .9 Provide an auxiliary switch with dry contacts on all elevator disconnects and as required by the Elevator Code. Review elevator shop drawings to confirm any additional requirements.
- .10 Weatherproof as required.

2.2 EQUIPMENT IDENTIFICATION

- .1 Indicate name of load controlled on size 4 name plate to Section 26 05 00.

Part 3 Execution

3.1 INSTALLATION

- .1 Install disconnect switches complete with fuses where indicated or required.
- .2 Provide and locate safety disconnect switches to isolate individual items of equipment in accordance with Canadian Electrical Code CSA 22.1 whether indicated on not on the contract drawings.

3.2 MOTOR PLUG/RECEPTACLE AND QUICK DISCONNECTS

- .1 Motor quick disconnects do not negate the requirement for a switched safety disconnect as specified in this Division. A separate disconnect is still required unless the Departmental Representative has given a special pre-approved circumstance.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 – Construction / Demolition Waste Management and Disposal and with the Waste Reduction Workplan.
- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Place materials defined as hazardous or toxic waste in designated containers.

1.3 REGULATORY REQUIREMENTS

- .1 The fire alarm system devices are to be installed in accordance the following standards:
 - .1 C.S.A. Standard C22.1, Canadian Electrical Code, Part 1 2009 and bulletins & amendments for British Columbia and as adopted by the City of Vancouver (where appropriate).
 - .2 The British Columbia Building Code 2006 edition and as adopted by the City of Vancouver (where appropriate).
 - .3 CAN/ULC S524-06: Standard for Installation of Fire Alarm System.
 - .4 CAN/ULC S537-04: Standard for Verification of Fire Alarm System.
- .2 Installation subject to approval of Departmental Representative and fire marshal for final acceptance.

1.4 SYSTEM

- .1 The fire alarm system is existing and will remain. The scope of this project is limited to removal and re-installation of devices to allow for mechanical work.
- .2 Equipment to be ULC approved.

1.5 WARRANTY/SERVICE

- .1 System installer to include with his base tender price a guarantee stating:
 - .1 Service to be provided on system within 24 hours of call origination during the warranty period.
 - .2 Full warranty on affected devices to be provided for a period of 12 months.

- .3 During warranty period the system installer at his expense shall repair and replace all such defective work and other work to the system damaged thereby which fails or becomes defective during the term of the warranty, provided that such failure is not caused by improper usage or physical damage.
- .4 Should the system installer fail to comply with Sub-item 1.1, work will be performed by others at the contractors expense.
- .5 Warranty date to commence from date of final acceptance of this work.

1.6 TESTS AND ADJUSTMENTS

- .1 Upon completion of system installation, tests to be conducted by the system installer to determine system conformity to requirements of the specification. Tests to be conducted in presence of the Departmental Representative who may suspend or discontinue tests at any time performance is considered unsatisfactory. Resumption of testing to cover the previously untested elements and any completed elements at the discretion of the Departmental Representative.
- .2 All equipment or wiring provided by system installer which tests prove to be defective or operating improperly to be corrected or replaced promptly at no additional cost to the Owner.

1.7 LABELLING – DEVICES AND PULLBOXES

- .1 Provide a 'Brother' style commercial quality label on each fire alarm device. Label to be clearly visible from the ground and contain the address information to correspond to the walk test voice or page.

Part 2 Products

2.1 GENERAL

- .1 All fire alarm devices are existing and are to be re-used.

Part 3 Execution

3.1 INSTALLATION

- .1 System installation shall conform to the latest CAN/ULC-S524 Standard for the Installation of Fire Alarm Systems.

3.2 AUTOMATIC DETECTORS

- .1 Locate automatic smoke and thermal detectors in locations as shown indicated.
- .2 Generally, locate ceiling mounted detectors centrally in rooms and corridors unless lights and/or mechanical devices interfere. Coordinate with other trades before proceeding.

- .3 Provide flush mounted devices in finished areas unless wiring is surface mounted in which case surface mounted devices shall be provided. Provide mounting base for surface mounted detectors
- .4 Maintain minimum 450mm [18"] clear to mechanical air diffusers and registers.
- .5 Typically maintain minimum 450mm [18"] clear in all directions around detectors.
- .6 Mount detectors out of line of direct heat and minimum 3m [10'-0"] from unit heaters.
- .7 Mount smoke detectors associated with smoke control doors, on the ceiling on either side of the doors; typically 1200mm [4'-0"] from door. Do not mount detectors closer than 900mm [3'-0"] or farther than 1500mm [5'-0"] from the doors.
- .8 Mount detectors shown in crawl spaces which have solid type joists or beams at the level of the underside of the joist or beam.
- .9 Install duct smoke detectors on the supply air side of air handling units as indicated. Exact location of duct detectors to be coordinated with Division 23 and fire alarm system manufacturer.

3.3 WIRING

- .1 Make conductor terminations on fixed terminal strips with separate terminal for each conductor. No loose wiring connections allowed.
- .2 Fire alarm wiring splices to be minimal. Line splices are not acceptable.
- .3 Neatly install wiring clamped with nylon cable straps or laced with jute cord.
- .4 Number identify all wiring terminations and terminal strips as indicated on shop drawings.
- .5 Attach wiring diagram to inside of panel doors.
- .6 All cables crossing fire zones to be protected by 1-hour fire rating.
- .7 Provide separate fire alarm zone (and indicated at the graphic annunciators) for each duct mounted products-of-combustion detector for mechanical pressurization and recirculation units.
- .8 Coordinate duct detector location and accessibility. Provide remote LED's for locations not readily viewable by maintenance personnel.
- .9 Visual signal appliances to be wired independent from audible devices on the system.
- .10 All backboxes in exposed installations to be as provided by system manufacturer.

3.4 PROTECTION OF COMPLETED WORK

- .1 Protect equipment in areas of construction to prevent the entry of dust, paint and any other foreign matter into the devices or panels.

3.5 SYSTEM INSPECTION

- .1 Carry out a complete inspection and test of system on completion of the installation to ensure the following:
 - .1 System is complete and functional in accordance with the contract documents and regulatory requirements.
 - .2 System is installed in accordance with the manufacturer's recommendations.
 - .3 Fire suppression detection devices are connected into the system and are functioning.
 - .4 Smoke control equipment has been installed, connected and functioning.
 - .5 All auxiliary equipment has been connected and functioning.
 - .6 On completion of inspection deliver three (3) final sets of maintenance and operating instructions manuals to the Departmental Representative.

3.6 PERFORMANCE VERIFICATION

- .1 The Electrical Division Contractor shall be responsible for directing performance verification of the fire alarm system in accordance with the latest CAN-S537, Standard for Verification of Fire Alarm System Installations.
- .2 Provide interim partial verifications to suit the progress of the work and any staged occupancy. All work to be tested and verified directly following the installation.
- .3 Submit all verification reports to the Departmental Representative. Provide an unconditional Appendix C and written test reports from the equipment manufacturer showing that the system has been tested, verified and commissioned by him and that the Fire Alarm system complies with all points of the specifications. Include the verification worksheets identifying every device and its status (i.e. smoke detector - room xx, verified for operation and supervision).
- .4 The qualified Fire Alarm verification agency shall be independent of the installing company.
- .5 Prior to requesting the final performance verification ensure that fire alarm system is fully operable and that subsequent work to be performed on system will not invalidate examinations and tests performed during verification procedure.
- .6 Include all costs for fire alarm system verifications, including the Fire Alarm System Manufacturer's representative's costs. Take into account that the system may have to be commissioned and verified after normal working hours.
- .7 Provide a minimum of ten working days written notice ahead of the verification process to the Departmental Representative.

3.7 FIRE DEPARTMENT DEMONSTRATION

- .1 Arrange, attend and carry out a Fire Department demonstration of the completed system after the final unconditional verification.
- .2 Activate alarms and demonstrate all controls as requested.

END OF SECTION