Queen Charlotte Hospital
Pharmacy Upgrade

Queen Charlotte, Haida Gwaii
British Columbia

Project No. N671370001
Project No. SAL 115602082

Issued for Tender
May 3, 2021

PROJECT MANUAL

Issued by

Stantec

northern health
the northern way of caring

END OF SECTION

INVITATION TO BID

Tenders marked "Queen Charlotte Hospital Pharmacy Upgrades" - project No. CE203732 will be received electronically through bid&tenders, up to 2:00 pm local time on Friday May 21st,2021.

All Bidders must register with a Bidding System Vendor account and be registered as a Plan Taker for this Bid opportunity. This will allow you to download the Bid Call Documents, to receive Addenda email notifications, to submit a bid, and other features. We recommend becoming familiar with the online Bid Requirements before the closing date.

Questions related to this bid are to be submitted through the Bidding System only by "Submit a Question" button for this specific bid opportunity.

Northern Health will accept no responsibility for any Bidder not properly following the registration procedures outlined in this Advertisement. Bidders MUST register for the project in bid&tenders to receive notification of Addenda.

Site Tour

The work to be undertaken generally includes the following:

1. Renovation to the existing Queen Charlotte Hospital Pharmacy in Haida Gwaii, BC
2. Mechanical and Electrical works also required.

There will be an opportunity to review the project during a Mandatory Teams Conference call to be held on May 13th, 2021. Time 1:00 pm. A power point presentation will be made. Invites will be sent to interested bidders.

Contractors that would like to attend the Teams Conference are to confirm their attendance to Jay.Dupras@northernhealth.ca by 2:00 pm on May 10th. If there are no confirmations, the conference will not proceed. There will NOT be further opportunities to examine the site during the tender period. All Contractors attending the site visit are subject to screening prior to entering the facility, and physical distancing will be required.

This will, at minimum include:

- Existing Pharmacy Area
- Access options

Following the presentation, on a different day, May 18th, 2021. Time TBD, Northern Health will host a conference call for bidders to ask questions/clarifications of the design team and Northern Health. The Design Team will be available at this time to gather and respond to questions.

Bid Bond

A Ten Percent (10%) Bid Bond must accompany the tender. A fifty Percent (50%) Labour and Materials Bond and a Fifty Percent (50%) Performance Bond must be provided by the selected Contractor within 10 days of award. Bonding is to be submitted electronically via bids&tender.

Contract

The successful Contractor will be required to enter into a CCDC2-2008 Stipulated Price Contract for the Work with reference to all CCDC2-2008 terms and conditions included. The Owner reserves the right to reject any or all Bids or to accept the Bid deemed most favorable in the interest of the Owner.

Technical inquiries should be directed to:

STANTEC CONSULTING LTD.

MANAGING CONSULTANT
1100 - 111 Dunsmuir Street
Vancouver, B.C. V6B 6A3
TEL: (604) 696-8099 + (604) 369-6753 (mob)
Contacts: Eleonore Leclerc, Senior Associate
e-mail: Eleonore.Leclerc@stantec.com

Part 1 General

1.1 SECTION INCLUDES

.1 Substitution submittal procedures during bidding period.

1.2 RELATED SECTIONS

.1 Invitation to Bid.

.2 Section 01 62 00 - Product Exchange Procedures: Product options and substitution submittal procedures during construction.

1.3 PROPOSED SUBSTITUTIONS

.1 The Work is based on the Materials and methods specified in the specifications. Proprietary names used in these bid documents are intended to establish a standard of quality and are not meant to exclude products of other manufacturers.

.2 Requests to substitute a specified material with alternative material may be considered during the bid period.

.3 Proposed substitutions (alternatives) to the specified materials, along with a full description and justification for the alternative, shall be submitted in writing to the Contact Person by 1500 hours (3:00 PM) PACIFIC TIME five (5) business days before the Tender Closing Date as specified in the Invitation to Tender, Article B.10 - Alternative Materials..

.4 Proposed substitutions (alternatives) are not allowed unless application has been made to, and prior approval has been granted by Addendum.

.5 A request constitutes a representation that the Bidder:

.1 Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product and is so certifying that the proposed substitute will fully perform the functions called for by the general design.

.2 The proposed substitution will be of equal or superior substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed work schedule.

.3 Will provide the same warranty for the Substitution as for the specified Product.

.4 Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.

.5 Waives claims for additional costs or time extension which may subsequently become apparent.

.6 Will reimburse Owner and Consultant for review or redesign services associated with re-approval by authorities.

.6 To be considered, each request must:

.1 Include sufficient information to enable the Consultant to properly evaluate the material. Such information shall include manufacturer's product data, specifications, drawings and other pertinent data to completely describe the substitution. References to manufacturers' online websites without submitting this information are not acceptable.

.2 Identify any and all changes required in the Work of all trades which would become necessary to accommodate the substitution.

1.4 SUBSTITUTION SUBMITTAL PROCEDURE

.1 Submit each substitution request cross-referenced to the specified product by specification section name and number, page number, article / paragraph number, and product description.

.2 Document each request with complete data substantiating compliance of proposed substitution with specified products.

.3 Submissions MUST include samples, colours, textures and other data of proposed substitution product where such submission requirements are specified in individual trade sections and when requested by the Consultant.

.4 Requests that are late, incomplete, ambiguous or do not contain sufficient information to allow the Consultant to properly evaluate the proposal may be rejected.

1.5 CONSULTANT REVIEW PROCESS

.1 Consultant will review supporting data and will determine that the substitution in the Consultant's opinion is or is not equal or superior in quality, utility, and appearance to the material specified.

.2 The Consultant may:

.1 Reject the proposed substitution; or

.2 Accept the proposed substitution and designate the material as an "acceptable material".

.3 Accept the proposed substitution and designate the material as an "alternative material".

.3 If the Consultant approves a substitute as an "acceptable material" any bidder may use the approved material in place of the specified item.

.4 If the Consultant designates the substitute as an "alternative material" bidders who wish to include the alternative material in their bids must base their bids on the acceptable material (base bid) and provide an alternative price in the bid form for each different alternative material proposed. Acceptance of alternative materials is at the sole discretion of the Owner.

.5 If the Consultant rejects the proposed substitution bidders must base their bids on "acceptable materials" only, as identified in the Project Manual before close of bids.

.6 The Consultant reserves the right to accept or reject any proposal without prejudice for any reason whatsoever and reserves the right to disclose or not to disclose his reasons for such rejection.

.7 During the bidding period, the Consultant will list approved substitutes as "acceptable material" or "alternative material" by addendum only.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

PART 1.4 PROJECT SPECIFIC AMENDMENTS

PART 1.1 – INSTRUCTIONS TO BIDDERS

Add:
3.2.3 Infection Control Guidelines - Contractors are required to comply with CSA Z317.13-13 which may require specialized equipment & procedures. The following are guidelines only and not to be taken as complete instruction. Requirements will vary from project to project and it is the contractor's responsibility to ensure they are fully aware of the requirements specific to this project. NH Infection Control Practitioners will instruct contractors as to the level of infection control measures required. Measures may include but are not limited to the following:

i) Dust control
   (1) may include hoarding from true ceiling to floor with 12 mil polyethylene, zippered doors.
   (2) hoarding may be required in ceiling space and vacuumed upon completion
   (3) room penetrations such as doors, windows, electrical outlets, intake and exhaust vents etc may need to be sealed with plastic & duct/tuck tape (includes holes cut in walls as part of the project unless repaired within 8 hours).
   (4) water misting of work surfaces before cutting.
   (5) Construction workers to wear personal protective equipment, and to vacuum themselves with a HEPA filtered vacuum before leaving the work site, or wear cloth paper coveralls that are removed before leaving the work site.
   (6) Sticky walk-off mats at exit of hoarding, changed daily or more often if necessary
   (7) Immediate cleanup with HEPA filtered vacuum in the event hoarding tears/breaks
ii) Ventilation
   (1) area ventilation system disabled during construction/renovation
   (2) maintain negative pressure in construction zone
   (3) Exhaust air directly outside and away from any intake vents or to be filtered through HEPA filters before recirculating
iii) Debris Removal
   (1) Debris removal at each days end in a covered container or plastic garbage bag through designated route covered with moistened sheet before transporting
   (2) Container and wheels to be wiped down before re-entering facility
   (3) External chute if construction is not on ground floor
iv) Construction Clean
   (1) Wet mop and vacuum area with HEPA filtered vacuum upon completion
   (2) Wipe horizontal work surfaces with hospital approved disinfectant
v) Terminal Clean
   (1) To be performed by facility housekeeping staff upon completion of construction clean and PRIOR to hoarding being taken down

CCDC2 STIPULATED PRICE CONTRACT 2008
AGREEMENT BETWEEN OWNER AND CONTRACTOR

PART A-5 PAYMENT
5.3.1. Replace "2%" with "0%" ; Replace "4%" with "0%"

PART 4 ALLOWANCES
GC 4.1 CASH ALLOWANCES
4.1.2 Add, after the first sentence "Unless noted otherwise, none of the work included in the drawings and specifications is intended to be paid for by the cash allowances. The cash allowances are for the *Owner's* use, at the *Owner's* sole discretion. "

PART 5 PAYMENT

GC 5.2 APPLICATIONS FOR PROGRESS PAYMENT

Add:

5.2.10 The *Contractor* shall with each and every application for payment have an up-to-date red-lined as-built drawing available on site for *Consultant* review.

GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK

5.4.6 Delete in its entirety and replace with:

"An application for *Substantial Performance of the Work* shall be deemed complete only if submitted with required supporting documentation, including those requirements in GC 5.2.8, as determined by the *Consultant*, and including draft copies of Operations and Maintenance Manuals including table of contents, and approved shop drawings complete with Operations and Maintenance Manuals submissions."

GC 5.8 WITHHOLDING OF PAYMENT

Add:

5.8.2 Upon the provision of *Notice in Writing* to the *Contractor*, and notwithstanding any other provisions of the *Contract Documents*, the *Owner* may withhold all or any portion of any payment to the extent necessary to protect the *Owner* from any actual or anticipated cost, damage, expense or loss arising from:

.1 the unsatisfactory progress of the *Contractor* in performing the *Work*, as determined by the *Consultant* acting reasonably and in good faith;

.2 the failure of the *Contractor* to pay any amounts properly due and payable by the *Contractor* to third parties arising from the performance of the *Work* in the aggregate amount of such amounts; and

.3 unsatisfied claims for costs, damages, expenses or losses caused by the *Contractor* to the *Work* or to the property of the *Owner*, the *Consultant*, other contractors, or to anyone employed at the *Place of the Work*, or in connection with the *Work*, including for greater certainty, wages, expenses or other amounts payable to any person employed for the performance of the *Work*, including *Subcontractors* and *Suppliers*.

5.8.3 The *Owner* may withhold any or all monies pursuant to GC 5.8.2 until such matters have been completed, remedied, discharged, cleared, satisfied or released. When the *Owner* is satisfied that it is no longer necessary to withhold payment from the *Contractor* for any or all of the matters listed in GC 5.8.2, the *Owner* shall release all or part of any amounts withheld except statutory holdback amounts.

PART 6 CHANGES IN THE WORK

GC 6.2 CHANGE ORDER

6.2.1 Replace: "promptly present" with "present within 5 business days".
Add: "Failure to respond within time limit deems the change in *Work* to be at no cost to the *Owner*."

6.2.3 Replace 20% with 15%; replace 10% with 7%.

PART 11 INSURANCE AND CONTRACT SECURITY

GC 11.1 Insurance

Replace entirely with the following:

11.1.1 The *Contractor* shall, without limiting its obligations or liabilities herein and at its own expense, provide and maintain the following insurances with insurers licensed in British Columbia and in forms and amounts acceptable to the *Owner*:

(a) Commercial General Liability Insurance in an amount not less than:

- Two Million Dollars ($2,000,000.00) inclusive per occurrence against bodily injury and property damage for projects less than Two Hundred and Fifty Thousand Dollars ($250,000.00); or

- Five Million Dollars ($5,000,000.00) inclusive per occurrence against bodily injury and property damage for projects greater than Two Hundred and Fifty Thousand Dollars ($250,000.00) but less than One Million Dollars ($1,000,000.00).

The *Owner* is to be added as an additional insured under this policy. Any deductible applicable to property damage shall not exceed Five Thousand Dollars ($5,000.00) or such other reasonable deductible. Such insurance shall include, but not be limited to:

.01 Products or Completed Operations Liability Twenty-Four (24) months);

.02 Owner's and Contractor's Protective Liability;

.03 Blanket Written Contractual Liability;

.04 Contingent Employer's Liability;

.05 Personal Injury Liability;

.06 Non-Owned Automobile Liability;

.07 Cross Liability;

.08 Employees as Additional Insureds;

.09 Broad Form Property Damage;

.10 Elevator and Hoist Liability;

.11 Operation of Attached Machinery;

and where such further risk exists:

.12 Shoring, Blasting, Excavating, Underpinning, Demolition, Piledriving and Caisson Work, Work Below Ground Surface, Tunneling and Grading, as applicable; and

.13 Limited Pollution Liability in an amount not less than Two Million Dollars ($2,000,000.00).

.14 Broad Form Tenants Legal Liability.

(b) **Property** insurance which shall cover, on a replacement cost basis, all property, of every description, to be used in the construction of the Work, against "All Risks" of physical loss or damage, including earthquake and flood, while such property is being transported to the site, and thereafter throughout erection, installation and testing and such insurance shall be maintained until Substantial Performance of the *Work*. Such policy of insurance shall extend to protect the interest of the *Owner*, and shall contain a waiver of subrogation against the *Owner*. Any deductible shall not exceed Five Thousand Dollars ($5,000.00) or such other reasonable deductible for each and every occurrence except for the peril of flood, which may include a maximum deductible of Twenty Five Thousand Dollars ($25,000.00), and earthquake, which may include a maximum deductible of Ten Percent (10%) based upon completed values at the time of loss.

(c) **Automobile Liability Insurance**. The *Contractor* (or Contractor's Subcontractors) shall provide, maintain and pay for Automobile Liability insurance with respect of all owned or leased vehicles if used directly or indirectly in the performance of the Work, subject to limits of not less than Two Million Dollars ($2,000,000.00) inclusive per occurrence. The insurance shall be placed with such company or companies and in such form and deductibles as may be acceptable to Owner.

(d) **Aircraft and/or Watercraft Liability Insurance**. When applicable, the *Contractor* (or *Contractor's Subcontractors*) shall provide, maintain and pay for liability insurance with respect to all owned or non-owned aircraft and watercraft if used directly or indirectly in the performance of the Work, subject to limits of not less than Two Million Dollars ($2,000,000.00) inclusive per occurrence for bodily injury, death, and damage to property including loss of use thereof and including aircraft passenger hazard liability. The Owner must be included as an additional insured but only with respect to liability arising out of the Contractor's performance of the Contract. The insurance shall be placed with such company or companies and in such form and dedu8ctibles as may be acceptable to Owner.

(e) **Contractors Pollution Liability Insurance.** When applicable, the *Contractor* (or Contractor's Subcontractors) shall provide, maintain and pay for Contractor's Pollution Liability, where the Contractor's performance (or Contractor's Subcontractors performance) of the work is associated with hazardous materials clean-up, removal and/or containment, transit and disposal. This insurance must have a limit of liability not less than Two Million Dollars ($2,000,000.00) inclusive per occurrence insuring against bodily injury, death, and damage to property including loss of use thereof. The Owner must be included as an additional insured but only with respect to liability arising out of the Contractor's performance of the Contract. Such insurance shall not be impaired by any time element limitations to the pollution events, biological contaminants (without limitation, mould and bacteria), asbestos or lead exclusions. Any "insured vs. insured" exclusion shall not prejudice coverage for the Owner and shall not affect the Owner's ability to bring suit against the Contractor as a third party.

If any such insurance is provided on a claims-made basis and that insurance is cancelled or not renewed, such policy must provide a twenty-four (24) month extended reporting period.

11.1.2 All the foregoing insurance shall be primary and not require the sharing of any loss by any insurer of the *Owner*.

11.1.3 The *Contracto*r shall provide the *Owner* with proof of insurance for those insurances required to be provided by the Contractor prior to the commencement of the Work. Such evidence shall be in the form of the Owner's certificate of insurance (copy attached – Appendix 1). When

requested by the *Owner*, the *Contractor* shall provide certified copies of required insurance policies. The Contractor must cause all Subcontractors to comply with the insurance requirements outlined herein.

11.1.4 All required insurance shall be endorsed to provide the *Owner* with thirty (30) days advance written notice of cancellation or adverse material change.

11.1.5 The *Contractor* hereby waives all rights of recourse against the *Owner* with regard to damage to the *Contractor*'s property.

GC 11.2 Contract Security

For projects of One Hundred and Fifty Thousand Dollars ($150,000.00) or greater, delete entirely and replace with the following:

11.2.1 The Contractor shall prior to commencement of the Work furnish performance and labour and material payment bonds within fourteen (14) days of the date of this Contract. Each bond must be in a sum equal to 50% of the total Contract price. The bonds must be issued on the latest CCDC-221 or CCDC-222 approved forms or other such forms approved by the Surety Association of Canada and issued by a surety company registered in the Province of BC or another surety company acceptable to the Owner. The Contractor must maintain the bonds in good standing until the fulfilment of the Contract.

PART 12 INDEMNIFICATION, WAIVER OF CLAIMS AND WARRANTY

GC 12.1 – INDEMNIFICATION

Delete GC 12.1.1 and 12.1.2 and replace with the following:

GC 12.1 – INDEMNIFICATION

12.1.1 Without restricting the parties' obligation to indemnify as described in paragraphs 12.1.4 and 12.1.5, and excepting always losses arising out of the independent acts of the party for whom indemnification is sought, the *Owner* and the *Contractor* shall each indemnify and hold harmless the other from and against all claims, demands, losses, costs, damages, actions, suits, or proceedings whether in respect to losses suffered by them or in respect to claims by third parties that arise out of, or are attributable in any respect to their involvement as parties to this contract, provided such claims are:

.1 caused by:
(1) the acts or omissions of the party from whom indemnification is sought or anyone for whose acts or omissions that party is liable, or
(2) a failure of the party to the Contract from whom indemnification is sought to fulfill its terms or conditions; and

.2 made by Notice in Writing within such periods as prescribed by the *Limitation Act* of the Province of British Columbia.

12.1.2 The obligation of either party to indemnify as set forth in paragraph 12.1.1 shall be limited as follows:

.1 In respect to losses suffered by the *Owner* and the *Contractor* for which insurance is to be provided by the O*wner* pursuant to GC 11.1 – INSURANCE, the limit of the GENERAL LIABILITY COVERAGE – GC 11.1.1(a) or the limit of the PROPERTY COVERAGE – GC 11.1.1(b) whichever is pertinent to the loss.

.2 In respect to losses suffered by the *Owne*r and the *Contractor* for which insurance is not required to be provided by either party in accordance with GC 11.1 – INSURANCE, the

greater of the *Contract Price* as recorded in Article A-4 – CONTRACT PRICE or $2,000,000.00, but in no event shall the sum be greater than $20,000,000.00.

.3 In respect to claims by third parties for direct loss resulting from bodily injury, sickness, disease or death, or to injury to or destruction of tangible property, the obligation to indemnify is without limit. In respect to all other claims for indemnity as a result of claims advanced by third parties, the limits of indemnity set forth in paragraphs 12.1.2.1 and 12.1.2.2 shall apply.

HP-1. OWNER'S BUSINESS AND PROTECTION

1.1 The Owner's business is the operation of the various facilities, units and sites, which constitute the Northern Health Authority, hereinafter referred to as the NH and it is carried out without interruption for twenty-four (24) hours a day.

1.2 The Contractor in performing the work assigned under the Contract shall ensure that there is no undue interference in the operation of the Owner's business. Prior to commencement of work, the Contractor shall liaise with the Owner's Representative to ensure planned work procedures meet the Owner's requirements.

1.3 The Contractor shall require his employees to comply with the rules and regulations in force governing the Owner's business, and shall conduct the work in such a manner as not to hinder, impede, nor injure the Owner's operations or schedule of any work being carried out by the Owner. Should the Owner become dissatisfied with the conduct of any of the Contractor's workers, the Owner shall so notify the Contractor and the unsatisfactory or objectionable person(s) shall be removed from the job site immediately.

1.4 The Contractor must abide by the Owner's requirements for protection and security of the Owner's occupied property and operations during the performance of the Work. The Contractor will confine its activities to immediate areas of the Work and to within the bounds established by the Owner. The Contractor shall take all necessary precautions to fully protect those portions of the existing building(s) to remain, against damage during demolition or installation of new Work.

1.5 The Contractor shall perform the Work so as not to endanger the health or safety of patients, residents or staff.

1.6 The Contractor/Subcontractors and/or their employees shall not disclose any business, client, patient and/or employee information gained during their affiliation with the NH, as per the Freedom of Information and Protection of Privacy Act and the NH Confidentiality Policy.

1.7 The Contractor shall not disrupt existing building(s) or site services or cause inconvenience to the Owner or to patients, residents or staff without the Owners prior approval.

1.8 The Owner provides a smoke-free environment for employees, patients and visitors. Smoking is therefore not permitted in any NH building and it is the responsibility of the Contractor to enforce this policy with its own staff and any of its Subcontractors.

1.9 A portion of the site will be allotted to the Contractor as a construction staging area for the performance of the Work. Confine operations to these areas and build a barricade around the area of a type that deters trespassing, provides security and complies with the local building codes and requirements. Confine construction trailers and materials to within Owner approved hoarding lines.

1.10 The Owner may designate washrooms in the building for use by the Contractor. The use of such washrooms is subject to the conditions of use stipulated by the Owner.

1.11 The Owner will not provide telephone lines on site for use by the Contractor.

HP-2. BONDS

2.1 This Contractor Shall Provide Bonding As Follows:

a) Contracts less than $100,000 in value - no security unless specifically requested in the Instructions to Bidders.

b) Contracts exceeding $100,000 in value – in accordance with Instructions to Bidders.

2.2 Subcontractors: Security requirements and sub trade bonding in accordance with the BCCA Bid Depository Rules of Procedure and as noted in the Instructions to Bidders.

2.3 Format of Bond: The bonds are to be those issued by Canadian Construction Documents Committee (CCDC), latest revision.

HP-4. CODES, PERMITS & INSPECTIONS

4.1 All Work shall meet or exceed the requirements of any applicable Federal, Provincial, and Municipal Codes, Regulations and By-Laws.

4.2 The Building Permit will be obtained by the Owner and paid for by the Contractor.

4.3 The Contractor shall obtain all other permits and pay all fees relating to the Work to all authorities having jurisdiction unless otherwise directed by the Owner.

4.4 Specific Complex Care Facility rules & regulations as outlined in documents entitled, "Contractor Site Safety Orientation and Contractor Safety Checklist" shall be adhered to by the Contractor and strictly enforced by NH. For example, a Hospital 'Welding & Cutting Permit' shall be required by the Contractor for each occasion requiring such work to be carried out. The permits are issued by the Owner to the Contractor and available at no cost, once the area of the work has been checked for safe work conditions.

HP-5. FIRE REGULATIONS

5.1 The Contractor and his subcontractors shall be required to comply with the fire regulations of the Owner.

5.2 The Contractor and his subcontractors shall communicate with the Owner to receive instructions on the regulations involved.

5.3 The Contractor shall keep all existing entrances and exits clear at all times, comply with all fire safety requirements of existing facilities during the period of construction and any other regulations pertaining to fire protection during construction work.

5.4 Provide fire extinguishers as required by codes. The Owner's extinguishers will not be considered as part of the required complement of extinguishers for compliance of fire regulations within the job site.

5.5 Combustible materials such as paint, gasoline, thinners, etc., shall not be stored in any building unless confined in approved storage areas. The Owner must approve storage areas in advance. Materials on site will be limited to a maximum of a two day working supply.

5.6 No burning will be allowed on site.

HP-6. PARKING

6.1 No vehicles of the Contractor or his employees will be permitted to park adjacent to the job site, unless such parking is within the confines of an area turned over to the Contractor for construction. All vehicles may use the NH parking lots / parkades, if height restrictions and space permits, otherwise offsite parking should be arranged by the individual.

6.2 Parking in the Owner's Parking Lot will be permitted only in accordance with the rules set by the Owner for public parking.

6.3 Vehicles making deliveries to the job site will be allowed free access to the job site for visits not exceeding 20 minutes. Towing of vehicles will be enforced after 20 minutes.

HP-7. OWNER'S REPRESENTATIVE

7.1 The Owner will appoint a construction representative. The work site must at all times be accessible to inspections by the Owner's representative.

7.2 The Consultant(s)' and the Owner's representative shall decide all questions, which may arise, as to the quality and acceptability of materials furnished and work performed, the manner of performance and rate of progress of the work.

7.3 Questions; which may arise as to the interpretation of drawings and specifications by the Contractor, disputes and mutual rights between Contractor and the Owner as well as all questions as to compensation; will be decided by the Owner's consultant(s). Their decision shall be final and they shall have authority to enforce such decisions and orders in the event the Contractor fails to fulfill the details of the Contract.

HP-8. INSPECTION OF SITE BY CONTRACTOR

8.1 Before commencing the Work, the Contractor shall examine the site conditions and requirements of work to assure himself that they are to his satisfaction. He shall notify the Consultant(s) of any conditions, which will affect the quality of his work. Commencement of the work shall mean the Contractor's acceptance as satisfactory of all pertinent conditions.

HP-9. DATES - START/FINISH

9.1 Within ten (10) Working Days of award of contract, the Contractor shall submit a detailed construction activities schedule for approval by the Consultant(s) and the Owner.

HP-10 ELEVATORS

10.1 Passenger elevators will not be available to any Contractor for movement of construction materials or demolition debris, unless approved by the Owner and so stated in the Contract Documents.

HP-11 SITE SUPERVISION AND COORDINATION

11.1 The Contractor shall provide a full time Superintendent on the job site at all times to co-ordinate the work of all trades. The Contractor is to advise the Owner as to the person appointed to this position within ten (10) Working Days of Contract Award and will retain the appointed supervisor on this project to completion, unless permission to do otherwise is obtained in writing from the Owner.

11.2 The co-ordination of the construction work is to include the review of all subtrades' work and site conditions; any conflict is to be reported to the Consultant and Owner before any work affected is started at the site

HP-12 DUST CONTROL, DEBRIS, REMOVAL OF RUBBISH, WASTE & COMBUSTIBLES

12.1 The Contractor shall be responsible for the removal of all rubbish and waste on a daily basis and shall permit no accumulation of rubbish and/or waste at any time.

12.2 Debris removal and material movement to or from the construction site shall be to the complete satisfaction of the Owner's representative. All debris shall be removed in covered dust tight containers.

12.3 The Contractor is to erect temporary, dust-proof, insulated, construction hoarding complete with a lockable access door to locations noted on the drawings, or as directed by the Consultant, for the control of dust and noise.

12.4 Provide dust tight polyethylene screens above existing ceilings to prevent the migration of dust to adjacent areas, rooms, ceiling spaces etc.

12.5 Provide dust tight polyethylene screens from underside of ceilings to floor for access of or through suspended acoustic tile ceilings or drywall ceilings at ceiling access panels in all Group II, III, & IV areas.

12.6 Where material or equipment is being transported within the existing building(s) on carts or pallets, such carts or pallets shall have rubber tires.

12.7 Comply with the mandatory requirements of CSA Z317.13.17 "Infection Control During Construction, Renovation and Maintenance of Health Care Facilities" and the NH document entitled, "Infection Control and Dust Containment During the Planning and Construction Phases of a Project". In the event of any discrepancy between the CSA document and the NH document, the CSA document will govern.

HP-13 NOISE OR VIBRATION

13.1 Excessively noisy construction activities that could affect the normal operation of the Complex Care Facility or patients shall be scheduled in advance with the Owner's representative. No electric or air jack hammering is allowed between 06:00 and 18:00 unless previously approved by the Owner.

13.2 The Owner reserves the right to stop or reschedule such work for a reasonable period of time to facilitate Facility operations without cost to the Owner.

13.3 The Contractor shall at all times comply with the limitations of the local municipality requirements for noise abatement.

13.4 Construction methods shall be maintained to ensure a low level of construction noise. Sound enclosures, sound baffles, muffler-equipped equipment and vibration platforms shall be employed to keep all equipment as quiet as practical and the noise emission as low as possible.

HP-14 SALVAGE

14.1 Salvaged material and equipment, specified to accrue to the Owner, shall be delivered to the Owner at a time and place agreed by the Owner and the Contractor, as outlined in the Contract documents.

14.2 Salvaged material and equipment shall be protected from dust, moisture and other damage until delivered to the Owner.

14.3 Salvaged material and equipment specified for reinstallation shall be protected and refurbished to the Owner's satisfaction.

14.4 Salvaged material and equipment specified for reinstallation shall be protected and refurbished to the Owner's satisfaction.

HP-15 ASBESTOS AND HAZARDOUS MATERIALS

15.1 Asbestos may be present in various buildings and materials throughout the Northern Health Authority sites. All personnel working are required to comply with the Asbestos Exposure Control Plan and the WorkSafeBC OH&S Regulations. Currently, the majority of asbestos containing materials have been identified in most buildings.

15.2 If the Contractor, during renovations, should discover asbestos (or material suspected to be asbestos) on piping, ductwork, etc., he shall immediately cease all work in that area and contact the Owner's representative. The Owner will notify the facilities Asbestos Co-ordinator.

15.3 The Owner will take immediate appropriate action and will appoint a qualified independent consultant to verify the presence of friable asbestos or other hazardous materials through a Risk Assessment Survey

15.4 The risk assessment will provide the project with an assessment of potential hazards that may be encountered or may develop as a result of the scope of the asbestos or other hazardous product

removal. It will also take into account the building occupants and general ongoing operations in the building that may affect the project.

15.5 Once the risk assessment is completed, specific work procedures, with monitoring requirements and inspections will be designed to ensure proper controls are established for abatement projects as per WorkSafeBC requirements.

15.6 The work procedures will address control of hazardous materials or release of asbestos fibre, worker protection requirements, decontamination systems, removal and clean up of waste.

15.7 The Contractor will not be entitled to a claim for any delays resulting from the investigation of or removal of asbestos

15.8 The Contractor shall obtain competitive bids from a minimum of three (3) NH approved Asbestos Removal Contractors. This work shall be covered under a separate "Change Order" issued by the Owner and Contractor to co-ordinate the subcontractor's work.

15.9 Removal of all asbestos products shall be carried out in accordance with applicable requirements of the WorkSafeBC – Occupational Health & Safety regulations Exposure Control Plan by a contractor licensed by the Ministry of Environment to transport special waste and experienced in these requirements.

5.10 NH will ensure that all contractors, including sub-contractors, receive a Contractor Safety Checklist and an Asbestos Exposure Control Plan Orientation Booklet.

15.11 The Complex Care Facility is responsible for the activities of contractors, as detailed in the WorkSafe OH&S Regulations. Please ensure that all contractors are capable of safely performing their contracted tasks by continuing to observe their work practices and by maintaining a due diligence approach to safety matters.

15.12 Notify the Owner in writing regarding any WHMIS controlled products or hazardous waste materials that will be used at, transported to or from the site. Include: - date of use or transport; - type of hazardous material and expected amounts; - Material Safety Data Sheets (MSDS's) for all controlled products.

15.13 MSDS's must be posted to the job site where the controlled products are being used and must be available for spill control by facility personnel.

HP-16 EXISTING SERVICES, COOPERATION, CONNECTIONS OR DISRUPTIONS

16.1 The Health Centre Facility will co-operate with the Contractor in the shutdown of services as is necessary to allow the Contractor to make connections to existing services. However, if as a result of defective materials or workmanship, it is necessary for any shutdowns to be repeated, then the cost of the labour provided by the Facility to repeat the shutdown and the later connection will be charged to the Contractor, and this cost will be deducted from the contract sum. The Facility reserves the right to decide upon the number and nature of Owner's staff to be assigned to any specific shutdown and reconnection.

16.2 When connections to existing services are required, i.e., electrical power, water connection, etc., the Contractor shall give seven (7) calendar days notice in writing to the Owner's representative. If, because of the Facility's operation, it is required that the work be done outside of normal working hours, the cost of such overtime incurred by the Contractor will be the Contractor's responsibility.

16.3 All final connections to existing operational systems shall be carried out by the Contractor under the direct supervision of, and as directed by the Owner's representative, unless otherwise instructed.

HP-17 EQUIPMENT LOCK-OUT PROCEDURE

17.1 Prior to commencement of any work on site, the Contractor shall provide in writing "The Equipment Lockout Procedure" to comply with WorkSafeBC regulations and Facility requirements.

17.2 The Lockout Procedure shall show ALL steps by which the locking-off of power to existing and newly installed electrical circuits and equipment is to be achieved.

17.3 The Contractor shall provide notification that areas and equipment where work is being performed is off limits to all unauthorized persons.

17.4 Work cannot begin until these procedures have been completed and notification has been given by the Facility Engineering and Construction Department that work may proceed.

HP-18 COMMISSIONING

18.1 The Contractor shall commission the work in the presence of the Owner's Facility Engineering and Construction staff and Facility Maintenance and Operations staff. Complete commissioning and a final report(s) are requirements for Substantial Performance.

18.2 A complete demonstration and all necessary instruction in the use and operation of equipment and systems shall be provided. The Contractor shall utilize supplier's representatives or other experts as is appropriate for the work.

18.3 Maintenance manuals shall be supplied prior to commissioning. These manuals shall include all pertinent information, including recommended list of spare parts for proper maintenance of the equipment.

18.4 If the project involves more than one construction phase, with the Owner requesting occupancy of any completed phase(s) prior to Substantial Performance of the total project, then the Contractor will provide commissioning of these completed and occupied phases during the course of the project less the final maintenance manuals which are due at Substantial Performance.

HP-19 OPERATION & MAINTENANCE MANUALS

19.1 Refer to DIVISION 1 – GENERAL REQUIREMENTS for specific contractual requirements for the preparation and distribution of Mechanical and Electrical Operating & Maintenance Manuals.

19.2 Where work performed includes supply and installation of mechanical or electrical equipment and controls, an in-service demonstration shall be conducted to the Owner's maintenance personnel, with complete manuals detailing proper maintenance and operations of the equipment and systems. Four copies of required manuals shall be provided prior to start of required demonstration.

HP-20 RECORD DRAWINGS, AS-BUILT

20.1 Refer to DIVISION 1 – GENERAL REQUIREMENTS for specific contractual requirements for the preparation and distribution of "record drawings" and "as-built" documentation.

HP-21 WorkSafeBC

21.1 Upon award of Contract, and also prior to receiving payment on Substantial Performance of the Work, the Contractor shall provide certification by WorkSafeBC that the Contractor and all subcontractors are in good standing.

21.2 The Contractor and subcontractors in performing the work shall comply with the Occupational Health & Safety Programs in place.

21.3 The General Contractor will be the "Principal Contractor" for WorkSafeBC purposes with respect to this project. The General Contractor is responsible for ensuring that work is performed in a safe manner and in accordance with WorkSafeBC Health & Safety Regulations. Provide proof Occupational Health & Safety (OH&S) staff that all contracted employees are covered by the Workers' Compensation Board (WCB) by forwarding WorkSafeBC registration number and a recent copy of payment of assessments.

HP-22 FINAL CLEANING

22.1 The Contractor shall examine and adjust all doors and hardware and leave all in perfect working order, cleaned and polished; examine and clean all fixtures to produce intended appearance and use; remove all paint spots, stains, rubbish, debris, tools and equipment from all areas, and leave in first class order.

22.2 The Contractor shall wash down and dry all floors, stairs and wall surfaces; brush off, dust and polish all ledges, stairs, steps, etc.; clean and polish all glass, mirrors, and remove all paint, putty and dirt.

22.3 Employ professional cleaning company when requested in the Contract documents.

HP-24 LAYOUT OF WORK

24.1 The Contractor shall ensure that all work, whatever trade, shall be laid out and installed so as to provide reasonable access to all parts or systems requiring access for operations, maintenance or repair. All code stated clearances shall be met.

24.2 Co-operation between trades shall at all times be maintained to eliminate conflicts and ensure best combined installation results.

HP-25 MEETINGS

25.1 Prior to commencement of on-site construction, the Contractor, and the successful Mechanical and Electrical Subcontractors, will be required to attend a "NH Construction Start-Up Meeting" to identify (but not be limited to) the procedures and requirements of the following:

1) Appointment of official representative of participants in the Work;
2) Schedule of Work, progress schedule;
3) Schedule of submission of shop drawings, samples, colour chips;
4) Requirements for temporary facilities, site signs, offices, storage sheds, utilities, fences;
5) Drawings;
6) Delivery schedule of specified equipment;
7) Site Security;
8) Contemplated change notices, Change Orders, procedures, approvals required, time extensions, overtime, mark-up percentages permitted, administrative requirements;
9) Owner provided products;
10) In Base Contract Items;
11) Record Drawings;
12) Maintenance Manuals;
13) Take over procedures, acceptance, warranties;
14) Monthly Progress Claims, administrative procedures, holdbacks, construction photos;
15) Appointment of inspection and testing agencies;
16) Insurance's, transcript of policies, bonds, WCB, Contract General Conditions;
17) Hospital Guidelines for construction;
18) Shutdowns;
19) Parking;
20) Site meetings;
21) Contractor Site Safety Requirements and Protocols.

25.2 The Contractor shall convene regularly scheduled "construction meetings" to expedite the Work. These meetings shall have a representative of the Contractor, Mechanical Subcontractor, Electrical Subcontractor, Owner's representative(s) and all Consultant(s) present

25.3 Minutes shall be taken by the Contractor and issued to each of the abovementioned persons, no later than three (3) days after each meeting. All minutes shall commence with an overview of the progress of Work at the time of the meeting, any construction schedule variances and a complete breakdown of manpower on site of the various trades.

HP–26 CELL PHONES AND RADIO TRANSMITTERS

26.1 The use of cellular phones and other non-essential radio transmitters is prohibited in general patient and "High Risk" areas of the Facility as they may interfere with medical equipment. Cell phones must be turned off, not merely left in "Standby" mode when in these areas.

HP-27 ELECTRICAL DEVICE REQUIREMENTS

27.1 All electrical devices must have prior certification from the Canadian Standards Association (CSA) or prior approval acceptable to the Electrical Safety Branch of the Safety Engineering Services Division of the Ministry of Municipal Affairs, Recreation & Housing.

27.2 To ensure compliance with regulations of the Electrical Energy Inspection Act of British Columbia, all electrical devices must be inspected and approved by the facility's Physical Plant or Biomedical Engineering personnel prior to use in the facility.

END OF NH OWNERS GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 OVERVIEW OF THE PROJECT

.1 Work of this contract shall include all labour, materials, construction work, site preparation and equipment, for architectural, mechanical and electrical, work necessary for the selective demolition, modifications and new construction at the Queen Charlotte Hospital, Haida Gwaii, BC., as indicated in the Contract Documents.

.2 A renovation to the Pharmacy Department is proposed to be built at the Queen Charlotte Hospital.

.3 Division of the Work among Subcontractors, suppliers or vendors is solely the Contractor's responsibility. Neither the Owner nor Consultant assumes any responsibility to act as an arbiter to establish subcontract terms between sectors or disciplines of work.

1.2 SCHEDULE AND COST

.1 The contractor is to develop a scheduled timeframe (dates) in which certain components will be undertaken.

.2 The Contractor is to allow for all overhead and management costs related to the project for the duration of the Construction period.

1.3 THE SITE

.1 Construction hoarding will not be required.

.2 Contractor's traffic movement and mobilization/storage area for the various components will be agreed with the Owner prior to commencement of the Work.

1.4 MATERIAL RECYCLING AND WASTE REDUCTION

.1 Material recycling is mandated through the Regional District requirements, and hazardous waste is controlled by the Provincial Government, and transportation of same on some roads is controlled by the Federal Government.

.2 Material recycling and waste reduction measures should result in the majority of materials being recycled.

1.5 WORK BY OTHERS

.1 Co-operate with Facilities Management & Operations (FM&O) of the Queen Charlotte Hospital in carrying out their respective works and carry out instructions from Consultant.

1.6 CONTRACTOR USE OF PREMISES

.1 Limit use of site and premises to allow:

.1 Owner and public occupancy

.2 Building Exits During Construction: Maintain existing exit routes except as noted on drawings.

.3 Construction Operations: Limited to areas noted on Drawings, however Greyed out areas of drawings are for reference only and do not constitute an absolute boundary to the extent of renovation.

1.7 OWNER OCCUPANCY

.1 The facility will be operational during regular business hours. Welfare of facility staff and the public visitors and preservation of facility operations is always a priority. Contractor must be prepared to stop work if requested by the Owner.

.2 Cooperate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

.3 Maintain fire and life safety systems to occupied areas and public access to exits during all stages of the work.

.4 Achieve Occupancy at the completion to allow for public occupation of the space prior to proceeding with subsequent phases.

1.8 CASH ALLOWANCE

.1 Not Used.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

PART 1 GENERAL

1.1 WORK SITE ACCESS AND EGRESS

.1 Access and egress of personnel and vehicles/equipment of work site shall be restricted to locations for each Component of work to be agreed with Contractor prior to commencement of the Work. The contractor does not require prior arrangements for access within the Area of Work as noted on the drawings.

1.2 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises.

.2 Where security is reduced by work provide temporary means to maintain security.

.3 Existing sanitary facilities anywhere on the Hospital site shall not be used by Contractor.

.4 Closures: protect work temporarily until permanent enclosures are completed

.5 Use of catering facilities already existing on site is prohibited.

1.3 EXISTING BUILDINGS

.1 Buildings immediately adjacent and connecting to the Work will be occupied during the Work. As operations progress execute work with least possible interference or disturbance to site operations, building operations and occupants of existing buildings. This includes interferences or disturbances such as:

.1 Noise, dust, fumes, vibrations, traffic.

.2 Allow for after-hours/weekend work where construction prevents access to and/or operation of the Pharmacy department.

1.4 EXISTING SERVICES

.1 Notify Owner one week prior to intended interruption of services and obtain required permission.

.2 Where Work involves terminating, breaking into or connecting to existing services, give Owner one week notice for necessary interruption of mechanical or electrical service throughout course of work.

1.5 SPECIAL RESTRICTION REQUIREMENTS

.1 Carry out noise generating Work on weekdays from 7:30am to 4:30pm and on Saturdays, (no Sundays and statutory holidays) from 10:00 a.m. to 4:00 p.m. hours. Excessively noisy work (hammer drilling, saw cutting, etc.) shall be coordinated with owner and executed during reduced patient hours.

1.6 PARKING

.1 Parking will not be permitted on the site except within the Contractor's work area. Parking directly adjacent to the project site is to be arranged by prior agreement, one week in advance, with the Owner. This is intended for short term deliveries.

1.7 SECURITY CLEARANCES

.1 Each Contractor hired at QCH shall appoint an individual responsible for occupational health and safety. This individual shall be responsible for verifying that a safe work

environment is maintained, and for notifying QCH and if applicable, other contractor firms, of potential hazards their work activities may create.

.2 While working on any site of QCH, all Contractors, Estimators, Inspectors, and Non- QCH representatives must:

.1 Comply with all aspects of the WorkSafeBC (WSBC) OH&S Regulation

.2 Work safely in a manner that does not pose a hazard to themselves, QCH staff, other contractors, patients or public

.3 Provide personnel that are trained to work safely in their appointed tasks

.4 Report any unsafe conditions to your QCH representative/contact

.5 Ensure that sub-contractors comply with the WSBC OH&S Regulation

.6 Follow hospital safety policies and procedures, where applicable.

.7 Please refer to the QCH Contractor Coordination Policy.

1.8 PHOTO ID

.1 Before each Contractor's employee can start work at QCH, they must obtain photo id from QCH. The application form can be obtained from the Photo ID department and must be signed by the QCH /LMFM Representative hiring the Contractor.

1.9 CONTRACTOR SIGN-IN

.1 At the start of each shift, the Contractor must sign in.

1.10 NON-SMOKING ENVIRONMENT

.1 Smoking is not permitted anywhere within the limits of the Hospital site.

1.11 HEALTH & SAFETY MEETING ATTENDANCE

.1 A mandatory meeting will be held prior to the commencement of physical work on the project for which the successful General Contractor on this project will be designated as the Prime Contractor. The meeting will be chaired by the Prime Consultant, will include the QCH Project Safety Co-ordinator and will also include representatives from all contracting companies and other affected groups. Sub-contractors must all designate a person as the "Sub-Trade Safety Co-ordinator (OH&S Reg. 20.3(3b). This person is responsible for the sub-contractors site health and safety activities. This person must be in full attendance at this meeting and sign off on the QCH OH&S document. This document will be completed in full and a completed copy will be provided to each attendee.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Words and terms.

.2 Complementary documents.

.3 Specification grammar.

.4 Words and terms.

.5 Complementary documents.

.6 Specification grammar.

1.2 RELATED SECTIONS

.1 Section 01 11 00 - Summary of Work.

.2 This section describes requirements applicable to all sections within Divisions 02 to 49.

1.3 WORDS AND TERMS

.1 Conform to definitions and their defined meanings in the Agreement and Definitions portion of CCDC 2 for supplementary words and terms. In addition, the following words and terms are applicable to the Contract Documents for this project:

.2 Addendum: A document that amends the Bid Documents during the Bidding Period and becomes part of the Contract Documents when a Contract is executed. (Plural: Addenda)

.3 AFF: Above Finished Floor.

.4 Agreement: The signed and sealed legal instrument binding parties in a Contract, describing in strict terms their mutual arrangement, roles and responsibilities, commencement, and completion responsibilities.

.5 Alternative Price: The amount stipulated by a Bidder for an Alternative and stated as an addition, a deduction, or no change to the Bid Price.

.6 Bid: To offer as a Bid stating for what price a Contractor will assume a Contract.

.7 Bid Documents: A set of documents consisting of the Instructions to Bidders, Bid Form, Contract Documents, and other information issued for the benefit of Bidders to prepare and submit a Bid.

.8 Bid Form: The specific and detailed form used to collect information about a Bid.

.9 Bidding: The process of preparing and submitting a Bid.

.10 Construction Documents: The Drawings and Project Manual. When combined with a Contract and Contract conditions, these documents form the Contract Documents.

.11 Contingency Allowance: An additional monetary amount added to a Project cost estimate and designated to cover unpredictable or unforeseen items of Work. The amount is usually based on some percentage of the estimated cost and expended and adjusted by Change Order. It is not intended to cover additions to the scope of Work.

.12 Cost Plus Contract: A Contract under which a Contractor is reimbursed for the direct and indirect costs for the performance of a Contract and, in addition, is paid a Fee for services. The Fee is usually stated as a stipulated price or as a percentage of cost.

.13 General Conditions: That part of the Contract Documents which sets forth many of the rights, responsibilities and relationships of the parties involved in a Contract.

.14 Instructions To Bidders: Instructions contained in the Bid Documents to convey an Owner's expectations and criteria associated with submitting a Bid.

.15 ICP: Infection Control Practitioner (appointed by Owner).

.16 Install: To remove from site storage, move or transport to intended location, install in position, connect to utilities, repair site caused damage, and make ready for use.

.17 Hospital: Where the term "hospital" is used in the Contract Documents and when the scope of work involved in the Contract involves a healthcare Facility other than a hospital (i.e. such as a cancer centre or health centre), the term "hospital" shall mean such Facility.

.18 NH: Northern Health, the Owner.

.19 Section: A portion of a Project Specification covering one or more segments of the total Work or requirements. Sections are included in a Project manual as required to meet Project requirements.

.20 Separate Price: A separate price for work to be added to the base price if selected by the Owner. This price type is not a part of the base bid price.

.21 Standard: A document describing a grade or a level of quality, which has been established by a recognized agency or organization, utilizing an internal voting process.

.22 Stipulated Price: An amount set forth in a Stipulated Price Contract as the total payment for the performance of the Work. Sometimes referred to as a stipulated sum or a lump sum stipulated price.

.23 Supply: To acquire or purchase, ship or transport to the site, unload, remove packaging to permit inspection for damage, re-package, replace damaged items, and safely store on-site.

.24 Tender: A term that was formally abandoned by CCDC and the Canadian Construction industry in the early 1980's in favour of the preferred term Bid.

.25 Unit Price: The amount payable for a single unit of Work as stated in a Schedule of Prices.

1.4 COMPLEMENTARY DOCUMENTS

.1 Generally, drawings indicate graphically, the dimensions and location of components and equipment. Specifications indicate specific components, assemblies, and identify quality.

.2 Drawings, specifications, diagrams and schedules are complementary, each to the other, and what is required by one, to be binding as if required by all.

.3 Should any conflict or discrepancy appear between documents, which leaves doubt as to the intent or meaning, refer to GC 1.1.7 priority of documents or obtain guidance or direction from Consultant.

.4 Examine all discipline drawings, specifications, schedules, diagrams and related Work to ensure that Work can be satisfactorily executed.

.5 All specification sections of the Project Manual and Drawings are affected by requirements of Division 01 sections.

1.5 SPECIFICATION GRAMMAR

.1 Specifications are written in the imperative (command) mode, in an abbreviated form.

.2 Imperative language of the technical sections is always directed to the Contractor identified as a primary constructor, as sole executor of the Contract, unless specifically noted otherwise.

.1 This form of imperative (command) mode statement requires the primary constructor to perform such action or Work.

.2 Perform all requirements of the Contract Documents whether stated imperatively or otherwise.

.3 Division of the Work among subcontractors, suppliers, or others is solely the fContractor's responsibility. The Consultant(s) and specification authors assume no responsibility to function or act as an arbiter to establish subcontract scope or limits between sections or divisions of Work.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

PART 1 GENERAL

1.1 INTENT

.1 Read this Section in conjunction with the conditions governing changes in the Work and valuation of changes in the General Conditions of Contract.

1.2 DEFINITIONS

.1 "Actual cost of material and labour" as used in the valuation of changes article in the General Conditions of Contract, means the sum of costs directly related to or necessarily and properly incurred by Contractor, Subcontractors and Sub subcontractors in the performance of a change in the Work. Direct costs shall include:

.1 Materials cost,

.2 total labour cost,

.3 travel and subsistence cost,

.4 temporary work cost,

.5 construction equipment cost,

and shall exclude overhead cost and profit.

.2 "Material cost" means cost of all Materials, including transportation and storage thereof. All rebates, refunds, returns from sale of surplus Materials, and trade discounts other than prompt payment discounts, shall be credited to Minister.

.3 "Total labour cost" means sum of direct labour cost and payroll burden cost.

.4 "Direct labour cost" means base wage costs of employees, excluding payroll burden cost.

.5 "Payroll burden cost" means costs statutory charges and fringe benefit costs additional to direct labour cost and includes unemployment insurance, workers' compensation, vacation pay, statutory holiday pay, health and welfare, pension plan, training fund, and other payroll costs which are hourly wage dependent and are paid by the employer.

.6 "Travel and subsistence cost" means travel and subsistence costs incurred by employees when working beyond a reasonable commuting distance from their normal place of residence.

.7 "Temporary work cost" means cost of temporary structures, facilities, services, controls, and other temporary items used in the performance of a Change in the Work, including maintenance, dismantling and removal, less any residual value after dismantling and removal.

.8 "Construction equipment cost" means the cost of rented or owned equipment, including cost of loading, transportation, unloading, erection, maintenance, dismantling and removal.

.9 "Overhead cost" means Contractor's, Subcontractors' and Sub-subcontractors' costs related to:

.1 operation and maintenance of head offices, branch offices, and site offices,

.2 administration at head offices, branch offices, and site offices,

.3 general management, legal, audit, and accounting services,

.4 buying organization, corporate tax,

.5 financing and other bank charges,

.6 bonding and insurance,

.7 salaries and other compensation of off-site personnel,

.8 salaries and other compensation of on-site superintendents and other supervisory personnel,

.9 planning, estimating, and scheduling of work,

.10 expendable and non-expendable small tools, including maintenance thereof,

.11 recruitment and training of on-site staff, and

.12 all other costs not defined as direct costs.

.10 The following shall apply to the valuation of adjustments to the Contract Price attributable to changes:

.1 The adjustment to the Contract Price will not exceed the actual cost of performing the Work attributable to the change plus the following:

.1 for Work performed by the Contractor directly, a 10% mark-up for overhead and profit on the actual cost of the Work attributable to the change;

.2 for any Work performed by a Subcontractor:

.1 a 10% mark-up on the actual cost of the Work performed by the Subcontractor attributable to the change for the Subcontractor's overhead and profit; and

.2 a 5% mark-up on the actual cost of the Work performed by the Subcontractor attributable to the change for the Contractor's overhead and profit.

1.3 CHANGE ORDER PROCEDURES – LUMP SUM METHOD OF VALUATION

.1 Consultant will issue a Request for Proposal to Contractor.

.2 Contractor shall submit a Contractor Proposal stipulating:

.1 a lump sum increase, decrease, or no change in the Contract Price, and

.2 an increase, decrease, or no change in the Contract Time, on account of the proposed change in the Work.

.3 Include in Contractor Proposal a detailed breakdown of lump sum increase or decrease, indicating Contractor's, and where applicable Subcontractors' and Sub subcontractors':

.1 itemized direct costs applicable to the proposed change in the Work, and

.2 applicable amounts for overhead and profit, in accordance with percentages specified in the General Conditions of Contract.

Do not include costs that would otherwise be incurred in the normal performance of the Work.

.4 Include in detailed breakdown of Contractor Proposal a further breakdown of the total labour cost component indicating, for each applicable trade and trade classification, the labour rate(s) and the number of hours from which the total labour cost is derived.

.5 Upon Owner's approval and acceptance of Contractor Proposal, a "Change Order" signed by the Owner will be issued to Contractor to be signed by the Contractor.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

.1 Owner/Contractor Agreement.

1.2 APPLICATIONS FOR PROGRESS PAYMENT

.1 Make applications for payment on account as provided in Agreement as Work progresses.

.2 Date applications for payment last day of agreed payment period and ensure amount claimed is for value, proportionate to amount of Contract, of Work performed and Products delivered to Place of Work at that date.

.3 Submit to Consultant, at least 14 days before first application for payment. Schedule of values for parts of Work, aggregating total amount of Contract Price, to facilitate evaluation of applications for payment.

1.3 SCHEDULE OF VALUES

.1 Provide schedule of values supported by evidence as Consultant may reasonably direct and when accepted by Consultant, be used as basis for applications for payment.

.2 Include statement based on schedule of values with each application for payment.

.3 Support claims for products delivered to Place of Work but not yet incorporated into Work by such evidence as Consultant may reasonably require to establish value and delivery of products.

1.4 PROGRESS PAYMENT

.1 Consultant will issue to Owner, no later than 10 days after receipt of an application for payment, certificate for payment in amount applied for or in such other amount as Consultant determines to be due. If Consultant amends application, Consultant will give notification in writing giving reasons for amendment.

1.5 SUBSTANTIAL COMPLETION OF WORK

.1 Prepare and submit to Consultant comprehensive list of items to be completed or corrected and apply for a review by Consultant to establish Substantial Completion of Work or substantial completion of designated portion of Work when Work is substantially performed if permitted by lien legislation applicable to Place of Work designated portion which Owner agrees to accept separately is substantially performed. Failure to include items on list does not alter responsibility to complete Contract.

.2 No later than 10 days after receipt of list and application, Consultant will review Work to verify validity of application, and no later than 7days after completing review, will notify Contractor if Work or designated portion of Work is substantially performed.

.3 Consultant: state date of Substantial Completion of Work or designated portion of Work in certificate.

.4 Immediately following issuance of certificate of Substantial Completion of Work, in consultation with Consultant, establish reasonable date for finishing Work.

1.6 PAYMENT OF HOLDBACK UPON SUBSTANTIAL COMPLETION OF WORK

.1 After issuance of certificate of Substantial Completion of Work:

.1 Submit application for payment of holdback amount.

.2 Submit sworn statement that accounts for labour, subcontracts, products, construction machinery and equipment, and other indebtedness which may have been incurred in Substantial Completion of Work and for which Owner might in be held responsible have been paid in full, except for amounts properly retained as holdback or as identified amount in dispute.

.2 After receipt of application for payment and sworn statement, Consultant will issue certificate for payment of holdback amount.

.3 Where holdback amount has not been placed in a separate holdback account, Owner shall, 10 days prior to expiry of holdback period stipulated in lien legislation applicable to Place of Work, place holdback amount in bank account in joint names of Owner and Contractor.

.4 Amount authorized by certificate for payment of holdback amount is due and payable on day following expiration of holdback period stipulated in lien legislation applicable to Place of Work.

1.7 PROGRESSIVE RELEASE OF HOLDBACK

.1 If Consultant has certified that Work of subcontractor or supplier has been performed prior to Substantial Completion of Work, Owner may pay holdback amount retained for such subcontract Work, or products supplied by such supplier, on day following expiration of holdback period for such Work stipulated in lien legislation applicable to Place of Work.

.2 If a progressive release of holdback is requested, the contractor is to coordinate a substantial completion review in-line with the consultants regularly scheduled site visits.

1.8 FINAL PAYMENT

.1 Submit application for final payment when Work is completed.

.2 Consultant will, no later than 10 days after receipt of application for final payment, review Work to verify validity of application. Consultant will give notification that application is valid or give reasons why it is not valid, no later than 7 days after reviewing Work.

.3 Consultant will issue final certificate for payment when application for final payment is found valid.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

PART 1 GENERAL

1.1 ADMINISTRATIVE REQUIREMENTS

.1 Schedule and administer project meetings throughout the progress of the Work in accordance with Section 01 10 00 - Owner's General Requirements and as specified in this Section.

.2 Prepare agenda for meetings.

.3 Distribute written notice of each meeting four working (4) days in advance of meeting date to Consultants and the Owner.

.4 Provide physical space for the meetings within the area of work.

.5 Make arrangements for and preside at meetings.

.6 Record the minutes. Include significant proceedings and decisions. Identify action required.

.7 Reproduce and distribute copies of minutes within three days after each meeting and transmit to meeting participants, affected parties not in attendance, the Consultant and the Owner.

.8 Representatives of Contractor, Subcontractor and suppliers attending meetings shall be qualified and authorized to act on behalf of the party each represents.

1.2 MEETINGS

.1 Within seven (7) days after award of contract, request a meeting of participants in the Work to discuss and resolve administrative procedures and responsibilities and scheduling.

.2 Representatives of the Owner, Infection Control Practitioner, Consultant, all other consultants, Contractor, major subcontractors, field inspectors and supervisors shall be in attendance.

.3 Establish time and location of meeting and notify parties concerned minimum four (4) days before meeting.

.4 Agenda to include the following:

.1 Construction start-up review by Owner's Representative.

.2 Confirmation of authorized representative of the Owner, Consultant, other Consultants, and the Contractor Construction Safety Officer.

.3 Schedule of Work, progress scheduling (Section 01 32 16).

.4 Schedule of submission of shop drawings, samples, colour schedule (Section 01 33 00).

.5 Infection Control Plan (Section 01 35 34).

.6 Requirements for temporary facilities, offices, storage sheds, utilities fences, barriers (Section 01 52 00).

.7 Construction Waste Management program (Section 01 74 21).

.8 Confirmation that affected utility services will be disconnected.

.9 Contemplated change notices, change orders, mark-up percentages, overtime, time extensions, procedures, approvals required, administrative requirements (GC - Part 6).

.10 As-Built documents (Section 01 33 00).

.11 Maintenance manuals (Section 01 33 00).

.12 Closeout procedures, acceptance, warranties (Section 01 78 00).

.13 Monthly progress claims, monthly submittals, administrative procedures, holdbacks (GC - Part 5).

.14 Insurances, transcript of policies (GC - Part 11).

.15 Review of certified professional related items.

1.3 PROGRESS MEETINGS

.1 During course of Work schedule progress meetings every two weeks. Construction Manager to review and confirm dates with both the client and consultant

.2 Contractor, major Subcontractors involved in Work and Consultants and Owner are to be in attendance.

.3 Notify parties minimum one week prior to meetings as to who is required to attend from Consultant Team.

.4 Contractor shall perform the following duties:

.1 Prepare agenda for meetings.

.2 Preside at meetings.

.3 Record minutes of meeting including significant proceedings and decisions.

.4 Reproduce and distribute copes of minutes within three days of meeting:

.1 To all participants at meeting.

.2 To all parties affected by decisions made at meeting.

.5 Agenda to include the following:

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

.5 Review of off-site fabrication delivery schedules.

.6 Corrective measures and procedures to regain projected schedule.

.7 Revision to deconstruction/construction schedule.

.8 Progress schedule, during succeeding work period.

.9 Review submittal schedules: expedite as required.

.10 Maintenance of quality standards.

.11 Review proposed changes for affect on construction schedule and on completion date.

.12 Other business.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Schedules, submission, contents, updating, distribution.

.2 Progress photographs.

1.2 RELATED SECTIONS

.1 Section 01 31 19 - Project Meetings.

.2 Section 01 33 00 - Submittals Procedures.

.3 Section 01 78 00 - Closeout Procedures.

.4 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 GENERAL SCHEDULE REQUIREMENTS

.1 Submit schedules as follows:

.1 Construction Schedule.

.2 Submittal Schedule for Shop Drawings and Product Data.

.3 Submittal Schedule for Samples.

.4 Submittal Schedule for Mock-ups.

.5 Shutdown or closure activity.

.2 Schule Format

.1 Prepare schedule in form of a horizontal bar chart.

.2 Provide a separate bar for each major activity.

.3 Split horizontally for projected and actual performance.

.4 Provide horizontal time scale identifying Working Day of each week.

1.4 SCHEDULE SUBMISSIONS

.1 Submit an initial Preliminary Construction Schedule within 10 calendar days of the award of the Contract including Plan of Construction (POC).

.2 Submit a detailed Construction Progress Schedule within 28 calendar days of the award of the Contract. The Schedule will be reviewed for approval by the Consultant in consultation with the Owner. Submit the detailed Construction Progress Schedule in "hard" copy, and also in electronic data file. Submission shall include:

.1 Construction Progress Schedule.

.2 Submittal Schedule for Shop Drawings.

.3 Submittal Schedule for Product Data and Samples.

.4 Submittal Schedule for Mock-ups.

.5 Product Delivery Schedule.

1.5 CONSTRUCTION PROGRESS SCHEDULING

.1 Submit initial schedule as specified.

.2 Revise and resubmit as required.

.3 Submit revised schedules with Application for Payment, identifying changes since previous version.

.4 Submit a chart with separate line for each activity, identifying first work day of each week.

.5 Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.

.6 Indicate estimated percentage of completion for each item of Work at each submission.

.7 Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by Owner and required by Allowances.

.8 Include dates for commencement and completion of each major element of construction.

.9 Indicate projected percentage of completion of each item as of first day of month.

.10 Indicate progress of each activity to date of submission schedule.

.11 Indicate changes occurring since previous submission of schedule:

.1 Major changes in scope.

.2 Activities modified since previous submission.

.3 Revised projections of progress and completion.

.4 Other identifiable changes.

.12 Provide a narrative report to define:

.1 Problem areas, anticipated delays, and impact on schedule.

.2 Corrective action recommended and its effect.

.3 Effect of changes on schedules of other prime contractors.

1.6 SHOP DRAWING SUBMITTAL SCHEDULE

.1 The submittal Schedule for Shop Drawings shall contain a list of all Shop Drawings required by the Consultant related to Sections of the Specification and shall include deadline dates for the following:

.1 Submission date to Consultant.

.2 Return from Consultant.

.3 Allowance for re-work and re-submission.

.4 Completion date of Shop Drawing Sequence.

.5 Include dates when shop drawing submittals and delivery will be required for Owner-furnished items.

1.7 PRODUCT DATA AND SAMPLES SUBMITTAL SCHEDULE

.1 The Submittal Schedule for Product Data and Samples shall contain a list of items requested by the Consultant related to Sections of the Specification and the following deadline dates:

.1 Availability date.

.2 Submission date to Consultant.

.3 Deadline approval date for ordering materials to maintain the Construction Progress Schedule.

1.8 PRODUCT DELIVERY SCHEDULE

.1 The Product Delivery Schedule shall list delivery dates of materials and equipment, including Owner-supplied items, that are critical in order to maintain the Construction Progress Schedule and shall contain information specifically requested by the Consultant.

1.9 DISTRIBUTION OF SCHEDULES.

.1 Contractor shall distribute copies of the agreed Schedule and the progress reports to the following:

.1 Owner.

.2 Prime Consultant and Sub-Consultants.

.3 Job Site file.

.4 Sub-contractors as appropriate.

.5 Other concerned parties.

1.10 PROGRESS PHOTOGRAPHY

.1 Digital Photography

.1 Submit electronic copy of colour digital photography in *.jpg format, minimum 6 megapixel resolution.

.2 Identification: name and number of project and date of exposure indicated.

.2 Number of viewpoints:

.1 Interior: Six (6): Locations of viewpoints determined by Consultant.

PART 2 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Shop drawings and product data.

.2 Samples.

.3 Operating Maintenance Manuals, Electronic copies of manuals. As-built drawings.

.4 Project documentation submittals checklist.

1.2 SECTION INCLUDES

.1 Section 01 32 10 - Construction Schedule

.2 Section 01 61 00 – Common Product Requirements.

.3 Section 01 77 00 - Closeout Procedures.

.4 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 ADMINISTRATIVE

.1 Submit to Managing Consultant submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

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

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

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

.5 Review submittals prior to submission to Consultant. 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 considered rejected.

.6 Notify Consultant 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 co-ordinated.

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

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

1.4 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 Where specified in individual sections submit shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of British Columbia, Canada.

.3 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 co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.4 Allow 10 (ten) working days for Consultant's review of each submission.

.5 Adjustments made on shop drawings by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

.6 Make changes in shop drawings as Consultant may require, consistent with Contract Documents. When resubmitting, notify Consultant in writing of revisions other than those requested.

.7 Accompany submissions with transmittal letter, containing:

- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Specification sections and indication of partial or complete submittal for stated section
- .5 Other pertinent data.

.8 Submissions include:

- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.9 After Consultant's review, distribute copies.

.10 Submit **electronic** copy of shop drawings for each requirement requested.

.11 Submit **electronic** copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Consultant where shop drawings will not be prepared due to standardized manufacture of product.

.12 Submit **electronic** copies of test reports for requirements requested in specification Sections and as requested by Consultant.

- .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
- .2 Testing must have been within 3 years of date of contract award for project.

.13 Submit **electronic** copies of certificates for requirements requested in specification Sections and as requested by Consultant.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract complete with project name.

.14 Submit **electronic** copies of manufacturers instructions for requirements requested in specification Sections and as requested by Consultant.

.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.15 Submit **electronic** copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Consultant.

.1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.16 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Consultant.

.17 Delete information not applicable to project.

.18 Supplement standard information to provide details applicable to project.

.19 If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.20 The review of shop drawings is for sole purpose of ascertaining conformance with general concept.

.1 This review shall not mean that the Consultant approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.5 SAMPLES/BROCHURES FOR COLOUR OR TEXTURE

.1 Submit for review samples in duplicate or as requested in respective specification Sections. Label samples with origin and intended use.

.2 Deliver samples prepaid to Consultant's business address.

.3 Notify Consultant 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 Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

.6 Make changes in samples which Consultant 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.

1.6 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit WorkSafe BC status.

.2 Submit transcription of insurance immediately after award of Contract.

1.7 OPERATION AND MAINTENANCE MANUALS

.1 Submit to the Consultant at least three (3) copies of maintenance, operating and instruction manuals.

.2 Provide maintenance manuals in hard and electronic format as specified hereafter, giving full operating and maintenance instructions for each system and major piece of equipment, as well as, maintenance instructions for building elements, fixtures and finishes.

.3 Manuals are to contain pertinent maintenance operational and installation instruction information on equipment, materials cleaning and lubrication schedules, filters, overhaul, replacement, adjustment schedules, and emergency procedures as applicable. Instructions in manuals shall be in simple language so as to guide the Owner in the proper operation and maintenance of building material, components, equipment and systems.

.4 Include all items covered by Change Orders.

.5 Update the manuals periodically during the installation and commissioning phase of the Work so that its manuals are final by the scheduled turnover date.

.6 Include equipment supplied by the Owner and pre-tendered equipment.

.7 Binders:

.1 Up to 3 inch thick: Vinyl, black colour, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with clear spine and face pockets. ACCO 1 inch 41805-0, 2 inch 41807 or equivalent.

.2 3 to 5.5 inch: Expandable bar-lock catalogue binder, stiff Fabrikoid cover, black colour, with full-metal hinge. Slide-lock mechanism. 3"-5 1/2" expansion. Provide self-adhesive label holders at top of spine and on front cover. ACCO 05436-0 or equivalent

.8 Manual Organization: Organize data in the form of an instructional manual

.1 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

.2 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents. Arrange content by systems under Section numbers and sequence of Table of Contents.

.3 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.4 Text: Manufacturer's printed data, or typewritten data.

.5 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

.9 Page Format

.1 Descriptions and lists are to be neatly typed or printed on 216 mm x 280 mm heavy bond paper. Duplicate pages shall be made by electrostatic dry copier.

.2 The maximum paper size for schedules and diagrams is 280 mm x 432 mm. Larger paper sizes will be accepted for diagrams only if a mylar sepia is provided for each sheet.

.3 Alphabetical and numerical index tab separators are to be used in each manual to identify each information "Section".

.10 Architectural manuals shall include in general, but shall not necessarily be limited to, the following:

.1 List of Subcontractors, manufacturers, and suppliers, complete with addresses and telephone and facsimile numbers.

.2 Copies of hardware schedule and paint schedules complete with the actual manufacturer, supplier and identification names and numbers.

.3 All manufacturer's equipment, materials, products, data, details, identification, list, schedules of maintenance, operational and installation instruction information as required in accordance with the various sections of the specification under Divisions 01 to 49 inclusive.

.4 All extended guarantees, warranties, maintenance bonds, certificates, letters of guarantees, registration cards, as called for in the various sections of the specifications under Divisions 01 to 49 inclusive, with the following information:

.1 Name and address of subject.

.2 Commencement date (Substantial Performance of the Work) of guarantees and warranties.

.3 Duration and expiry date of guarantees and warranties.

.4 Signature and seal of the Contractor, installer, manufacturer and/or supplier as applicable.

.5 Complete set of all final reviewed shop drawings.

.6 Certificates of Inspection.

.7 Test reports and certificates as applicable.

.8 Confirmation letters of all extra, reserve, replacement materials as required in accordance with various sections of the specification under Divisions 01 to 14, 21 to 23, and 25 to 28 inclusive has been properly handed over and received by the Owner in good order.

.9 Confirmation letters of all portable units, equipment, materials such as fire extinguishers, special tools, keys for all equipment and/or panels, elevator pads/accessories, keys to millwork, casework, has been properly handed over and received by the Owner in good order.

.10 Submit to the Consultant at least four (4) copies of plumbing/mechanical and electrical manuals in accordance with this section and to detailed requirements specifically set out in the various sections of the specification under Divisions 21 to 23, and 25 to 28 inclusive as applicable

1.8 ELECTRONIC COPIES OF MANUALS

.1 In addition to the printed copies, submit electronic copies of all operating and maintenance data as specified herein.

.2 Submit data on "read only" CD's. Provide 2 copies of each CD for the Owner and 1 copy to the Consultant.

.3 Do not provide separate CD's for each major section. Use more than one CD only if the volume of data exceeds the capacity of a single CD. Professionally label each CD and CD jewel case, including the name of the Owner, project and CD title.

.4 Organize electronic data using directories and sub-directories as generally described in article 1.6. Prior to assembling the electronic data, submit to the Consultant a detailed list of the proposed directory/sub-directory structure including proposed file names. File names to be easily recognizable without the need to open the document to know what information the file contains. Directory structure and file naming is subject to the approval of the Consultant.

.5 Provide information in Portable Document Format (PDF). Break down large files into sections and use bookmark structure for easy navigation.

1.9 RECORD DOCUMENTS

.1 Keep one set of white prints of all contract drawings and all addenda, revisions, clarifications, change orders and reviewed shop drawings, in site office; identify them as "Project As-Built Copy" and have them available at all times for inspection by the Consultant.

.2 As the Work proceeds, record, clearly and indelibly in red pencil, as-built conditions wherever they deviate from the original directions of the contract documents. The deviations that are to be recorded shall include, in general but not necessarily limited to, things that are hidden from view and things of major importance to future operations and maintenance and to future alterations and/or additions. Detailed requirements in this connection are set out in various sections of the specifications.

.3 Record Drawings: As a minimum, during the construction period, Record Drawings shall be marked up, in colour, to reflect the 'As-Built' state. Include elevations, rough-in details and detailed locations of all hidden mechanical and electrical services, including locations of maintenance items and their associated identification code (ie. valves).

.4 Other Documents: maintain manufacturer's certifications, inspection certifications, and field test records, required by individual specifications sections and submit with Record Documents in accordance with Section 01 78 00.

.5 Present the as-built prints for scrutiny at each project meeting and as may be required by the Consultant.

.6 Provide two sets of project record drawings for all mechanical and electrical systems in accordance with relevant clauses within Mechanical Divisions 21 - 23 and Electrical Divisions 25 - 28.

.7 Upon completion of the Contract the Contractor shall submit two (2) full sized sets of all marked up architectural, mechanical and electrical as-built colour drawings to the Owner and one set to the Consultant. Each marked up drawing shall bear a stamp stating Verified AS-BUILT with the name, signature, and date of the subcontractor responsible for preparing these drawings. Record drawing information shall be recorded as specified herein.

1.10 PROJECT DOCUMENTATION SUBMITTALS (CHECKLIST)

.1 Be responsible for arranging, obtaining, collecting, compiling all clearances, certificates, permits, guarantees, maintenance manuals, as-built drawings, etc., as required within the various divisions of the specifications or bylaws. Without limiting the generality of the foregoing requirement, or the General Conditions, the following is a consolidated checklist for convenience only. Forward to the Consultant as noted below.

.2 Provide within ten (10) days of date of receipt of Notice of Acceptance of contract and prior to commencement of construction:

- .1 Performance Bond and Labour and Material Payment Bond each in the amount of fifty percent (50%) of the contract amount.
- .2 Certified copies of Contractor's insurance policies as specified.
- .3 Construction Schedule (in triplicate).
- .4 Confirmation of site and managerial personnel to be employed on the Project.
- .5 Contract price breakdown (schedule of values). Note: The contract price breakdown shall be in such form and be itemized as required by the Owner. The breakdown shall indicate initially all trade sections as listed in the specifications. Submit a proposed breakdown format to the Owner and the Consultant for approval prior to submission of actual contract price breakdown.
- .6 Projected cash flow requirement for the various progress payments.

.3 Provide prior to making application for first payment and as a condition thereof:

- .1 WorkSafe BC letter stating that the Contractor and all Subcontractors are in good standing.
- .2 Copies of all permits and receipts for fees paid by the Contractor.
- .3 Sample of proposed statutory declaration forms and list of corporate signing officers.
- .4 List of all electrical fixtures and equipment proposed to be installed for approval prior to ordering.
- .5 Shop drawings submittal schedule.

.4 Provide the following documentation during progress of construction:

- .1 Copies of test reports, other than those prepared by Owner appointed independent testing agencies.
- .2 Copies of all permits, licenses, certificates and receipts for fees paid. Shop drawings and samples.
- .3 All applicable permits obtained by the Contractor (i.e. gas, oil, refrigeration, pressure vessels, piping, etc.).
- .4 Revised construction progress schedule (at end of each month). Contractor's safety checklist and meeting minutes.

.5 Provide the following documentation at Substantial Performance:

- .1 Statement indicating reconciliation of all Change Orders or claims to the Contract;
- .2 Draft copies of all operating and maintenance manuals, maintenance and operating tools, replacement parts or materials, reserve maintenance replacement material as specified in the Contract Documents;
- .3 Certification by WorkSafe BC letter stating that Contractor and all Subcontractors are in good standing;

.4 Certification from all permit issuing authorities indicating approval of all permitted installations including but not limited to electrical items;

.5 A list of all items to be completed or corrected, including the time required to perform the work as well as the proposed completion date.

.6 Record documents: drawings, specifications.

.7 All required manufacturer's inspections, certifications, field test records, guarantees, warranties as specified.

.6 Provide the following before release of holdback monies and as a condition thereof:

.1 WorkSafe BC letter stating that Contractor and all Subcontractors are in good standing.

.2 Release of liens arising out of this contract.

.3 Certification, acceptable to the Owner, stating that all taxes, UIC payments, Canada Pension Plan contributions, duties, royalties and all other monies required to be paid by law or statute have been paid in full by the Contractor and its Subcontractors and other parties as applicable.

.7 For any and all billings, forward to the Consultant:

.1 Application for payment.

.2 Associated documentation as required and as specified.

.3 Updated schedule.

.4 Detailed project record.

.5 Coordinate progress billing with cost breakdown.

.6 Include gross and net value of Work completed during billing period.

.7 Include running total of gross and net value of Work completed by the end of the billing period.

.8 The documentation required by the General Conditions and amendments thereto under the Supplementary General Conditions shall accompany each application for progress payments.

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PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 This section addresses general requirements for environmental protection. This section is not intended to identify all and/or specific requirements. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the works described herein.

.2 Comply with General Conditions, and all applicable Environmental Laws.

.3 No unnecessary or unauthorized site disturbances shall be permitted within registered tree covenant boundaries, riparian areas or within the critical root zones of other treed areas designated for preservation.

1.2 FIRES

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

1.3 DISPOSAL OF WASTES

.1 Do not bury rubbish and waste materials on site.

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

1.4 DRAINAGE

.1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.

.2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.

.3 Control disposal of runoff water containing suspended materials or other harmful substances in accordance with local authority's requirements.

1.5 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees and plants on site and adjacent properties where indicated.

.2 Protect roots of designated trees to drip line during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.

.3 Minimize stripping of topsoil and vegetation.

1.6 EROSION AND SEDIMENT CONTROL

.1 Utilize erosion control measures such as but not limited to the following to reduce or eliminate the detachment and transport of soil particles:

.1 Schedule earth moving and stripping work to periods when rainfall is minimal.

.2 Maintain or establish permanent vegetative cover shortly after earthworks are completed.

.3 Apply mulching in the form of protective straw layers or other suitable material on any exposed soils areas that are not to be covered with permanent vegetative cover shortly after.

.2 Utilize sediment control measures such as the following to slow the velocity of sediment laden water, thereby allowing suspended particles to settle out of suspension:

.1 Construct and maintain sediment traps and sediment barriers.

.2 Construct and maintain temporary check dams in areas where sediment laden water congregates.

.3 Construct and maintain filter socks and storm drain inlet barriers in and around all receiving catch basins.

.3 Keep roadways, sidewalks and walkways clear of mud, silt, topsoil etc. from vehicles entering and exiting the project site. Mud, which may accumulate on the road, is to be removed immediately by shoveling and or sweeping. Roadways are not to be washed with water that may end up in receiving waters, unless appropriate sediment removal techniques are used.

1.7 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this contract.

.2 Control emissions from equipment and plant to local authority's emission requirements.

.3 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

.5 Contractor to maintain all equipment used onsite to ensure no leaking of fuel, engine oils, hydraulic fluids or other potentially toxic material onto the site or surrounding areas.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.2 Province of British Columbia

.1 Occupational Health and Safety Act

.3 BC Fire Code.

.4 Queen Charlotte Building Bylaw.

.6 See also Section 01 14 00 Work Restrictions, item 1.10 Health & Safety Meeting Attendance.

1.2 SUBMITTALS

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

.2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:

.1 Results of site-specific safety hazard assessment.

.2 Site access and material storage proposal.

.3 Noise and dust control measures.

.3 Submit 2 copies of Contractor's authorized representative's work site health and safety inspection reports to Consultant and authority having jurisdiction, weekly or as pre-agreed with the Consultant.

.4 Submit copies of incident and accident reports.

.5 Submit WHMIS MSDS - Material Safety Data Sheets.

.6 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

.7 An updated Fire Safety Plan to the Village of Queen Charlotte Fire Department and the Consultant.

1.3 FILING OF NOTICE

.1 File Notice of Project with Work Safe BC prior to beginning of Work.

.2 File Notice with the Village of Queen Charlotte Fire Department regarding a Contractor – specific Fire Safety Plan prior to beginning of Work.

1.4 SAFETY ASSESSMENT

.1 Perform site specific safety hazard assessment related to project.

.2 Complete exposure control plans as noted in Appendix A - Hazardous Building Material Assessment.

1.5 MEETINGS

.1 Schedule and administer Health and Safety meeting with Consultant prior to commencement of Work (see Section 01 14 00 – item 1.10).

1.6 REGULATORY REQUIREMENTS

.1 Do Work in accordance with Section 01 41 00 - Regulatory Requirements.

1.7 GENERAL REQUIREMENTS

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 Consultant may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.8 RESPONSIBILITY

.1 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.

.2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable Federal, Provincial, and Local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.9 COMPLIANCE REQUIREMENTS

.1 Comply with Occupational Health and Safety Act, General Safety Regulation, British Columbia Reg.

1.10 UNFORSEEN HAZARDS

.1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Consultant verbally and in writing.

1.11 HEALTH AND SAFETY CO-ORDINATOR

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:

.1 Have site-related working experience specific to activities.

.2 Have working knowledge of occupational safety and health regulations.

.3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.

.4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

.5 Be on site during execution of Work and report directly to and be under direction of site supervisor.

1.12 POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Consultant.

.2 Post the Fire Safety Plan (see end of Specification) at the Site Supervisor’s Workstation and with QCH and the Village of Queen Charlotte Fire Department prior to commencement of Work.

1.13 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Consultant.

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

.3 Consultant may stop Work if non-compliance of health and safety regulations is not corrected.

1.14 POWDER ACTUATED DEVICES

.1 Use powder actuated devices only after receipt of written permission from Consultant and/or QCH FM&O.

1.15 WORK STOPPAGE

.1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

.2 For Organized Labour stoppages/concerns immediately contact the Owner's site representative (FM&O), and the Consultant.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

.1 The work specified herein shall be the removal of all visible dust, debris and waste from all surfaces within the work area from the floor to the true ceiling by competent persons trained, knowledgeable and qualified in the handling and disposal of dust and waste materials within a Hospital following infection and dust control procedures as defined in these specifications and CSA –Z317.13-17 standards.

.2 The Constructor's cleaning supplies to be utilized onsite must be approved in writing by Northern Health in advance.

.3 Any platforms, scaffolds, swing stages, or miscellaneous stages used in the cleaning will be constructed or used in accordance with the requirements of the BC Occupational Health & Safety Regulations.

.4 All necessary documentation will be the responsibility of the Constructor.

.5 The health and safety of all contract employees is the sole responsibility of the Constructor (Prime Contractor).

.6 All cleaning work is to be carried out as per these specifications, CSA and Northern Health requirements.

.7 The Constructor will provide all necessary labour, materials and equipment necessary to carry out the work in accordance with all applicable regulations, standards and this documentation.

.8 All electrical and water connections necessary to the Owner's supply system will be the responsibility of the Constructor through co-ordination and approval by FM&O.

.9 The Constructor will not demobilize from an area of cleaning until the ICP has inspected and tested the completed area. The Constructor is to allow 24 Hours advance inspection notification in project schedule.

.10 If the Building Owner permits the Constructor to use any of the Owner's equipment, tools, or facilities, such use will be gratuitous, and the Constructor will absolve the Owner from any responsibility arising from claims for personal injury, including death, arising out of the use of such items irrespective of the condition thereof or any negligence on the part of the Owner in permitting their use.

PART 2 MANAGEMENT SERVICES

2.1 PROJECT CONSULTING

.1 The Constructor will work under the direction of the owner appointed ICP.

.2 All inspections will be conducted by the ICP.

.3 The ICP will have full access to all documentation.

.4 No work will be undertaken without the express written permission of the ICP and Northern Health Project Manager.

2.2 PERSONAL PROTECTIVE REQUIREMENTS

.1 Training:

.1 Prior to commencement of work activities all personnel who will be required to enter the work area must be fully versed in all aspects of dust control and hazards associated with the work.

.2 Training in emergency response and evacuation procedures shall be provided to strategic personnel.

PART 3 AIR MONITORING

3.1 AIR MONITORING

.1 Air monitoring shall be performed as required by the ICP.

.2 Negative pressure inside the work area and ante room will be monitored via digital or analog manometers supplied by the Constructor. The Constructor is to supply and install manometers and record manometer readings at minimum 3 times daily for the duration of the work. At minimum two (2) hours shall pass between readings.

.3 The Constructor shall assist the ICP in the collection of air samples, including the provision of workers to wear sampling pumps for up to a full work shift period as required and the provision of adequate, uninterrupted power for low amperage vacuum/pressure type air sampling pumps.

3.2 INSPECTIONS

.1 The ICP is empowered by the Owner to periodically inspect site conditions and work procedures inside and outside the work area.

.2 The ICP is empowered by the Owner to order the Constructor to stop work at any time the conditions of CSA infection control standards and/or the specifications have not been complied with or if there are violations to the WCB OH&S Regulations.

.3 The Owner or his representative will not be held responsible for any work stoppages, delays or any other disruptions occurring due to the conditions of the specifications not being complied with.

PART 4 MAINTENANCE OF ENCLOSURE

4.1 MAINTENANCE OF ENCLOSURES

.1 Enclosures shall be maintained in clean and tidy condition.

.2 Ensure barriers and plastic linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.

.3 Visually inspect enclosures regularly and at the beginning of each working period.

.4 Maintain emergency and fire exits from the work areas, or establish alternative exits satisfactory to fire officials and FM&O.

.5 Establish and maintain negative pressure within the work area at minus 7.5 Pa. Air movement equipment shall operate continuously from the time of the start of work until approval of clean-up procedures by ICP.

.6 Work at risk of generating dust and/or noise SHALL NOT commence until:

.1 Air movement equipment is operating as specified.

ICP and FM&O has been notified 72 hours in advance of the Constructor's intention to proceed and has inspected and approved in writing enclosures, ductwork isolation, equipment and procedures ('Milestone Inspection A' PRE-CONTAMINATION INSPECTION).

.2 All workers and personnel having cause to enter the work area are appropriately instructed and protected, as specified.

PART 5 PERSONNEL ENTRY AND EXIT

5.1 REQUIREMENTS

.1 All workers and authorized personnel shall enter the interior work areas through the anteroom enclosure system.

.2 All personnel who enter the work area shall read and be familiar with all posted regulation, personal protective requirements (including work place entry and exit procedures) and emergency procedures. The Prime Contractor sign-off sheet shall be used to acknowledge that these have been received and understood by all personnel prior to entry.

.3 All personnel shall proceed first to the anteroom, and appropriately don the assigned respiratory protection deemed suitable for the project conditions by the Constructor. All personnel will wear launder able (if appropriate) and/or disposable coveralls. Hard hats, eye protection and gloves shall also be utilized if required. Clean respirators and protective clothing shall be provided and utilized by each person for each separate entry in to the work area.

.4 Personnel wearing designated personal protective equipment shall proceed from the anteroom through to the main work area.

.5 Before leaving the work area all personnel shall remove gross contamination from the outside of respirators and protective clothing by HEPA vacuuming, and/or wet wiping procedures.
Each person shall clean bottoms of protective footwear in the walk-off mat just prior to entering the equipment or anteroom.

.6 Personnel shall proceed to anteroom where they will remove all protective equipment except respirators. Deposit disposable (and launder able) clothing into appropriately labeled containers for disposal (and laundering).

.7 Reusable footwear will be required if worker decontamination procedures prove inadequate.

.8 These procedures or the Constructor's equivalent shall be posted in the anteroom and equipment room (if applicable).

5.2 WASTE REMOVAL - WASTE CONTAINER PASS-OUT PROCEDURE

.1 Waste will be containerized and shall be transported out of the work area through the anteroom. Before the container is removed from the anteroom it will be thoroughly cleaned.

.2 Exit from anteroom shall be secured to prevent unauthorized entry.

PART 6 CLEAN UP AND AIR CLEARANCE SAMPLING

.1 Cleaning products used on site will be pre-approved by the Owner's representative

.2 The Constructor's cleaning contractor will clean all visible dust, debris and waste from all wall cavities opened during the work. Following the completion of wall cavity cleaning, the ICP will conduct a visual inspection. If the inspection is satisfactory the Constructor will install the wall board.

.3 The Constructor's cleaning contractor will clean all visible dust, debris and waste from all surfaces from the T-Bar Grid to the true ceiling. Following the completion of above T-Bar cleaning operations, the ICP will conduct a visual inspection. If the inspection is satisfactory the Constructor will install the ceiling tiles.

.4 The Constructor's cleaning contractor will upon installation of the T-Bar ceiling tiles clean all visible dust, debris and waste from all surfaces within the work area from the T-Bar to the floor. A visual inspection will be carried out upon completion of the below T-Bar cleaning.

.5 Upon a satisfactory final construction cleaning inspection, ICP will conduct clearance particulate air monitoring. Work areas found to be in excess of air clearance criteria for total particles which are higher than the adjacent areas shall be re-cleaned.

.6 Following the satisfactory completion of air clearance sampling and with written approval; the Constructor will be directed to proceed with work area enclosure tear down activities.

.7 Northern Health Environmental Services will carry out Terminal Cleaning.

PART 7 WASTE DISPOSAL PROCEDURES

7.1 REQUIREMENTS

.1 Waste materials stored on site will be stored in a sealed locked container.

.2 Containers will not be filled to capacity for transport.

END OF SECTION

PART 1 GENERAL

1.1 DEFINITIONS

.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare.

.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during deconstruction or construction.

1.2 SUBMITTALS

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

.2 Prior to commencing construction activities or delivery of materials to site, submit Environmental Protection Plan which may be combined with a Health and Safety Plan for review and approval by Consultant. Environmental Protection Plan is to present overview of known or potential environmental issues which must be addressed during construction. This will be reviewed at the Health and Safety Meeting Attendance.

.3 Environmental Protection Plan/Health & Safety Plan, include:

.1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.

.2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.

.3 Names and qualifications of persons responsible for training site personnel.

.4 Erosion and sediment control plan which identifies type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan.

.5 Drawings showing locations of proposed temporary excavations or embankments for haul roads, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.

.6 Traffic control plans including measures to minimize amount of mud/debris transported onto paved public roads by vehicles or runoff.

.7 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use. Plan to include measures for marking limits of use areas including methods for protection of features to be preserved within authorized work areas.

.8 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off project site.

.9 Waste water management plan that identifies methods and procedures for management and/or discharge of waste waters which are directly derived from deconstruction and construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.

1.3 FIRES

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

1.4 DISPOSAL OF WASTES

.1 Remove all materials off site except salvaging of components identified in the Specification.

.2 Do not bury rubbish and waste materials on site.

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

1.5 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this contract.

.2 Control emissions from equipment and plant to local authorities' emission requirements.

.3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area, by providing temporary enclosures.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.6 NOTIFICATION

.1 Consultant will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.

.2 Contractor: after receipt of such notice, inform Consultant of proposed corrective action and take such action for approval by Consultant.

.3 Consultant will issue stop order of work until satisfactory corrective action has been taken.

.4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES AND CODES

.1 Perform Work in accordance with Local Bylaws including 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 MUNICIPALITIES & PERMITS

.1 Perform Work in accordance with the by-laws and ordinances of the Village of Queen Charlotte, Provincial and Federal requirements.

.2 A Building Permit will be obtained and paid for by the Client. All other Permits required for the Work are to be applied for and paid for by the Contractor.

.3 The Contractor is to call for Building Inspections by the Village of Queen Charlotte, as required by the Building Permit as work progresses – Report copies to be forwarded to the Consultant.

.4 A Fire Safety Plan is to be provided to the Fire Department by the Contractor prior to work commencing on site as per “Construction and Demolition Sites” Section of the BC Fire Code. This is associated with the Building Permit.

1.3 BUILDING SMOKING ENVIRONMENT

.1 Smoking is not permitted in any building or on the adjacent site including anywhere on the Hospital Site.

.2 Comply with regulations of Provincial and local Municipalities.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

PART 1 GENERAL

1.1 INSPECTION

.1 Allow Consultant 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 Consultant 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 Consultant will order 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, Consultant shall pay cost of examination and replacement.

1.2 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged by the Owner for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Owner.

.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 Consultant at no cost to Owner, pay costs for retesting and reinspection.

1.3 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.

1.4 PROCEDURES

.1 Notify appropriate agency and Owner 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 orderly sequence to not cause delays 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.

1.5 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

Consultant 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 Consultant it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Consultant.

1.6 REPORTS

.1 Submit electronic copies of inspection and test reports to Consultant.

.2 Provide copies to subcontractor of work being inspected or tested and manufacturer or fabricator of material being inspected or tested.

1.7 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

.2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Consultant and may be authorized as recoverable.

1.8 MILL TESTS

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

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

PART 1 GENERAL

1.1 SUBMITTALS

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

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 WATER SUPPLY

.1 Provide continuous supply of potable water for construction use.

1.4 TEMPORARY HEATING AND VENTILATION

.1 Temporary heaters are not permitted unless permission is granted by the Owner, in which case they must be electric.

.2 Provide temporary ventilation in enclosed areas as required to:

- .1 Facilitate progress of Work.
- .2 Provide adequate ventilation to meet health regulations for safe working environment.
- .3 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction or deconstruction.
- .4 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
- .5 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
- .6 Ventilate storage spaces containing hazardous or volatile materials.
- .7 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

.3 Maintain strict supervision of operation of temporary ventilating equipment to:

- .1 Conform to applicable codes and standards.
- .2 Enforce safe practices.
- .3 Prevent abuse of services.

.4 Be responsible for damage to Work due to failure in providing adequate ventilation and protection during construction.

1.5 TEMPORARY POWER AND LIGHT

.1 Provide temporary power during the course of Work for temporary lighting and operating of power tools.

.2 Provide and maintain temporary lighting throughout project.

1.6 TEMPORARY COMMUNICATION FACILITIES

.1 Provide and pay for temporary data hook up, lines, and equipment necessary for own use.

1.7 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by Insurance companies, Building Code and Fire Code.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

PART 1 GENERAL

1.1 SUBMITTALS

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

1.2 HOARDING

.1 See Section 01 56 00 – Temporary Barriers and Enclosures.

1.3 SCAFFOLDING AND STAIRS

.1 Scaffolding in accordance with CAN/CSA-S269.2 for Deconstruction and Making-good.

.2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms, and temporary stairs (scaffold stairs).

.3 Existing entrance and exits at adjacent buildings to be maintained for Owner's staff whenever possible.

1.4 HOISTING

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

.2 Hoists cranes to be operated by qualified operator.

1.5 SITE STORAGE/LOADING

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

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

1.6 SECURITY

.1 Provide security for site. Contractor is responsible for any damage or missing items until Substantial Completion.

1.7 OFFICES

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

.2 Contractors to provide their own offices as necessary. Location to be confirmed by Consultant.

1.8 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in 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 manner to cause least interference with work activities.

1.9 SANITARY FACILITIES

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

.2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.10 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Provide access and temporary relocated roads as necessary to maintain traffic.

.2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Consultant.

.3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs

.4 Protect travelling public from damage to person and property.

.5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.

.6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.

.7 Construct access and haul roads necessary.

.8 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.

.9 Dust control: adequate to ensure safe operation at all times and maintain wetted surfaces during deconstruction.

.10 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations.

.11 Provide snow removal during period of Work within contractors hoarding zone.

1.11 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from work site daily.

.2 Clean dirt or mud tracked onto paved or surfaced roadways.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

PART 1 GENERAL

1.1 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.2 HOARDING

.1 Contractor to provide, erect, remove when complete, temporary enclosures as required. Locations are to be as required for all work and not limited to as shown on drawings. Continuous access is to be maintained to all working areas of the facility as required by client.

1.3 GUARD RAILS AND BARRICADES

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

.2 Provide as required by governing authorities.

1.4 WEATHER ENCLOSURES

.1 Provide weather tight closures to unfinished openings at all new and existing buildings as demolition progresses.

1.5 ACCESS TO SITE

.1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.6 FIRE ROUTES

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

1.7 PROTECTION OF EXISTING BUILDING(S)

.1 Provide protection to existing building(s) and equipment during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Owner and Managing Consultant locations and installation schedule two weeks prior to installation.

.4 Be responsible for damage incurred due to lack of or improper protection.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

.1 Within text of each specifications section, reference may be made to reference standards.

.2 Conform to these reference standards, in whole or in part as specifically requested in specifications.

.3 If there is question as to whether products or systems are in conformance with applicable standards, Consultant reserves right to have such products or systems tested or to receive test data.

.4 Cost for such testing will be born by Consultant in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 QUALITY

.1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.

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

.4 Should disputes arise as to quality or fitness of products, decision rests strictly with Consultant based upon requirements of Contract Documents.

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

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

1.3 AVAILABILITY

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Consultant 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 Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Consultant reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.4 STORAGE, HANDLING AND PROTECTION

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

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

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

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

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

.6 Store sheet materials, 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 Consultant.

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

1.5 TRANSPORTATION

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

1.6 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 Consultant in writing, of conflicts between specifications and manufacturer's instructions.

1.7 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 Consultant if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Consultant 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 Consultant, whose decision is final.

1.8 CO-ORDINATION

.1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.

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

1.9 CONCEALMENT

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

.2 Before installation inform Consultant if there is interference. Install as directed by Consultant.

1.10 REMEDIAL WORK

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

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

1.11 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate. Contractor to coordinate the work of all trades to ensure placement of fixtures work in tandem.

.2 Inform Consultant of conflicting installation. Install as directed.

1.12 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.

1.13 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.

1.14 PROTECTION OF WORK IN PROGRESS

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

1.15 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.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Substitutions.

.2 Alternatives.

.3 Separate prices.

1.2 RELATED SECTIONS

.1 Section 00 26 00 - Procurement Exchange Procedures.

.2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 DEFINITIONS

.1 Products Not Available: When all listed manufacturers products in the specification section are no longer manufactured.

.2 Proprietary Specification: A specification which includes one or more proprietary names of products or manufacturers, or both, and may also include descriptive, reference standard, or performance requirements, or any combination thereof.

.3 Non-proprietary Specification: A specification which includes descriptive, reference standard or performance requirements, or any combination thereof, but does **not** include proprietary names of products or manufacturers.

.4 Substitution: A product or manufacturer not specified by proprietary name, which may be acceptable in place of a product or manufacturer which, is specified by proprietary name.

1.4 PRODUCT OPTIONS

.1 The Work is based on the Materials and methods specified in the specifications.

.2 For products specified only by reference standard or by performance: Select any product by any manufacturer, which meets requirements of Contract Documents.

.3 For products specified by proprietary specification:

.1 Select any product or manufacturer named, or

.2 Submit a Product Substitution Request for an unnamed product or manufacturer in accordance with requirements of this Section.

.4 For products specified by proprietary specification and accompanied by words indicating that substitutions will not be accepted: No option, substitutions are not permitted.

.5 For products specified by naming one (1) or more manufacturers and one of the

following terms: "Approved Substitution"; "Approved Alternate"; "Approved Alternative"; "Approved equal"; "Approved Equivalent": Such products are defined as products that are functionally equivalent in material, size, thickness, colour, texture and overall quality to the specified products and are readily exchangeable for the specified product(s).

1.5 SUBSTITUTIONS

.1 Proposed substitutions to materials specified will be considered during the bidding period in accordance with the Instructions to Bidders and Section 00 26 00 - Procurement Exchange Procedures.

.2 Substitute products will not be considered after the award of Contract except in the case of product unavailability or other conditions beyond the control of the Contractor. Should substitutions be required after Contract Award the Consultant will consider proposals to substitute specified products/materials with alternate products/materials.

.3 To be considered, each proposal must:

.1 Include sufficient information to enable the Consultant to properly evaluate the material. Such information shall include manufacturer's product data, specifications, drawings, and other pertinent data to completely describe the substitution.

.2 Identify any and all changes required in the Work of all trades which would become necessary to accommodate the substitution.

.4 Substitute products shall be the same type as, be capable of performing the same functions as, and meet or exceed the standards of quality and performance of the named product(s). Substitutions shall not require revisions to Contract Documents nor to work of Other Contractors.

.5 Substitute manufacturers shall have capabilities comparable to those of the named manufacturer(s). Substitutions shall not require revisions to Contract Documents nor to work of Other Contractors.

.6 In submittal of a Product Substitution Request it is hereby understood that the person or entity submitting the request is certifying that the proposed substitute will fully perform the functions called for by the general design, be of equal or superior substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed work schedule.

.7 In making a Product Substitution Request the person or entity submitting the request represents that:

.1 He will provide the same warranty for the Substitution as for the specified Product.

.2 He will coordinate installation and make any changes to the Work necessitated by the substitution as required for the Work to be complete in all respects with no additional cost to the Contract.

.3 He waives claims for additional costs or time extension which may subsequently become apparent.

.4 He will reimburse Owner and Consultant for review or redesign services associated with re-approval by authorities.

.8 Substitutions shall not be ordered nor installed without Consultant's acceptance.

.9 If in Consultant's opinion, a substitution does not meet requirements of Contract

Documents, Contractor shall, at no extra cost to the Contract, provide a product which, in Consultant's opinion, does meet requirements of Contract Documents.

1.6 SUBSTITUTION SUBMITTAL PROCEDURE

.1 Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

.2 Submit three (3) copies of request for Substitution for consideration. Limit each request to one (1) proposed Substitution.

.3 Submit shop drawings, product data, and certified test results attesting to the proposed Product equivalence. Burden of proof is on proposer.

.4 Product substitution request form:

.1 All proposed substitutions must be submitted with the attached "Product Substitution Request Form during Construction Period".

1.7 PRODUCT DATA

.1 When requested by Consultant, submit complete data substantiating compliance of a product with requirements of Contract Documents. Include the following:

.1 Product identification, including manufacturer's name and address.

.2 Manufacturer's literature providing product descriptions, applicable reference standards, and performance and test data.

.3 Samples, as applicable.

.4 Name and address of projects on which product has been used and date of each installation.

.5 For substitutions and requests for changes to accepted products, include in addition to the above, the following:

.1 Itemized comparison of substitution with named product(s). List significant variations.

.2 Designation of availability of maintenance services and sources of replacement materials.

1.8 CONSULTANT REVIEW PROCEDURE

.1 In reviewing the supporting data submitted for substitutions, Consultant will use, for purposes of comparison, all the characteristics of the specified material or equipment as they appear in the manufacturer's published data even though all the characteristics may not have been particularly mentioned in the Specifications.

.2 Consultant will review supporting data and will determine that the substitution in the Consultant's opinion is or is not equal or superior in quality, utility, and appearance to the material specified.

.3 The Consultant may:

.1 Reject the proposed substitution; or

.2 Accept the propose substitution and designate the material as an "acceptable material".

.4 The Consultant reserves the right to accept or reject any proposal without prejudice for any reason whatsoever and reserves the right to disclose or not to disclose his reasons

for such rejection.

.5 Substitutions accepted after Contract Award will be authorized by issue of a Change Order.

1.9 ALTERNATIVES

.1 Accepted Alternatives will be identified in Owner-Contractor Agreement.

.2 Submit alternatives identifying the effect on adjacent or related components.

.3 Alternatives quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. Accepted alternatives will be identified in the Owner-Contractor Agreement.

.4 Coordinate related work and modify surrounding work to integrate the Work of each alternative.

.5 Schedule of Alternatives: Refer to Bid Documents.

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 NOT USED.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 00 - Summary of Work.
.2 Section 01 32 16 - Construction Schedule.
.3 Section 01 33 00 - Submittals Procedures.
.4 Section 01 45 00 - Quality Control.
.5 Section 01 61 00 – Common Product Requirements.
.6 Section 01 74 11 – Cleaning.
.7 Section 01 74 21 - Waste Managing and Disposal.
.8 Section 01 77 00 - Closeout Procedures.
.9 Section 09 21 16 - Gypsum Board Assemblies: backing/blocking for mounting brackets for wall mounted equipment; rough openings for equipment.
.10 Section 11 70 00 - Healthcare Equipment.
.11 Division 22: Plumbing services for equipment.
.12 Division 23: HVAC services for equipment
.13 Division 26: Electrical services for equipment.

1.2 DEFINITIONS

.1 Owner Furnished Products (OFP).
  .1 New equipment purchased and delivered to site by Owner, to be received, unloaded, unpackaged, delivered to designated room, assembled, roughed-in, installed, and connected by Contractor.
  .2 New equipment purchased and delivered to site by Owner, to be received, unloaded, delivered to designated room, unpackaged, assembled, installed, and connected by Equipment Vendor. Building services roughed-in by Contractor.
  .3 Transfer Equipment:
    .1 OSCI-designated items: Existing equipment to be disconnected and relocated to designated room by Owner, re-assembled, roughed-in, installed, and connected by Contractor.
    .2 OSOI-designated items: Existing equipment to be disconnected and relocated to designated room by Owner, re-assembled, roughed-in, installed, and connected by Owner.
.2 Assemble or Assembly: fitting together of multiple components and accessories in accordance with manufacturer's instructions and specifications.
.3 Install or Installation: providing structural support and/or blocking, placing into position, anchorage and adjusting of product as indicated by drawings, specifications and manufacturer's instruction.
.4 Connect or Connection: providing mechanical and electrical services as indicated and required to interface with building services for proper operation.
.5 Abbreviations:
  .1 OSCI - Owner-supply, Contractor-install.
  .2 OSVI - Owner-supply, Vendor-install.
  .3 OSOI - Owner-supply, Owner-install.

1.3 OWNER'S RESPONSIBILITIES

.1 Arrange for delivery of shop drawings, product data, samples, manufacturer's instructions, and certificates to Contractor in accordance with Construction Progress Schedule.
.2 Deliver supplier's bill of materials to Contractor.

.3 Arrange and pay for delivery to the Place of the Work in accordance with Construction Progress Schedule.
.4 Arrange for Equipment Vendor to receive and deliver OSVI-designated products to designated room.
.5 Inspect deliveries jointly with Contractor and Equipment Vendor.
.6 Submit claims for transportation damage.
.7 Arrange for replacement of damaged, defective or missing items.
.8 Arrange for manufacturer's field services; arrange for and deliver manufacturer's warranties and bonds to Contractor.
.9 Install OSOI-designated products in designated rooms.

1.4 CONTRACTOR'S RESPONSIBILITIES

.1 Obtain the necessary shop drawings from the Owner and proceed to coordinate details for installation.
.2 Designate submittals and delivery date for each Product in Construction Progress Schedule.
.3 Coordinate with Owner to expedite delivery of products in accordance with delivery date for each product in accordance with Construction Progress Schedule.
.4 Review shop drawings, product data, samples, and other submittals. Submit to Consultant, notification of any observed discrepancies or problems anticipated due to non-conformance with Contract Documents.
.5 Provide support frames for suspended products, backing/blocking and rough openings in walls and partitions to support wall mounted products, including OSOI-designated wall mounted products.
.6 Inspect deliveries jointly with Owner; record shortages, and damaged or defective items.
.7 Receive and handle OSCI-designated products at site, including uncrating, storage until installation, installation, connection, and testing of products. Be responsible for warranty.
.8 Protect Products from damage, and from exposure to elements.
.9 Assemble, install, connect, adjust, and finish OSCI-designated products. Coordinate work with Vendor.
.10 Coordinate and arrange with Owner for Equipment Vendor to receive and deliver OSVI-designated products to designated room.
.11 Arrange for installation inspections required by public authorities.
.12 Repair or replace items damaged by Contractor.

1.5 SUBMITTALS

.1 Shop Drawings.
  .1 Owner will obtain and issue to Contractor, 1 printed copy and 1 electronic copy (when available), of manufacturer's product data, shop drawings, electrical and mechanical connections, installation instructions, and all other relevant information for each Owner Furnished Product (OFP) to assist Contractor with his work.
.2 Closeout Submittals.
  .1 Obtain operating and maintenance instructions, parts lists and wiring diagrams and incorporate into Operations and Maintenance Manual specified in Section 01 78 00.
  .2 Turn over to Owner spare parts, maintenance materials, maintenance manuals that were included in product delivery, in accordance with Section 01 78 00.
.3 Certificates of Insurance:
  .1 Obtain and issue to Owner, certificates of insurance on new and existing OFP.

.4 Record Drawings.
.1 Incorporate new and existing OFP into Project Record Drawings as specified in Section 01 78 00.

1.6 QUALITY ASSURANCE

.1 Assemble and install OFP using manufacturer's representative or trade specializing in work or assembling and installing manufacturer's products and having minimum of 3 years documented experience and written approval from manufacturer.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Owner will arrange and pay for delivery of new OFP to site in accordance with construction schedule. Contractor to provide Owner with delivery and packing slips accompanying deliveries.
.2 If necessary, be responsible for costs Owner incurs, such as demurrage, warehousing and storage and delivery charges that are due to Contractor's failure to conform to mutually agreed-upon schedule for the Work, or to delays for which Contractor is responsible.
.3 Inspect deliveries jointly with Owner and jointly record shortages, and damaged or defective OFP. Owner will submit claims for transportation damage and arrange for replacement of damaged, defective or missing OFP.
.4 Receive, unload, unpackage and handle OFP on site in accordance with Section 01 61 00.
.5 Waste Managing and Disposal: in accordance with Section 01 74 21.

1.8 SCHEDULING

.1 Provide Owner with dates required for receipt of submittals as specified, and for delivery of OFP to site for incorporation into project. Incorporate OFP installation dates into construction schedule specified in Section 01 32 16.
.2 Be responsible for overall coordination of OFP and associated installers within overall project schedule.
.3 Be responsible for all safety provisions of Owner-installers and ensure their attendance at regular project safety and toolbox meetings.

1.9 WARRANTIES

.1 Owner will obtain and issue to Contractor, copy of manufacturer's standard warranty document.
.2 Collect and assemble all warranties and include in Maintenance Manual specified in Section 01 78 10.

1.10 INSURANCE

.1 New OFP:
.1 Include new Owner supplied - Contractor installed OFP under the Base Building Contract insurance policies.
.2 Insurance coverage for any individual piece of new OFP shall commence on the date said item is delivered to the Base Building site and has been accepted by the Base Building Contractor.
.2 Existing OFP:
.1 Include existing Contractor installed OFP under the Base Building Contract insurance policies.

.2 Insurance coverage for any individual piece of existing OFP shall commence on the date the Base Building Contractor commences removal of the item from the existing hospital building.

.3 Owner shall provide the Contractor an estimate of the value of each piece of new and existing OFP to be included in the Base Building Contract insurance policies.

Part 2 Products

2.1 MANUFACTURED UNITS AND EQUIPMENT

.1 Refer to Section 11 06 70 - Healthcare Equipment and Accessories for list of OSCI items.

Part 3 Execution

3.1 PREPARATION

.1 Coordinate and prepare all required services for new and existing relocated OFP.

.2 Refer to manufacturer's shop drawings provided by Owner, for mechanical and electrical requirements for OFP relating to details of service connections or rough-ins. Provide frames and anchors for placement in other work.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 INSTALLATION

.1 Coordinate with Owner, acceptable dates for transfer by Owner of existing OFP items designated as OSCI. Verify condition and functioning of existing OFP with Owner prior to installation.

.2 Provide necessary rough-ins for new and existing transfer equipment including but not limited to, blocking, backing, conduits, wiring, electrical boxes, piping, inserts, depressions, trimming, openings, drains, canting and core drilling as indicated on shop drawings and as directed by manufacturer.

.3 Employ services of qualified installer, in accordance with paragraph 1.4.1 of this Section, to assemble, install, connect, commission and certify OFP.

.4 Install OFP products in strict accordance with manufacturer's printed instructions.

.5 Final locations of services and equipment as shown on reviewed shop drawings and Contract Documents. Report any discrepancies to Consultant

.6 Anchor fixed components firmly, square, level, plumb.

.7 Install supplied trim pieces as specified and in accordance with manufacturer's printed instructions.

.8 Repair or replace OFP damaged by own forces on site (under Contractor control).

3.4 INTERFACE WITH OTHER PRODUCTS

.1 Coordinate installation of mechanical and electrical services, rough openings, adjacent materials and equipment.

3.5 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services.
- .1 Arrange for manufacturer's field services to coordinate mechanical and electrical rough-ins prior to and during installation and connection of OFP.

.2 Site Tests, Inspection.
- .1 Perform initial start-up of new and existing relocated OFP with Owner and manufacturer's representative present.
- .2 Request inspection of installation as required by Authorities Having Jurisdiction.

3.6 OPERATIONAL CHECK

.1 When the installation is complete test equipment to confirm functionality.
.2 Test each individual item to ensure proper function.
.3 Provide commissioning report and submit copies, signed by authorized installer, to Consultant. Include one copy in operation and maintenance manual.

3.7 SYSTEM DEMONSTRATION AND TRAINING

.1 At completion of installation clean and adjust systems and controls for correct function.
.2 After final adjustment and cleaning, arrange for and provide orientation instructions and systems demonstration with Owner's designated personnel in accordance with Section 01 79 00 - Demonstration and Training.

3.8 ADJUSTING

.1 Adjust components to assure proper alignment and operation.
.2 Repair, if acceptable, or replace damaged or improperly operating items.

3.9 CLEANING

.1 Clean in accordance with Section 01 74 11.
.2 Immediately after installation and adjustment; clean surfaces to remove marks, soil and foreign matter.
.3 Prior to Substantial Completion, recheck components and perform required additional cleaning.
.4 Remove labels, protective coverings, surplus materials, excess materials, rubbish, tools and equipment.

3.10 DEMONSTRATION

.1 Owner will arrange for demonstration and testing of OFP in accordance with Section 01 79 00.

3.11 PROTECTION

.1 Protect installed products from damage until substantial performance of the Work.

3.12 SCHEDULE: OWNER FURNISHED PRODUCTS

	Equipment	Quantity	Room	Installation
.1	Fridge	1	Hazardous Compounding 1-927	Existing to be relocated

END OF SECTION

PART 1 GENERAL

1.1 EXISTING SERVICES

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

1.2 RECORDS

.1 Maintain a complete, accurate log of control and survey work as it progresses.

1.3 SUBSURFACE CONDITIONS

.1 Promptly notify Consultant in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.

.2 After prompt investigation, should Consultant determine that conditions do differ materially, instructions will be issued for changes in Work as provided in Changes and Change Orders.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

PART 1 GENERAL

1.1 SUBMITTALS

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

.2 Submit written request in advance of cutting or alteration which affects:

- .1 Structural integrity of elements of project.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of operational elements.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of Owner or separate contractor.

.3 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 Owner or separate contractor.
- .7 Written permission of affected separate contractor.
- .8 Date and time work will be executed.

1.2 MATERIALS

.1 Required for original installation.

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

1.3 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 are to be exposed by uncovering work; maintain excavations free of water.

1.4 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 airtight 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 in accordance with Section 07 84 00 – Firestopping, full thickness of the construction element.

.13 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

.14 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Requirements and limitations for cutting and patching of Work.

1.2 RELATED SECTIONS

.1 Section 01 61 00 – Common Product Requirements.

.2 Individual Product Specification Sections:

.1 Cutting and patching incidental to work of the section.

.2 Advance notification to other sections of openings required in Work of those sections.

1.3 SUBMITTALS

.1 Submit written request in advance of cutting or alteration which affects:

.1 Structural integrity of any element of Project.

.2 Efficiency, maintenance, or safety of any operational element.

.3 Visual qualities of sight exposed elements.

.4 Work of Owner or separate contractor.

.2 Include in request:

.1 Identification of Project.

.2 Location and description of affected Work.

.3 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 Owner or separate contractor.

.7 Written permission of affected separate contractor.

.8 Date and time work will be executed.

1.4 WARRANTY

.1 Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Primary Products: Those required for original installation.

.2 Product Substitution: For any proposed change in materials, submit request for substitution.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Examine existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.

.2 After uncovering existing Work, assess conditions affecting performance of work.

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

3.2 PREPARATION

.1 Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.

.2 Provide protection from elements for areas which may be exposed by uncovering work.

.3 Maintain excavations free of water.

3.3 CUTTING

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

.2 Uncover work to install improperly sequenced work.

.3 Remove and replace defective or non-conforming work.

.4 Remove samples of installed work for testing when requested.

.5 Provide openings in the Work for penetration of mechanical and electrical work.

.6 Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

.7 Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

3.4 PATCHING

.1 Execute patching to complement adjacent Work.

.2 Fit Products together to integrate with other Work.

.3 Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.

.4 Employ original installer to perform patching for weather exposed and moisture resistant elements, and sight-exposed surfaces.

.5 Restore work with new Products in accordance with requirements of Contract Documents.

.6 Fit work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.7 At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material, to full thickness of the penetrated element.

.8 Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit:

END OF SECTION

PART 1 GENERAL

1.1 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from excessive accumulation of waste products and debris, including that caused by Owner or other Contractors.

.2 Remove waste materials from site at regularly scheduled times.

1.2 FINAL CLEANING

.1 Employ a professional cleaning company to perform final cleaning prior to final project assessment.

.2 Conduct cleaning and disposal operations to comply with local ordinances and regulations.

.3 Use only proper low VOC cleaning materials, chemical agents and equipment recommended by the manufacturer of the surface to be cleaned, ensuring that they are compatible with cleaning materials and methods that will be used by the Owner following completion of the Work.

.4 Examine, repair and adjust all hardware operation to door units, window units, millwork/casework units, equipment units, leaving all in clean, polished, smooth, perfect, functional working order.

.5 Examine, clean and polish all accessories, fittings and fixtures to produce intended appearance and use.

.6 Clean work prior to final review by Consultant.

.7 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.8 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.

.9 Prior to final review remove surplus products, tools, construction machinery and equipment.

.10 Remove waste products and debris including that caused by Owner or other Contractors.

.11 Remove waste materials from site at regularly scheduled times or dispose of as directed by Consultant. Do not burn waste materials on site, unless approved by Consultant.

.12 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.13 Vacuum clean and dust building interiors.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

PART 1 GENERAL

1.1 WASTE MANAGEMENT GOALS

.1 Prior to start of Work conduct meeting with Consultant to review and discuss Waste Management Plan and Goals.

.2 Waste Management Goal is to divert all materials considered recyclable from landfill sites.

.3 Accomplish maximum control of solid construction waste.

.4 Preserve environment and prevent pollution and environment damage.

1.2 DEFINITIONS

.1 Class III: non-hazardous waste - construction renovation waste.

.2 Inert Fill: inert waste - exclusively asphalt and concrete.

.3 Recycled: ability of product or material to be recovered at end of its life cycle and reused.

1.3 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

.2 Do not dispose of waste, volatile materials, mineral spirits, oil, and paint thinner into waterways, storm, or sanitary sewers.

.3 Keep records of construction waste including:

.1 Number and size of bins.

.2 Waste type of each bin.

.3 Reused or recycled waste destination.

.4 Remove materials from deconstruction as deconstruction/disassembly Work progresses.

.5 Review the contaminated soils report provided by the consultant, and account for removal of all contaminated soils encountered during excavation and performance of the work. Disposal of contaminated soils is to be in compliance with the BC Ministry of Environment guidelines.

1.4 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises.

.2 Provide temporary security measures approved by Consultant.

1.5 SCHEDULING

.1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 APPLICATION

.1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.2 CLEANING

.1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.

.2 Clean-up work area as work progresses.

.3 Source separate materials to be reused/recycled into specified sort areas.

END OF SECTION

1.0 OPERATING AND MAINTENANCE MANUALS

.1 Submit to the Consultant one (1) copy of maintenance, operating and instruction manuals.

.2 Separately bound manuals are to be prepared for the following trade work:

1) Building: Architectural elements, fixtures, finishes, casework, hardware, specialties, etc.

2) Mechanical: Heating ventilating, air conditioning, etc.

3) Plumbing: Plumbing, fire sprinklers, etc.

4) Electrical: Power, lighting, fire alarm system, data, communications, security, etc.

.3 Provide maintenance manuals in hard and electronic format as specified hereafter, giving full operating and maintenance instructions for each system and major piece of equipment, as well as, maintenance instructions for building elements, fixtures and finishes.

.4 Manuals are to contain pertinent maintenance operational and installation instruction information on equipment, materials cleaning and lubrication schedules, filters, overhaul, replacement, adjustment schedules, and emergency procedures as applicable. Instructions in manuals shall be in simple language so as to guide the Owner in the proper operation and maintenance of building material, components, equipment and systems.

.5 Include all items covered by Change Orders.

.6 Update the manuals periodically during the installation and commissioning phase of the Work so that the manuals are final by the scheduled turnover date.

.7 Include equipment supplied by the Owner and pre-tendered equipment.

.8 Binders:

1) Binders shall be ACCO Canadian Co. Ltd. or approved substitution as follows:

2) ACCO Inview D-Ring Binders – color Black
1 inch – 41805-0
2 inch - 41807

3) ACCO expanding bar-lock catalogue binder - color Black
3 to 5.5 inches – 05436-0

.9 Pages:

1) Descriptions and lists are to be neatly typed or printed on 216 mm x 280 mm heavy bond paper. Duplicate pages shall be made by electrostatic dry copier.

2) The maximum paper size for schedules and diagrams is 280 mm x 432 mm. Larger paper sizes will be accepted for diagrams only if a mylar sepia is provided for each sheet.

3) Alphabetical index tab separators are to be used in each manual to identify each information “Section”.

.10 Manual contents shall be organized into applicable categories of Work, parallel to specifications divisions and sections.

.11 Architectural manuals shall include in general, but shall not necessarily be limited to, the following:

1) List of all Subcontractors, manufacturers, suppliers, complete with addresses and telephone and facsimile numbers.

2) Copy of hardware schedule and paint schedules, complete with the actual manufacturer, supplier and identification names and numbers.

3) All manufacturer’s equipment, materials, products, data, details, identification, list, schedules of maintenance, operational and installation instruction information as required in accordance with the various sections of the specification.

4) All extended guarantees, warranties, maintenance bonds, certificates, letters of guarantees, registration cards, as called for in the various sections of the specification, with the following information:

.1 Name and address of subject.
.2 Commencement date (Substantial Performance of the Work) of guarantees and warranties.
.3 Duration and expiry date of guarantees and warranties.
.4 Signature and seal of the Contractor, installer, manufacturer and/or supplier as applicable.

5) Complete set of all final reviewed shop drawings.

6) Certificates of Inspection.

7) Test reports and certificates as applicable.

8) Confirmation letters of all extra, reserve, replacement materials as required in accordance with various sections of the specification has been properly handed over and received by the Owner in good order.

9) Confirmation letters of all portable units, equipment, materials such as fire extinguishers, special tools, keys for all equipment and/or panels, elevator pads/accessories, keys to millwork, casework, has been properly handed over and received by the Owner in good order.

10) Submit to the Consultant one (1) copy of plumbing/mechanical and electrical manuals in accordance with this section and to detailed requirements specifically set out in the various sections of the specification as applicable.

1.1 ELECTRONIC COPIES OF MANUALS

.1 In addition to the printed copies, submit electronic copies of all operating and maintenance data as specified under clause 1.4.

.2 Submit data on “read only” CDs. Provide one (1) copy of each CD for the Owner and 1 copy to the Consultant.

.3 Do not provide separate CDs for each major section. Use more than one CD only if the volume of data exceeds the capacity of a single CD. Professionally label each CD and CD jewel case, including the name of the Owner, project and CD title.

.4 Organize electronic data using directories and sub-directories as generally described in clause 1.4. Prior to assembling the electronic data, submit to the Consultant a detailed list of the proposed directory/sub-directory structure including proposed files names. File names to be easily recognizable without the need to open the document to know what information the file contains. Directory structure and file naming is subject to the approval of the Consultant.

.5 Provide information in Portable Document Format (PDF). Break down large files into sections and use bookmark structure for easy navigation.

END of SECTION

PART 1 GENERAL

1.1 SUBMITTALS

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

.2 Submit an electronic / scanned copy of all ‘redlined’ marked up documents as detailed under 1.5 RECORDING ACTUAL SITE CONDITIONS.

.3 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.4 Copy will be returned after final inspection, with Consultant's comments.

.5 Revise content of documents as required prior to final submittal.

.6 At a minimum of two weeks prior to Substantial completion application, submit to the Consultant, final copies of operating and maintenance manuals in English.

.7 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.

.8 Furnish evidence, if requested, for type, source and quality of products provided.

.9 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.10 Pay costs of transportation.

1.2 FORMAT

.1 The manual will be submitted for review and approval prior to substantial completion.

.2 Following review, the Contractor will submit two hard copies and one digital copy of the manual.

.3 Organize data as instructional manual. The consultant will provide the contractor with the word template for the manual format.

.4 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

.5 When multiple binders are used correlate data into related consistent groupings. Identify contents of each binder on spine.

.6 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

.7 Arrange content by systems, process flow, under Section numbers and sequence of Table of Contents.

.8 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.9 Text: manufacturer's printed data.

.10 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

.11 Provide electronic copy on two disks upon completion (scan documents to suit).

1.3 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project;

.1 Date of submission; names.

.2 Addresses and telephone numbers of Consultant and Contractor with name of responsible parties.

.3 Schedule of products and systems, indexed to content of volume.

.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.

1.4 AS-BUILTS AND SAMPLES

.1 Maintain, in addition to requirements in General Conditions, at site for Consultant one record copy of:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to 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.

1.5 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of drawings provided by Consultant.

.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: 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: 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, and field test records, required by individual specifications sections.

.7 Submit an electronic / scanned copy of all ‘redlined’ marked up documents as detailed under 1.5 RECORDING ACTUAL SITE CONDITIONS.

1.6 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 Consultant.

1.7 WARRANTIES AND BONDS

.1 Develop warranty management plan to contain information relevant to Warranties.

.2 Assemble approved information in binder and submit upon acceptance of work. Organize binder as follows:

.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 applicable item of work.

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

.5 Co-execute submittals when required.

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

.3 Conduct joint 4 month and 9 month warranty inspection, measured from time of acceptance, by Consultant.

.4 Respond in a timely manner to oral or written notification of required construction warranty repair work.

.5 Written verification will follow oral instructions. Failure to respond will be cause for the Consultant to proceed with action against Contractor.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Equipment and systems.

.2 Materials and finishes.

.3 Spare parts.

.4 Maintenance manuals.

.5 Special tools.

.6 Storage, handling and protection.

1.2 RELATED SECTIONS

.1 Section 01 45 00 - Quality Control.

1.3 EQUIPMENT AND SYSTEMS

.1 Information in this section is to be incorporated into the Operation and Maintenance Manuals.

.2 List 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.

.3 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.4 Include installed colour coded wiring diagrams.

.5 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.

.6 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.7 Provide servicing and lubrication schedule, and list of lubricants required.

.8 Include manufacturer's printed operation and maintenance instructions.

.9 Include sequence of operation by controls manufacturer.

.10 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.11 Provide installed control diagrams by controls manufacturer.

.12 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.

.13 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.14 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.15 Include test and balancing reports as required.

.16 Additional requirements: As specified in individual specification sections.

PART 2 PRODUCTS

2.1 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.

2.2 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 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.

.4 Obtain receipt for delivered products and submit prior to final payment.

2.3 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 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.

.4 Obtain receipt for delivered products and submit prior to final payment.

2.4 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 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.

PART 3 EXECUTION

3.1 DELIVER TO SITE

.1 Deliver to site location as directed, place and store.

3.2 STORAGE, HANDLING AND PROTECTION

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration. Confirm with Consultant and Owner.

.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 Consultant.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Procedures for demonstration and instruction of Products, equipment and systems to Owner's personnel.

.2 Demonstrations.

1.2 RELATED SECTIONS

.1 This section describes requirements applicable to all Sections.

1.3 DESCRIPTION

.1 Demonstration and Training is to occur after Commissioning has been completed and reports submitted to Consultant.

.2 Demonstrate operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date of substantial performance.

.3 Owner will provide list of personnel to receive instructions and will coordinate their attendance at agreed-upon times.

1.4 COMPONENT DEMONSTRATION

.1 Manufacturer to provide authorized representative to demonstrate operation of equipment and systems.

.2 Instruct Owner's personnel and provide written report that demonstration and instructions have been completed.

1.5 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 Consultant'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.

1.6 CONDITIONS FOR DEMONSTRATIONS

.1 Equipment has been inspected and put into operation in accordance with specified requirements.

.2 Testing, adjusting, and balancing has been performed and equipment and systems are fully operational.

.3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 PREPARATION

.1 Verify that suitable conditions for demonstration and instructions are available.

.2 Verify that designated personnel are present.

.3 Prepare agendas and outlines.

.4 Establish seminar organization.

.5 Explain component design and operational philosophy and strategy.

.6 Develop equipment presentations.

.7 Present system demonstrations.

.8 Accept and respond to seminar and demonstration questions with appropriate answers.

3.2 PREPARATION OF AGENDAS AND OUTLINES

.1 Prepare agendas and outlines including the following:

- .1 Equipment and systems to be included in seminar presentations.
- .2 Name of companies and representatives presenting at seminars.
- .3 Outline of each seminar's content.
- .4 Time and date allocated to each system and item of equipment.
- .5 Provide separate agenda for each system

3.3 SEMINAR ORGANIZATION

.1 Coordinate content and presentations for seminars.

.2 Coordinate individual presentations and ensure representatives scheduled to present at seminars are in attendance.

.3 Arrange for presentation leaders familiar with the design, operation, maintenance and troubleshooting of the equipment and systems. Where a single person is not familiar with all aspects of the equipment or system, arrange for specialists familiar with each aspect.

.4 Coordinate proposed dates for seminars with Owner and select mutually agreeable dates.

3.4 EXPLANATION OF DESIGN STRATEGY

.1 Explain design philosophy of each system. Include following information:

.1 An overview of how system is intended to operate.

.2 Description of design parameters, constraints and operational requirements.

.3 Description of system operation strategies.

.4 Information to help in identifying and troubleshooting system problems.

3.5 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 Instruct personnel on control and maintenance of sensory equipment and operational equipment associated with maintaining energy efficiency and longevity of service.

.4 Review contents of manual in detail to explain all aspects of operation and maintenance.

.5 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 INTENT

.1 This Section includes, but not limited to, the following:

- .1 Demolition, removal completely from site, and disposal of all identified components, materials, equipment and debris
- .2 Selective demolition to allow new, doors, flooring and other materials to meet existing construction as indicated.
- .3 Repair procedures for selective demolition operations.

.2 This Section does not include the following:

- .1 Removal of hazardous materials or asbestos abatement. Refer to Section 02 81 01 – Hazardous Materials.
- .2 Mechanical or electrical equipment, except as required to make minor modifications to allow the work to be completed.

.3 Drawings contain details that suggest directions for solving some of the demolition and removal requirements for this project; Contractor is required to develop these details further by submitting a demolition plan prepared by a professional engineer employed by the Contractor.

1.2 RELATED SECTIONS

.1 Section 01 35 34 – Infection control cleaning requirements

.2 Section 01 73 30 – Cutting and Patching

.3 Section 09 21 16 – Gypsum Board Assemblies

.4 Section 09 91 10 – Painting

.5 Division 22 – Mechanical: Specific requirements for demolishing, cutting, patching, or relocating mechanical items.

.6 Division 26 – Electrical: Specific requirements for demolishing, cutting, patching, or relocating electrical items.

1.3 REFERENCES

.1 American National Standards Institute (ANSI)

- .1 ANSI A10.8-2011, Safety Requirements for Scaffolding.

.2 Canadian Federal Legislation

- .1 Motor Vehicle Safety Act (MVSA), 1995
- .2 Hazardous Materials Information Review Act, 1985

.3 Canadian Standards Association (CSA)

- .1 CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.

.4 National Fire Protection Association (NFPA)

- .1 NFPA 241-2013, Standard for Safeguarding Construction, Alteration, and Demolition Operations.

.5 Provincial Legislation

.1 Legislation specific to Authority Having Jurisdiction for work governed by this Section

1.4 DEFINITIONS

.1 Demolish: Detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstalled.

.2 Remove and Salvage: Detach items from existing construction and deliver them to Owner.

.3 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

.4 Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Demolition Meeting: Conduct a pre-demolition meeting at Project site in accordance with requirements listed in Section 01 10 00 – Owners General Requirements, to confirm extent of salvaged and demolished materials.

.2 Coordination:

.1 Coordinate selective demolition work so that work of this Section adheres to aesthetic criteria established by the Drawings and specified dimensions with all elements in planes as drawn, maintaining their relationships with all other building elements.

.2 Coordination with Owner's continuing occupancy of portions of existing building.

.3 Coordination for shutoff, capping, and continuation of utility services.

.3 Material Ownership:

.1 Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor’s property and shall be removed from Project site.

.4 General Items for Salvage: unless otherwise indicated by owners’ Facilities staff, items to be salvaged include:

.1 Doors and Door openers/controls/hardware

.2 Stainless corner guarding

.3 HVAC equipment excluding pneumatic HVAC Controls

.4 Door intercom system equipment

1.6 SUBMITTALS

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

.2 Provide the following submittals before starting work of this Section:

.1 Schedule of Selective Demolition Activities: Coordinate with Construction Progress Documentation, and indicate the following:

.1 Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.

.2 Interruption of utility services.

.3 Schedule of selective demolition.

.4 Coordination for shutoff, capping, and continuation of utility services.

.5 Locations of temporary partitions and means of egress, including for other tenants affected by selective demolition operations.

.3 Pre-demolition Photographs or Videotape: Submit photographs or videotape indicating existing conditions of adjoining construction and site improvements prior to starting Work. Include finish surfaces that may be misconstrued as damage caused by selective demolition operations.

1.7 QUALITY ASSURANCE

.1 Regulatory Requirements: Perform work as follows; use most restrictive requirements where differences occur between the municipal, provincial and federal jurisdictions:

.1 Provincial and Federal Requirements: Perform work in accordance with governing environmental notification requirements and regulations of the Authority Having Jurisdiction.

.2 Municipal Requirements: Perform hauling and disposal operations in accordance with regulations of Authority Having Jurisdiction.

.3 Conform to the British Columbia Occupational Health and Safety Regulations.

.4 Conform to Workers' Compensation Board Regulations.

.5 Conform to local municipal bylaws and regulations governing this type of work.

.2 Comply with regulations of local authorities having jurisdiction and standards referenced above. Where differences occur between the local regulations and referenced standards, the most restrictive requirement shall govern.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 10 00 – Owners General Requirements.

.2 Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner’s property, demolished materials shall become Contractor’s property and shall be removed from Project site. Maximize to the fullest extent possible, salvage, and recycling of such materials, consistent with proper economy and expeditious performance of the Work.

.3 To reduce the quantity of material otherwise destined for disposal at a landfill, the Contractor is encouraged to consider utilizing the services of businesses and non-profit organizations that specialize in salvage and recycling of used building materials, but does so at his own option and risk.

1.9 SITE CONDITIONS

.1 Visit and examine the site and note all characteristics and irregularities affecting the work of this Section.

.2 Owner will occupy portions of building immediately adjacent to selective demolition area:

.1 Conduct selective demolition so that Owner's operations will not be disrupted.

.2 Provide not less than 72 hours notice to Owner of activities that will affect Owner's operations.

.3 Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities:

.1 Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.

.4 Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

.5 Maintain fire-protection facilities in service during selective demolition operations.

Part 2 Products

2.1 DEBRIS

.1 Make all arrangements for transport and disposal of all demolished materials from the site.

2.2 EQUIPMENT

.1 Provide all equipment required for safe and proper demolition.

.2 Use equipment suitable for work identified.

.3 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

2.3 REPAIR MATERIALS

.1 Use repair materials identical to existing materials:

.1 If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible. Submit samples to Consultant for approval.

.2 Use material whose installed performance equals or surpasses that of existing materials.

.3 Comply with material and installation requirements specified in individual Specification Sections.

.2 Floor Patching and Levelling Compounds: Cement based, trowelable, self-levelling compounds compatible with specified floor finishes. Gypsum based products are not acceptable for work of this Section.

.3 Floor Preparation: Remove sub-floor ridges and bumps. Grind floor to provide uniform levelling between existing and new floor drains. Fill low spots, cracks, joints, holes and other defects with sub-floor filler. Fill openings through slab with cementitious fire stop. Clean and shot blast floor. Apply and average filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.

.4 Gypsum Board Patching Compounds: Joint compound to ASTM C475, bedding and finishing types thinned to provide skim coat consistency to patch and prepare existing gypsum board walls ready for new finishes in accordance with Section 09 21 16 – Gypsum Board Assemblies.

.5 Hoarding and Dust Screens:

.1 Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.

.2 Maintain and relocate protection until such work is complete.

2.4 EXISTING MATERIALS

.1 Items to be retained for re-use in new construction include, but are not limited to the following:

.1 As indicated on Drawings.

Part 3 Execution

3.1 EXAMINATION

.1 Inspect building and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.

.2 Locate and protect utilities. Verify that utilities have been disconnected and capped as required.

.3 Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

.4 Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

.5 Notify the Consultant where existing mechanical, electrical, or structural elements conflict with intended function or design:

.1 Investigate and measure the nature and extent of conflict and submit a written report to Consultant.

.2 Consultant will issue additional instructions or revise drawings as required to correct conflict.

.6 Engage a Professional Engineer to survey condition of building when removing elements that may result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.

.7 Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

.1 Coordinate existing services indicated to remain and protect them against damage during selective demolition operations.

.2 Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.

.1 Arrange to shut off affected utilities with utility companies.

.2 If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.

.3 Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

.4 Cut off pipe or conduit to a minimum of 25 mm below slab, and remove concrete mound.

.3 Coordinate with mechanical and electrical sections for shutting off, disconnecting, removing, and sealing or capping utilities.

.4 Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 PREPARATION

.1 Identify and mark all equipment and materials identified to be retained by Owner or to be re-used in subsequent construction. Separate and store items to be retained in an area away from area of demolition and protect from accidental disposal.

.2 Post warning signs or electrical lines and equipment that must remain energized to serve other areas during period of demolition.

.3 Confirm that all electrical and telephone service lines entering building are not disconnected.

.4 Do not disrupt active or energized utilities crossing the demolition site.

.5 Provide and maintain barricades, warning signs, protection for workmen and the public during the full extent of the Work. Read drawings carefully to ascertain extent of protection required.

.6 Mark all materials required to be re-used, store in a safe place until ready for re-installation.

.7 Adjust all junction boxes, receptacles and switch boxes flush with new wall construction where additional layers to existing construction are indicated.

.8 Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

3.4 PROTECTION

.1 Take precautions to guard against damage to adjacent work. Be liable for any damage or injury caused.

.2 Cease operations and notify Consultant if safety or any adjacent work appears to be endangered. Do not resume operations until reviewed with Consultant.

.3 Prevent debris from blocking drainage inlets and systems and ground draining and protect material and electrical systems and services that must remain in operation.

.4 Keep noise, dust, and inconvenience to occupants to minimum.

.5 Protect building systems, services and equipment.

.6 Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain and as follows:

.1 Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

.2 Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.

.3 Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

.4 Cover and protect furniture, furnishings, and equipment that have not been removed.

.7 Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.

.8 Provide and maintain fire prevention equipment and alarms accessible during demolition.

.9 Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

3.5 SELECTIVE DEMOLITION

.1 Demolish and dismantle work in a neat and orderly manner and in strict accordance with all regulations.

.2 At end of each day's work, leave Work in safe condition so that no part is in danger of toppling or falling.

.3 Demolish in a manner to minimize dusting and to prevent migration of dust.

.4 Burning of demolition materials is not permitted.

.5 Remove concrete bases by cutting and chipping, take precautions against slab cracking and degradation. Grind edges smooth, fill and make level with self levelling grout.

.6 Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

.1 Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.

.2 Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

.3 Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

.4 Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.

.5 Maintain adequate ventilation when using cutting torches.

.6 Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

.7 Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

.8 Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.

.7 Demolish existing flooring and adhesive remnants as follows:

.1 Apply fine mist water spray to floors to minimize dust generation during removal. Avoid spraying near electrical outlets.

.2 Demolish existing residual floor finishes, remove and dispose of off site.

.3 Remove adhesive to the greatest extent possible using scrapping tools and as follows:

.1 Do not use solvent based cleaners to remove adhesive remnants.

.2 Lightly shot blast or grind floor using machine designed for purpose to remove adhesive remnants.

.3 Vacuum floor ready for application of skim coating.

.4 Repair all slab depressions and damage with cementitious patching compound.

.5 Skim coat floor with minimum 1 mm thick cementitious floor underlayment compatible with new flooring materials.

.4 Floor substrate shall be smooth, free from ridges and depressions, and adhesive remnants that could telegraph through resilient flooring materials and carpets.

.8 Demolish existing tile finishes. Remove setting bed or adhesive to the greatest extent possible using mechanical scrapping tools and as follows:

.1 Saw cut edge of tile for clean and even transition joint between existing tile to remain and new flooring materials.

.2 Lightly shot blast or grind floor to remove remnants of setting materials.

.3 Vacuum floor ready for application of skim coating.

.4 Repair all slab depressions and damage with cementitious patching compound. Skim coat floor with minimum 1 mm thick cementitious floor underlayment compatible with new flooring materials.

.9 Fill all openings in gypsum board walls with gypsum board and framing to match existing, skim coat to make wall smooth and even.

.10 Patch and repair all walls, floor and ceilings damaged during demolition with material matching adjacent walls, prepare ready for new finishes.

.11 Patch and repair all mechanical equipment and electrical fixtures damaged or exposed during demolition to match adjacent finished surfaces.

3.6 PATCHING AND REPAIRING

.1 Floors and Walls: refer to Section 01 73 30 – Cutting and Patching and as follows:

.1 Where walls or partitions that are demolished extend from one finished area into another, patch and repair floor and wall surfaces in the new space.

.2 Provide a level and smooth surface having uniform finish colour, texture, and appearance.

.3 Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform colour and appearance.

.4 Patch with durable seams that are as invisible as possible.

.5 Provide materials and comply with installation requirements specified in other Sections of these Specifications.

.6 Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.

.7 When requested, test and inspect patched areas after completion to demonstrate integrity of installation.

.2 Restore areas and existing works outside areas of demolition to conditions that existed prior to beginning of Work.

3.7 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 Consultant and re-install under appropriate section of specification.

3.8 DISPOSAL

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

3.9 CLEANUP

.1 Promptly as the Work progresses, and on completion, clean up and remove from the site all rubbish and surplus material. Remove rubbish resulting from demolition work daily.

.2 Maintain access to exits clean and free of obstruction during removal of debris.

.3 Keep surrounding and adjoining roads, lanes, sidewalks, municipal rights-of-way clean and free of dirt, soil or debris that may be a hazard to vehicles or persons.

END OF SECTION

Part 1 – General

1.1 DOCUMENTS

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

1.2 SECTION INCLUDES

.1 Removal, clean up, transport and disposal of all asbestos containing materials and other hazardous materials identified in way of the work in accordance with applicable regulatory requirements.

1.3 RELATED SECTIONS

.1 Section 01 35 34 Infection Control – Cleaning Requirements

1.4 PERMITS

.1 Ensure that through the requirements for renovations or demolition, all electrical disconnection, capping or isolation of the appropriate services and utilities is complete should these services be affected by the removal.

1.5 STANDARDS

.1 Conform to and perform work in accordance with the B.C. Worker's Compensation Board.

.2 Conform to and perform work in accordance with M.S.D.S. sheets for all regulated products in use on the project.

.3 Conform to and perform work in accordance with CSA Z-190 standard for respirator fit testing.

.4 Conform to and perform work in accordance with WCB WHMIS core manual.

.5 Conform to and perform work in accordance with current WCB Occupational Health & Safety Regulations.

.6 Conform to and perform work in accordance with current WCB publication regarding work with asbestos.

.7 Conform to and perform work in accordance with Latest edition of the BC Building Code.

.8 Conform to and perform work in accordance with all applicable electrical codes.

.9 Conform to and perform work in accordance with WCB manual of First Aid requirements.

.10 Conform to and perform work in accordance with WCB Notice of Project.

.11 Conform to and perform work in accordance with WCB publication - "Confined Space Entry - A Manual of Standard Practice" (Latest Edition).

.12 Conform to CSA Z 317.13 -12 Infection Control during the Construction, Renovation and Maintenance of Health Care Facilities

.13 Conform to and perform work in accordance with CSA S350-M1980, Code of Practice for Safety in Demolition of Structures

1.6 PROCEDURES AND REQUIREMENTS

.1 The Hazardous Materials (hazmat) Contractor will be a subcontractor to the Prime Contractor for the purposes of this Specification unless otherwise determined in contract documents.

.2 Asbestos removal for this project will be conducted under moderate risk work conditions as defined by the Work Safe B.C. publication "Safe Work Practices for Handling Asbestos".

.3 The HazMat Contractor and the Prime Contractor must submit, upon award, a copy of his exposure control plans and site-specific written work procedures including methods of hazardous materials removal or procedures to work on or around hazardous materials specifically as they relate to this project.

Part 2 – Description of Work

2.1 SCOPE OF WORK

.1 The scope of work covers the complete removal, cleanup, transport and disposal at a licensed landfill of all asbestos, lead and PCB containing materials and equipment in way of the work as defined in the project Architectural, Mechanical, Structural and Electrical Specifications and Drawings.

.2 HazMat removal for this project will be conducted under Moderate and High-Risk work conditions as defined by the Work Safe B.C. for Asbestos, Lead, Silica and PCBs.

.3 Conditions of Work:

1. All work at Queen Charlotte Hospital site must conform to CSA Z317.13-17 Standards and WorkSafeBC Occupational Health and Safety Regulations and Guidelines.

2. Viewing Windows must be installed within each enclosure to provide unrestricted access for use by the Fire Department, Night Watchman, Supervisors and Consultants. The viewing window will be a minimum of two feet by two feet in size.

3. The waste bins will be in the loading dock or other approved SJH FM&O location.

Part 3 – Waste Handling and Disposal

.1 Disposal of all hazardous wastes will be conducted in accordance with the B.C. Ministry of Environment and local regulations pertaining to hazardous waste.

.2 The contractor will have a Transportation or Dangerous Goods certified person prepare a waste manifest form prior to the disposal of any asbestos-containing waste materials from the site.

.3 All waste bins used for material transportation will be lockable. The contractor will ensure that the waste bin is always locked when there is no employee watching the bin. Hazardous wastes will be moved only after 07:00 p.m. or as agreed to by the owner.

.4 The waste level in the bins is not to go above one foot from the top of the bin before transport.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Furnishing of all labour, materials, services and equipment necessary for:

- .1 Finishing slabs-on-grade and monolithic suspended floor slabs.
- .2 Concrete topping, sealers, patching and levelling compounds.
- .3 Surface treatment with concrete hardener and sealer.
- .4 Floor finishing and tolerances.
- .5 Forming and Finishing of concrete housekeeping pad.

1.2 RELATED SECTIONS

.1 Section 01 74 21 –Construction Waste Management and Disposal.

.2 Section 07 92 00 - Joint Sealants.

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 CAN/CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction / Methods of Test for Concrete.

.3 CAN/CGSB-25.20, Surface Sealers for Floors.

.4 ACI 302.1R, Guide for Concrete Floor and Slab Construction.

.5 ASTM E1155M, Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.

1.4 SUBMITTALS

.1 Section 01 33 00: Submittal procedures.

.2 Product Data: Provide data on concrete hardener, sealer, and slip resistant finish compatibilities, and limitations.

1.5 MAINTENANCE DATA

.1 Section 01 33 00: Submittal procedures.

.2 Maintenance Data: Provide data on maintenance renewal of applied coatings.

1.6 QUALITY ASSURANCE

.1 Perform Work in accordance with CAN/CSA A23.1/A23.2.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials in manufacturer's packaging including application instructions.

1.8 COORDINATION

.1 Coordinate floor finishing with concrete floor placement and concrete floor curing.

1.9 WASTE MANGEMENT AND DISPOSAL

.1 Comply with Section 01 74 21 - Construction Waste Management and Disposal.

Part 2 Products

2.1 CONCRETE TOPPING

.1 Portland cement based, self-leveling, self-drying topping.

.2 Acceptable materials;

.1 Sika EmeriCrete Topping

.2 Target Bonded Topping Mix

.3 Ardex K 301 Self-Leveling Concrete Topping; Ardex K 500 self-leveling cementitious topping; or Ardex SD-T fast track self leveling, self drying concrete topping.

.4 Or approved substitution.

.3 Product selection to be compatible with flooring to be installed.

2.2 CAST IN PLACE CONCRETE

.1 Concrete materials, quality, mixing, placing, formwork and other construction practices to conform to csaa23.1/a23.2

.2 Supply controlled concrete in accordance with csa-a23.1 with properties noted in schedule of concrete properties.

.3 Use normal weight 2400 kg/m3 type gu cement for all concrete.

2.3 CONCRETE REINFORCING

.1 Reinforcement steel to conform to CSA-G30.18-09 grade 400R and grade 400W where welding is required.

.2 Submit shop drawings and details for all reinforcement for review prior to fabrication.

.3 Reinforce all interior housekeeping slabs with 10m at 300 mm on center unless noted otherwise. Provide dowels into the existing concrete slab.

2.4 BONDING AGENTS

.1 Portland cement/ epoxy-based bonding agent: Formulated for bonding new concrete to cured concrete.

.2 Acceptable materials;

.1 Ardex Bonding and Anti-corrosion agent

.2 Grace Daraweld C

.3 Target Polymer Bonding Agent

.4 Sternson Surfacrete Concentrate Bond Agent

.5 Steels Multipurpose Acrylic

.6 Or approved substitution.

2.5 LEVELING COMPOUND:

.1 Self-drying, cement-based, polymer modified, trowel-grade underlayment.

.2 Acceptable materials:

.1 Mapei Plani/Patch

.2 Ardex Feather Finish, Ardex Fortifinish high strength, Ardex SD-P trowelabe and rampable.

.3 Starpatch Super Fine Skim Coat Mortar

.4 Or approved substitution.

2.6 SURFACE SEALER

.1 Surface sealer: acrylic polymer water emulsion type, clear, to CAN/CGSB-25.20, Type 2 or ASTM-C309, Type 1.

.1 Acceptable material:

.1 CPD Acrylic Floor Sealer (Water Emulsion)

.2 W.R. Meadows Sealtight Vocomp-20

.3 Sika Florseal WB 25.

.4 Sonneborne Kure-N-Seal WB

2.7 FLOOR HARDENER

.1 Non-metallic hardener (plain): premixed, dry shake surface hardener.

.1 Acceptable material: Sternson Diamag 7; Target Non-Metallic; CPD Floor Hardener Pre-Mix (Standard); Master Builders Mastercron; Sonneborn Harcol Redi-Mix.

.2 Non-metallic hardener (coloured): premixed, dry shake surface hardener, colour selected by Consultant.

.1 Acceptable material: Sternson Colorplete; Master Builders Colorcron; Sonneborn Harcol Redi-Mix.

2.8 MIXING

.1 Site mix materials in accordance with manufacturer's written instructions.

2.9 SUBSTITUTIONS

.1 Specified manufacturer's products stated herein establish minimum acceptable standards for work of this Section.

.2 Other manufacturers offering products meeting or exceeding specified products and requirements may be considered.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify site conditions.

.2 Verify that floor surfaces are acceptable to receive the work of this section.

3.2 PREPARATION

.1 Prior to finishing concrete floors, confirm with the manufacturers of all finished flooring to be used on the project, the specific floor finish, (rough or smooth) required for the application of the finished flooring.

.2 Prior to application of levelling compounds and curing compounds, confirm compatibility of products with finished flooring manufacturers.

.3 Examine surfaces to receive curing compounds, patching and levelling compounds and report any defects which may affect the performance of the work of this section.

.4 Beginning of installation means acceptance of existing conditions.

.5 Prepare and clean substrates in accordance with manufacturer's directions for application of curing compounds, patching and levelling compounds.

.6 Concrete surfaces shall have been cured for time periods stipulated by manufacturers for installation of their products.

3.3 FLOOR SLAB FINISHING

.1 Finish concrete floor surfaces in accordance with CSA-23.1, Section 22 - Treatment of Unformed Surfaces, for Class 'A' floor finish.

.2 Steel Trowel Finish: In accordance with CSA-23.1, Section 22 and as follows:

.1 Thoroughly float surface with disc power floating machine until compacted. Continue floating until sufficient mortar rises to surface and fills all voids.

.2 When floor surface has hardened sufficiently and no fines are brought to the surface, trowel floor with steel trowel to smooth surface free from pinholes and imperfections.

.3 Ensure trowel disc lines are removed and provide a smooth hard burnished finish.

.4 Schedule:

.1 Concrete floors to be prepared to receive resilient flooring.

.3 Tool all control joints and construction joints. Coordinate tooling with concrete finishing. Re-tool joints at completion of finishing as required to give full size joint and provide sound substrate suitable for sealant application.

3.4 FLOOR TOLERANCES

.1 Concrete tolerance for horizontal surfaces in accordance with CSA-A23.1/A23.2. Use F-number method to verify flatness within 48 hours after slab installation.

.2 Finish concrete to achieve the following tolerances:

.1 Under Resilient Finishes: F_F 32 and F_L 25.

.3 Correct the slab surface if the actual F_F or F_L number for the floor installation measures less than required.

.4 Correct defects in the defined traffic floor by grinding or removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.5 APPLICATION: CURING COMPOUND

.1 Apply curing and sealing compound in accordance with the manufacturer's instructions to all areas not scheduled to receive further floor finish. Apply at the rate of not less than 10 m2/litre for smooth steel troweled surfaces and 5 to 7.5 m2/litre for float or broom finished surfaces.

.2 Do not apply concrete curing compound to floors designated to receive resilient flooring, liquid applied finishes or ceramic tile.

3.6 APPLICATION: SURFACE SEALERS

.1 Ensure compatibility of floor treatment materials with adhesives of finished flooring

materials and other bonded toppings or coatings prior to application.

.2 Apply floor treatment in accordance with manufacturer's written instructions.

.3 Clean overspray. Clean sealant from adjacent surfaces.

3.7 APPLICATION: FLOOR HARDENERS

.1 Apply hardener in accordance with manufacturer's written instructions.

.2 Apply floor hardener aggregate at rate of 0.75 - 1.0 lbs/ft² [3.66 - 4.88 kg/m²] for a "light duty" hardened surface.

.3 Apply floor hardener aggregate at rate of 1.0 - 1.25 lbs/ft² [4.88 - 6.1 kg/m²] for a "medium duty" hardened surface.

.4 Protect finished installation until floor treatment has cured.

3.8 BONDING AGENT

.1 Apply bonding agent to all concrete when new concrete will be applied against it under the following conditions:

.1 Patching

.2 At construction joints.

3.9 DEFECTIVE CONCRETE

.1 Repair honeycombing, rock pockets, chips, spalls and stains in exposed concrete surfaces. Remove fins and other protrusions in concrete surfaces by chipping, not grinding.

3.10 PROTECTION

.1 At all times during the work protect architectural members as required with polyethylene sheets or the like from staining or becoming coated with leakage, due to continuing concreting operations. Protect concrete from staining due to rusting of reinforcing steel.

3.11 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 As work proceeds and on completion deposit all recyclable packing materials and containers in appropriate recycling containers.

.3 Rubbish and debris resulting from work of this section shall be collected regularly, and removed from the project site and disposed of in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Repair, remove and clean all drips or smears resulting from the work of this section on exposed, finished surfaces or surfaces to be subsequently finished.

.5 Clean adjacent soiled surfaces.

3.12 SCHEDULES

.1 Refer to Room Finish Schedule for Areas with resilient flooring, and concrete housekeeping pads.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Roof curbs.

1.2 RELATED SECTIONS

.1 Section 07 21 16 – Blanket Insulation

1.3 REFERENCES

.1 APA (American Plywood Association) - Grades and Specifications.

.2 CANPLY (Canadian Plywood Association) - Grading and certification.

.3 CSA O121-M1978 (R2003) - Douglas Fir Plywood

.4 CSA O151-04 - Canadian Softwood Plywood.

.5 NLGA (National Lumber Grades Authority) - Standard Grading Rules for Canadian Lumber 2005.

1.4 SUBMITTALS FOR REVIEW

.1 Section 01 33 00 - Submittal Procedures.

1.5 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00 - Submittal Procedures.

1.6 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 9000 certification requirements.

.2 Perform Work in accordance with the following agencies:

- .1 Lumber Grading Agency: Certified by NLGA.
- .2 Plywood Grading Agency: Certified by CANPLY, APA

1.7 DELIVERY, STORAGE, AND PROTECTION

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

.2 Storage and Handling Requirements:

- .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect wood from nicks, scratches, and blemishes.
- .3 Protect materials from warping or other distortion by stacking in vertical position.
- .4 Replace defective or damaged materials with new.

Part 2 Products

2.1 LUMBER MATERIALS

.1 Lumber: NLGA (Standard Grading Rules for Canadian Lumber).

.1 CSA O141, softwood SPF species, grade 2.

.2 19 percent maximum moisture content.

2.2 PLYWOOD MATERIALS

.1 Plywood: 19 mm plywood to CSA 0121, 1220 x 2440 mm sheets.

.1 Locations: locations as detailed on drawings.

2.3 ACCESSORIES

.1 Sealants: to Section 07 92 00 - Joint Sealing.

.2 General purpose adhesive: to CSA O112 Series.

.3 Nails, spikes, and staples: to CSA B111 and NBC requirements.

.4 Fasteners and Anchors:

.1 Fasteners: Hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.

.5 Structural Framing Connectors: Hot dipped galvanized steel, sized to suit framing conditions, manufactured by Simpson Strong Tie or Approved Equivalent.

Part 3 Execution

3.1 FRAMING

.1 Construct framing members full length without splices.

.2 Furring and blocking:

.1 Install furring and blocking as required to space-out and support casework, cabinets, surface applied fixtures and equipment, wall and ceiling finishes, and other work as indicated.

.2 Construct base around new flue thru roof to match size of existing curbs.

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

3.2 ERECTION TOLERANCES

.1 Framing Members: 6mm from true position, maximum.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Interior sound attenuating insulation.

.2 Exterior roof curbing.

1.2 RELATED SECTIONS

.1 Section 06 11 00 – Rough Carpentary

.2 Section 09 21 16 – Gypsum Board Assembles

1.3 REFERNCES

.1 ASTM C665-06 - Mineral-Fibre Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

.2 ASTM E84 -07- Test Method for Surface Burning Characteristics of Building Materials.

.3 CAN/ULC-S102-03 - Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.4 CAN/ULC-S702-97 - Thermal Insulation, Mineral Fibre, for Buildings.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordinate with other work having a direct bearing on work of this section.

1.5 SUBMITTALS FOR REVIEW

.1 Section 01 33 00 - Submittal Procedures.

.2 Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

1.6 QUALITY ASSURANCE

.1 Perform Work in accordance with GANA Glazing Manual, for glazing installation methods.

Part 2 Products

2.1 MATERIALS

.1 Mineral Fibre Insulation (Acoustic / interior walls): CAN/ULC-S702, Type 1, mineral fibre, semi-rigid board, with the following characteristics:

.1 Board Density: 45 kgs/m3.

.2 Board Size: stud/girt spacing x 1219 mm.

.3 Board Thickness: As per drawings, fill stud/girt cavity.

.4 Facing: Unfaced

.5 Batt Edges: Square

.6 Flame/Smoke Properties: 0/0 in accordance with CAN/ULC-S102

.7 Air Erosion: maximum air velocity 5.08 m/s.

.8 Locations: interior walls

.9 Exterior roof curb.

.2 Insulation Fasteners: Steel impale spindle and clip on flat metal base, self-adhering backing, length to suit insulation thickness, capable of securely and rigidly fastening insulation in place.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00 - Examination and Preparation, verify existing conditions before starting work.

.2 Verify that substrate, adjacent materials, and insulation are dry and ready to receive insulation.

3.2 INSTALLATION

.1 Install in walls spaces without gaps or voids. Do not compress insulation.

.2 Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

.3 Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation.

.4 Retain insulation in place with fasteners secured to framing members. Tape seal tears or cuts in vapour retarder.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 61 00 – Common Product Requirements

.2 Section 01 74 11 – Cleaning

.3 Existing Metal Roofing

.4 Section 07 92 00 – Joint Sealants

1.2 REFERENCES

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

.1 ASTM A653/A653M-07, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM D523-89(1999), Standard Test Method for Specular Gloss.

.3 ASTM D822 - 01(2006) Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.3 Roofing Contractors Association of British Columbia (RCABC).

.1 RGC, RCABC Guarantee Corporation

.2 RGC Manual, RGC Roofing Practices Manual published by RCABC.

.4 Canadian General Standards Board

.1 CAN/CGSB 37.5-M89, Cutback Asphalt Plastic Cement

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies WHMIS MSDS - Material Safety Data Sheets.

.3 Submit manufacture’s full colour range for review and selection.

.3 Shop Drawings:

.1 Shop drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations and installation details.

.2 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

.3 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3, FIELD QUALITY CONTROL

1.4 QUALITY ASSURANCE

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements.

Part 2 Products

2.1 SHEET METAL MATERIALS

.1 Zinc coated steel sheet: commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.

.1 Thickness: 24 gauge

.2 Finish: Prefinished

.2 Prefinished steel with factory applied polyvinylidene fluoride.

.1 Colour: to matching existing roof panels.

.2 Specular gloss: 30 units +/- in accordance with ASTM D523.

.3 Coating thickness: not less than 22 micrometres.

.4 Resistance to accelerated weathering for chalk rating of 8, colour fade 5units or less and erosion rate less than 20 % to ASTM D822 as follows:

.1 Outdoor exposure period 2500 hours.

.2 Humidity resistance exposure period 5000 hours.

2.2 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint.

.2 Plastic cement: to CAN/CGSB 37.5.

.3 Sealants: Refer to Section 07 92 00 – Joint Sealants.

.4 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.

.5 Fasteners: of same material as sheet metal.

.6 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.7 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 CRCA 'FL' series details as indicated.

.2 Form pieces in 2400 mm maximum lengths.

.1 Make allowance for expansion at joints.

.3 Hem exposed edges on underside 12 mm.

.1 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

.1 Form flashings, copings to profiles indicated or as required.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install sheet metal work in accordance with RCABC.

.2 Use concealed fastenings except where approved before installation.

.3 Provide underlay under sheet metal.

.1 Secure in place and lap joints 100 mm.

.4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs.

.1 Flash joints using standing seams forming tight fit over hook strips, as detailed.

.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 under cap flashing 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 Install pans, where shown around items projecting through roof membrane.

.10 Construct curb around new flue thru existing metal roof panels and seal.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.4 CLEANING

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

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Leave work areas clean, free from grease, finger marks and stains.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.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 mechanical and electrical sections respectively.

1.2 REFERENCES

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

.2 National Building Code of Canada (NBC) – 2015 edition.

.3 BCBC - 2018

1.3 DEFINITIONS

.1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.

.2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.

.3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.

.4 Tightly Fitted; (ref: NBC Part 3.1.9.1.1): penetrating items that are cast in place in buildings of noncombustible construction or have "0" annular space in buildings of combustible construction.
  .1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.4 SUBMITTALS

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

.2 Product Data:

  .1 Submit ULC or cUL Design system listing.

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

  .3 Where there is no specific tested design system listing available for particular fire stop configuration, the contractor shall obtain from the manufacturer an Engineering Judgement (EJ).

    .1 Each EJ shall come with a drawing of the proposed system, a description of the system, Project Name and Room Name / Number that the EJ is located in, copies of all referenced Design Listings, and signed and dated by the Manufacturer’s fire protection engineer.

    .2 EJ’s shall be accepted only for a single specific job and location and should not be transferred to any other job or location without thorough and appropriate review of all aspects of the next job or location’s circumstances.

.3 Shop Drawings:

.1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.

.2 Construction details shall accurately reflect actual job conditions.

.3 Submit shop drawings and details for each type of fire stopping installation.

.4 Provide separate fire stopping schedules for wall penetrations and for floor / ceiling penetrations. Each schedule shall include location of installations, ID plate numbers, FS number, room number, etc.

A typical Firestopping Schedule as follows:

Ref No.	Dwg. No.	Room No.	Wall Type	I.D. Plate No.	Photo No.	Quantity	Description	Size	FS No.	Design No.	Penetration Notes

.5 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.

.1 Test reports: in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics.

.1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.

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

.3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

.4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work.

1.5 QUALITY ASSURANCE

.1 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.

.2 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.

.3 A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate the Contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

.4 Qualifications:

.1 Company: specializing in fire stopping installations with at least one of the following qualifications:

.1 FM 4991 Approved the Contractor.

.2 UL Approved the Contractor.
.3 Manufacturer accredited fire stop specialty applicator.

.2 Installers: person with not less than 3 years documented experience with fire stop installation and approved/trained by manufacturer.

.5 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with the Contractor's representative and the Consultant to:
.1 Verify project requirements.
.2 Review installation and substrate conditions.
.3 Co-ordination with other building subtrades.
.4 Review manufacturer installation instructions and warranty requirements.

.6 Site Meetings: as part of Manufacturer's Services to schedule site visits, to review Work, at stages listed.
.1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.
.2 Twice during progress of Work at 25% and 60% complete.
.3 Once during deficiency review.
.4 Once upon completion of Work, after cleaning is carried out.

.7 Fire stopping shall be applied by factory trained specialist, provide evidence of valid certification “Fire Stopping Contractors International Association (FCIA)”.

.8 Hire an independent agent (Engineer or Architects registered in the Province of British Columbia) approved by Consultant to conduct inspection for fire stopping installation, submit letter of assurance for field review and compliance

1.6 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

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

.3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.

.2 Storage and Protection:

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

.2 Replace defective or damaged materials with new.

1.7 WASTE MANAGEMENT AND DISPOSAL:

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

Part 2 Products

2.1 FIRE STOP SYSTEMS - GENERAL

.1 Use only fire stop materials that have been ULC or cUL tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

.2 Provide fire stopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the fire stopping under conditions of service and application, as demonstrated by the fire stopping manufacturer based on testing and field experience.

.3 Provide components for each fire stopping system that are needed to install fill material. Use only components specified by the fire stopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

.4 Firestopping Materials are either “cast-in-place” (integral with concrete placement) or “post installed.” Provide cast-in-place firestop devices prior to concrete placement.

.5 Penetrations in Smoke Barriers: Provide fire stopping with ratings determined in accordance with ULC S115.
.1 L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures.

.6 Mold Resistance: Provide penetration firestoppping with mold and mildew resistance rating of 0 as determined by ASTM G21.

2.2 MATERIALS

.1 Fire stopping and smoke seal systems: in accordance with ULC S115.
.1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of ULC-S115 and not to exceed opening sizes for which they are intended and conforming to special requirements specified.
.2 Firestop system rating: meeting requirements in ULC-S115.

.2 Service penetration assemblies: certified by ULC in accordance with ULC S115 and listed in ULC Guide No. 40 U19.

.3 Service penetration fire stop 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 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.

.6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.

.7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

.8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

.9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.10 Sealants for vertical joints: non-sagging.

.11 Pre-installed firestop devices for use with non-combustible and combustible pipes (closed and open systems), conduit and/or cable bundles penetrating concrete floors:
.1 Cast-in-place firestop device.
.2 Tub box kit for use with tub installations.
.3 Cast-in-place firestop device for use with noncombustible penetrants.
.4 Speed sleeve for use with cable penetrations.
.5 Firestop drop-in device for use with noncombustible and combustible penetrants.
.6 Firestop block.

.12 Re-penetrable, round cable management devices for use with new or existing cable bundles penetrating masonry walls:
- .1 Speed sleeve with integrated smoke seal fabric membrane.
- .2 Firestop sleeve.
- .3 Retrofit sleeve for use with existing cable bundles.
- .4 Gangplate for use with multiple cable management devices.
- .5 Gangplate cap for use at blank openings in gangplate for future penetrations.

.13 Sealants or caulking materials for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT):
- .1 Intumescent firestop sealant.
- .2 Firestop silicone sealant self-leveling.
- .3 Fire foam.
- .4 Flexible firestop sealant.
- .5 Firestop silicone sealant gun grade.

.14 Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:
- .1 Firestop silicone sealant gun grade.
- .2 Flexible firestop sealant.
- .3 Intumescent firestop sealant.
- .4 Firestop silicone sealant self-leveling.

.15 Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps, the following products are acceptable:
- .1 Firestop joint spray
- .2 Firestop silicone sealant gun grade
- .3 Flexible firestop sealant
- .4 Firestop silicone sealant self-leveling

.16 Pre-formed mineral wool designed to fit flutes of metal profile deck; as a backer for spray material.
- .1 Speed plugs.
- .2 Speed strips.

.17 Intumescent sealants or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:
- .1 Intumescent firestop sealant.

.18 Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:
- .1 Intumescent firestop sealant.
- .2 Fire foam.
- .3 Firestop silicone sealant gun grade.
- .4 Flexible firestop sealant.

.19 Non-curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:
- .1 Firestop putty stick
- .2 Firestop plug

.20 Wall opening protective materials for use with cul. / ulc listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:
- .1 Firestop putty pad
- .2 Firestop box insert

.21 Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems) tested to 50 pa. Differential, the following products are acceptable:

.1 Firestop collar
.2 Firestop collar
.3 Wrap strips

.22 Materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
.1 Firestop mortar
.2 Firestop block
.3 Fire foam
.4 Firestop board

.23 Non-curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
.1 Firestop block
.2 Firestop board

.24 Sealants or caulking materials used for openings between structurally separate sections of wall and floors, the following products are acceptable:
.1 Firestop joint spray
.2 Elastomeric firestop sealant
.3 Flexible firestop sealant
.4 Self-leveling firestop sealant

.25 For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, the following products are acceptable:
.1 Firestop block (for walls and floors)
.2 Firestop plug (for walls and floors)
.3 Cast-in place firestop device (for floors only)

.26 For penetrations through a fire separation wall provide a fire stop system with a "f" rating as determined by ULC or cUL as indicated below:

Time	Required ULC or cUL “F” Rating of Firestopping Assembly
30 minutes	20 minutes
45 minutes	45 minutes
1 hour	45 minutes
1.5 hours	1 hour
2 hours	1.5 hours
3 hours	2 hours
4 hours	3 hours

For combustible pipe penetrations through a Fire Separation provide a firestop system with a “F” Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.

.27 For penetrations through a Fire Wall or horizontal Fire Separation provide a firestop system with a “FT” Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.

.28 Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction joint assembly.

2.3 IDENTIFICATION

.1 Provide warning sign or self-adhesive sticker at each fire stop location, containing the following information:

.1 The words “Fire Rated Assembly” or similar warning that the opening has been fire stopped.
.2 Fire stop system used (ULC or cUL).
.3 Fire stop system rating.
.4 Product(s) used.
.5 Name and phone number of initial installer.
.6 Date of initial installation.
.7 Date, name and phone number of person or company responsible for re-penetration of assembly (allow several lines).

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.

.1 Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 INSTALLATION

.1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained. Install fire stop material to obtain fire resistance rating not less than the fire resistance rating of surrounding floor and wall assembly.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

.6 Install fire stopping work as shown in mechanical and electrical drawings and specifications.

.7 Mechanical and electrical recessed boxes in walls and partitions.

.8 Rigid ducts: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of ire separation.

3.4 SEALING OF WALL AND FLOOR OPENINGS FOR ELECTRICAL SERVICES

.1 All conduit and cable entries through outside walls of building, through partition walls separating electrical rooms from other areas, through fire separations, and through floors above grade shall be sealed to prevent passage of moisture, water, dust, gasses, flame, or to maintain pressurization.

.2 Openings shall be sealed when all wiring entries have been completed, coordinate with Division 26, 27 and 28.

.3 Sealing material shall be fire resistant and shall not contain any compounds which will chemically affect the wiring jacket or insulating material. Cable penetrations through fire separations shall be sealed. Cable penetrations through retaining wall shall be watertight.

3.5 SEQUENCES OF OPERATION

.1 Proceed with installation only when submittals have been reviewed by Consultant.

.2 Mechanical pipe insulation: certified fire stop system component.

.1 Ensure pipe insulation installation precedes fire stopping.

.3 Confirm with Division 26, 27 and 28 to ensure all cable are installed prior to proceeding with fire stopping.

3.6 FIELD QUALITY CONTROL

.1 Inspections: notify Consultant when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

.2 Manufacturer's Field Services:

.1 Provide manufacturer's field services consisting of product use recommendations, engineering judgements (EJs), and periodic site visits.

.2 Schedule periodic site visits by manufacturer’s field representative to inspect installation. All fire stopping work shall be inspected as per ASTM 2174.

.3 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product. Submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS. Report to be submitted to Consultant for review prior to concealment.

.3 Coordinate with Division 22, 23, 25, 26, 27 and 28 to examine fire stopping assembly is installed as per ULC listing. Allow for 10% destructive testing of installed fire stopping. Coordinate with Division 7 to ensure all assemblies tested shall be repaired.

3.7 CLEANING

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

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

3.8 SCHEDULE

.1 Schedule fire stopping and smoke seal materials at openings and penetrations in fire-resistance rated assemblies to the following locations:

.1 Penetrations through fire-rated gypsum board partitions.

.2 Top of fire-rated gypsum board partitions.

.3 Intersection of fire-rated gypsum board partitions.

.4 Openings and sleeves installed for future use through fire-rated partitions.

.5 Around mechanical and electrical assemblies/devices penetrating fire-rated partitions.

.6 Electrical outlet boxes installed within fire separation require fire stopping as required by the NBCC (3.1.9).

.7 Rigid ducts: greater than 129 cm^2: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

.8 Mechanical and electrical recessed boxes in walls and partitions.

.9 Where indicated on working drawings and specification detail drawings.

.2 Smoke seals for smoke separations:

.1 Use elastomeric sealant (fire stop caulking) to provide smoke seals in smoke separations at:

.1 Penetrations (pipes, ducts, conduit, wiring and other penetrations).

.2 Intersection of smoke separations and adjacent walls, partitions, floors and ceilings.

.3 Perimeter seal around door and window frames in separations.

.2 Apply sealant on both sides of separation where applicable. Elastomeric sealant does require a fire stop system rating, but is required to effectively seal smoke separations form passage of smoke in the event of a fire.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Preparing substrate surfaces.

.2 Sealant and joint backing.

1.2 RELATED SECTIONS

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

.2 Section 08 11 13 - Standard Metal Doors and Frames: Sealants required in conjunction with door frames.

.3 Section 09 21 16 - Gypsum Board Assemblies: Sealants required in conjunction with wall finishes and acoustical treatment.

.4 Other Sections as may be applicable.

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 ASTM C509 - Elastomeric Cellular Preformed Gasket and Sealing Material.

.3 ASTM C834 - Latex Sealants.

.4 ASTM C919 - Use of Sealants in Acoustical Applications.

.5 ASTM C920 - Elastomeric Joint Sealants.

.6 ASTM C1193 - Guide for Use of Joint Sealants.

.7 ASTM C1311 - Solvent Release Sealants.

.8 ASTM C1330 - Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.

.9 CGSB 19-GP-5M - Sealing Compound, One Component, Acrylic Base, Solvent Curing.

.10 CGSB 19-GP-14M - Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.

.11 CAN/CGSB-19.13 - Sealing Compound, One-component, Elastomeric, Chemical Curing.

.12 CAN/CGSB-19.17 - One-Component Acrylic Emulsion Base Sealing Compound.

.13 CAN/CGSB-19.24 - Multi-component, Chemical Curing Sealing Compound.

1.4 PERFORMANCE REQUIREMENTS

.1 Sealant Design: Design structural sealant to withstand specified loads without breakage, loss, failure of seals, product deterioration, and other defects.

.2 Design installed sealant to withstand:

.1 Dead loads and live loads caused by positive and negative wind loads acting normal to plane of wall as calculated in accordance with BC Building Code. as measured in accordance with ASTM E330.

.2 Movement from ambient temperature range of 49 degrees C.

.3 Movement and deflection of structural support framing.

.4 Water and air penetration.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate with other work having a direct bearing on work of this section.

.2 Coordinate the work with all sections referencing this section.

1.6 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, colour availability.

1.7 QUALITY ASSURANCE

.1 Perform sealant application work in accordance with ASTM C1193 and ASTM C1481.

.2 Perform acoustical sealant application work in accordance with ASTM C919.

.3 Applicator Qualifications: Company specializing in performing the work of this section with minimum 3 years experience.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.9 WARRANTY

.1 Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, water tight seal, exhibit loss of adhesion or cohesion, or do not cure.

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 Where sealants are qualified with primers use only these primers.

.3 Accessories:

.1 Primer: Non-staining type, recommended by sealant manufacturer to suit application.

.2 Joint Backing: Polyethylene, Urethane, Neoprene or Vinyl Foam.

.1 Extruded open cell foam backer rod.

.2 Size: oversize 30 to 50 %.

.3 Tensile strength: 20 to 30psi.

.4 Acceptable material: Tremco Sof-Rod or approved equal to ASTM D1056; round, closed cell, polyethylene foam rod; oversized 30 to 50 percent larger than joint width.

.3 Bond Breaker: Pressure sensitive tape which will not bond to sealant recommended by sealant manufacturer to suit application.

2.2 SEALANT MATERIAL DESIGNATIONS

.1 Butyl Sealant (Type A): ASTM C1311, single component, solvent release, non-skinning, non-sagging, black colour.

.2 Acoustic Sealant (Type B): ASTM C920, Acoustic grade, single component, non-skinning, non-hardening; Grey colour.

.3 Polyurethane Sealant (Type C): ASTM C920, Grade NS, single component, chemical curing, non-staining, non-bleeding, non-sagging self-leveling type; colour as selected.

.4 Polyurethane Sealant (Type D): ASTM C920, multi-component, non-sagging type; colour as selected.

.5 Silicone Sealant (Type E): ASTM C920, single component; colour as selected.

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.

2.4 ACCESSORIES

.1 Primer: Non-staining type, recommended by sealant manufacturer to suit application.

.2 Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

.3 Joint Backing: ASTM C1330; round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.

.4 Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

.5 Masking tape: Non-staining, non-absorbent type compatible with sealant and adjacent surfaces.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that substrate surfaces are clean, dry, and free of frost and ready to receive work.

3.2 PREPARATION

.1 Remove loose materials and foreign matter which might impair adhesion of sealant.

.2 Clean and prime joints in accordance with sealant manufacturer's written instructions.

.3 Perform preparation in accordance with ASTM C1193 for solvent release and latex base sealants, ASTM C1481 for EIFS systems.

.4 Protect elements surrounding the work of this section from damage or disfiguration.

3.3 INSTALLATION

.1 Perform installation in accordance with ASTM C1193 for solvent release and latex base sealants, ASTM C919 for acoustical sealants.

.2 Measure joint dimensions and size materials to achieve required 2:1 width/depth ratios.

.3 Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.

.4 Install bond breaker where joint backing is not used.

.5 Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

.6 Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

.7 Tool joints concave.

3.4 CLEANING

.1 Clean adjacent soiled surfaces.

3.5 PROTECTION OF FINISHED WORK

.1 Remove masking tape and excess sealant.

.2 Protect sealants until cured.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Non-rated and fire rated steel frames.

1.2 RELATED SECTIONS

.1 Section 01 74 21 – Construction Waste Management and Disposal

.2 Section 08 14 16 – Flush Wood Doors

.3 Section 08 71 00 - Door Hardware: Hardware, silencers, and weather-stripping.

.4 Section 09 91 10 - Painting: Field painting of door frames.

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 ASTM A653/A653M-04a - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 AAMA/WDMA/CSA 101/I.S.2/A440, North American Fenestration Standard/Specification for Windows, Doors, and Unit Skylights.

.4 AAMA/WDMA/CSA/101/I.S.2/A440S1, Canadian Supplement to Standard/Specification for Windows, Doors, and Unit Skylights.

.5 ASTM A653/A653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.6 ASTM C1289 - Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

.7 ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.8 ASTM E413 - Classification for Rating Sound Insulation

.9 CSA W59 - Welded Steel Construction (Metal Arc Welding).

.10 Canadian Steel Door Manufacturers Association (CSDMA), Recommended Dimensional Standards for Commercial Steel Doors and Frames,

.11 Canadian Steel Door Manufacturers Association (CSDMA), Selection and Usage Guide for Steel Doors and Frames,

.12 DHI - Door Hardware Institute: The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.

.13 NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

1.4 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Indicate door frame configurations and finishes, location of cut-outs for hardware reinforcement.

.3 Shop Drawings:

.1 Indicate frame elevations, reinforcement, anchor types and spacing, location of cut-outs for hardware, and finish.

1.5 QUALITY ASSURANCE

.1 Conform to requirements of CSDMA.

1.6 REGULATORY REQUIREMENTS

.1 Fire Rated Door and Frame Construction: Labelled and listed to CAN/ULC S104M, Fire Tests of Door Assemblies.

.2 Fire Rated Door Construction: Rate of rise of 250 C degrees across door thickness.

.3 Installed Door and Frame Assembly: Conform to NFPA 80 for fire rated class as scheduled.

1.7 DELIVERY, STORAGE, AND PROTECTION

.1 Section 01 61 00: Deliver, store, protect and handle products to site.

.2 Remove frames from wrappings or coverings upon receipt on site and inspect for damage.

.3 Store in vertical position, spaced with blocking to permit air circulation between components.

.4 Store materials on planks or dunnage, out of water and covered to protect from damage.

.5 Clean and touch up scratches or disfigurement caused by shipping or handling with zinc-rich primer.

1.8 COORDINATION

.1 Coordinate the work with frame opening construction, door, and hardware installation.

.2 Sequence installation to ensure wire connections are achieved in an orderly and expeditious manner.

Part 2 Products

2.1 MATERIALS

.1 Sheet Steel - Hot dipped galvanized steel to ASTM A653/A653M, commercial grade (CS), Type B, minimum base steel thickness in accordance with CSDMA.

.1 Interior Frames: coating designation ZF75 (A25).

.2 Minimum base steel thickness (gauge) in accordance with CSDFMA Table 1, except as follows:

.1 Frames: 1.6 mm (16 gauge).
.2 Floor anchors: 1.6 mm (16 gauge).
.3 Jamb anchors:
  .1 "T" strap type : 1.6 mm (16 gauge).
  .2 "L" type: 1.2 mm (18 gauge).
  .3 Stirrup-strap type: 15 x 250 x 1.6 mm (5/8" x 10" x 16 gauge).
  .4 Stud type: 1.2 mm (18 gauge).
  .5 Wire type: 4.0 mm (9 gauge).
.4 Reinforcing steel:
  .1 Locks, strikes: 1.6 mm (16 gauge).

.2 Butts, hinges: 3.4 mm (10 gauge).
.3 Surface mounted hardware: 2.7 mm (12 gauge).
.5 Jamb spreaders: 1.2 mm (18 gauge).

.3 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation same as specified for door materials.

2.2 PRIMERS

.1 Rust inhibitive touch-up only.

2.3 ACCESSORIES

.1 Primer: to CAN/CGSB-1.181.

.2 Isolation Coating: Alkali resistant bitiminous paint.

.3 Metallic paste filler: to manufacturer's standard.

2.4 FABRICATION - FRAMES

.1 Interior Frames:

.1 Door Frames and Window Assemblies: Welded type construction.
.2 Transom Frames: Welded type construction.
.3 Sidelight Assemblies: Welded type construction.

.2 Mortised, blanked, reinforced, drilled and tapped for templated hardware, in accordance with templates provided by hardware supplier.

.3 Protect mortised cutouts with steel guard boxes for frames installed in masonry and concrete walls.

.4 Reinforce head of frames wider than 1219 mm (48 inches).

.5 Prepare frames for silencers. Provide three single silencers for single doors on strike side. Provide single silencers on frame head at double doors without mullions.

.6 Attach fire rated label to each fire rated door unit.

.7 Fabricate frames with integral junction boxes for electrically wired hinge, door position switch, and future consideration of electric strike for selected doors as scheduled.

.8 Manufacturer's nameplates on frames and screens are not permitted.

.9 Conceal fastenings except where exposed fastenings are indicated.

2.5 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 Provide 2 anchors for rebate opening heights up to 1520 mm (5'-0") and one additional anchor for each additional 760 mm (2'-6") of height or fraction thereof.

.4 Locate anchors for frames in existing openings not more than 150 mm (6") from top and bottom of each jambs and intermediate at 660 mm (2'-2") on centre maximum.

.5 Where frames are installed in prepared openings, countersink frame at screw anchor location.

2.6 FRAMES: WELDED TYPE

.1 Welding in accordance with CSA W59.

.2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile. Spot welding not acceptable.

.3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.

.4 Grind welded joints and corners to a flat plane, fill with metallic paste and sane to uniform smooth finish.

.5 Securely attach floor anchors to inside of each jamb profile.

.6 Fabrication frame assemblies in largest sections possible. Where field splices are required provide welded joints, ground smooth. Make field splices and joints inconspicuous after assembly. Exposed fasteners not permitted.

.7 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.7 SHOP PRIMING

.1 Provide touch-up primer at areas where zinc coating has been removed during fabrication or installation.

.2 For frames fabricated of steel sheet with Z275 (G90) designation galvanized coating apply in factory one coat of zinc-rich primer CAN/CGSB-1.181 to all exposed surfaces. Properly pre-treat and prepare surfaces before application of primer to ensure good primer adhesion.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 EXAMINATION

.1 Section 01 70 00: Verify existing conditions before starting work.

.2 Verify that opening sizes and tolerances are acceptable; check floor area within path of door swing for flatness.

.3 Verify frames are correct size, swing, rating and opening number.

.4 Remove temporary shipping spreaders.

3.3 INSTALLATION

.1 Coordinate with wall construction for anchor placement.

.2 Coordinate installation of glass and glazing.

.3 Coordinate installation of doors and frames with installation of hardware specified in Section 08 71 00.

.4 Frames:

.1 Frame type on all new doors to be double rebate pressed steel, c/w paint finish to match existing.

.2 Set frames plumb, square, level and at correct elevation.

.3 Secure anchorages and connections to adjacent construction.

.4 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm (4'-0") wide. Remove temporary spreaders after frames are built-in.

.5 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.6 Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

.7 Coordinate installation with Electrical Subcontractor for installation of junction boxes and conduit for electric hardware, wiring, and controls for electronic hardware.

.8 Contractor to field measure wall thickness for new doors in existing walls.

.5 Doors:

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.

.2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.

.1 Hinge side: 1.0 mm (0.040").

.2 Latch side and head: 1.5 mm (1/16").

.3 Finished flooring and thresholds: 13 mm (1/2"), except where doors are fitted with exit rod devices margin shall be 6 mm (1/4").

.6 Provide door silencers on all new doors.

.7 Finish paint in accordance with Section 09 91 10.

.8 Adjust operable parts for correct function.

3.4 REMEDIAL WORK

.1 Refer to all drawings, schedules, and work of other trades that may affect work of this section.

.2 Remove existing doors and frames and reinstall in new locations where indicated.

.3 Modify frames for new finish hardware where indicated.

.4 Reuse existing hardware where indicated.

3.5 CAULKING AND SEALING

.1 For interior frames seal joint between frames and adjacent construction with sealant (caulking). Apply sealant around full perimeter of frames, on both sides of opening.

.2 Install continuous bead of sealant where door frames abut floors.

.3 Apply sealants in accordance with Section 07 92 00 - Joint Sealing. Provide smooth, neat bead, tooled to slight concave profile.

3.6 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish. Apply primer on sanded surfaces.

3.7 ERECTION TOLERANCES

.1 Maximum Diagonal Distortion: 1.5 mm measured with straight edges, crossed corner to corner.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Flush wood doors and transom panels; flush and flush glazed configuration; fire rated and non-rated.

1.2 RELATED SECTIONS

.1 Section 01 74 21 – Construction Waste Management and Disposal.

.2 Finish Carpentry: Installation of Flush Wood Doors.

.3 Section 08 12 13 - Standard Metal Frames.

.4 Section 08 71 00 - Door Hardware - Common Requirements.

.5 Section 08 80 50 - Glass and Glazing.

.6 Section 09 91 10 - Painting: Site or shop finishing of doors.

1.3 REFERENCES

.1 ANSI A135.4-2004 - Basic Hardboard.

.2 ASTM E413-10 - Classification for Rating of Sound Insulation.

.3 AWMAC (Quality Standards for Architectural Woodwork), Latest Edition.

.4 CAN4 S104-10 - Fire Tests of Door Assemblies.

.5 CAN/CSA O132.2 Series-90 (R2003) - Wood Flush Doors.

.6 CHPVA (Canadian Hardwood Plywood and Veneer Association).

.7 HPVA (Hardwood Plywood and Veneer Association).

.8 NEMA LD3-2005 - High Pressure Decorative Laminates (HPDL).

.9 ITS (Intertek Testing Services) - Certification Listings.

.10 NFPA 80 - Standard for Fire Doors and Fire Windows.

.11 NFPA 252-2008 - Standard Method of Fire Tests of Door Assemblies..

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 30 00 - Coordination: Coordinate with other work having a direct bearing on work of this section.

.1 Coordinate the work with door opening construction, door frame and door hardware installation.

1.5 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

.3 Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, identify cutouts for glazing.

1.6 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements.

1.7 QUALITY ASSURANCE

.1 Perform work in accordance with AWMAC Quality Standard, Custom Grade.

.2 Finish doors in accordance with AWMAC Quality Standard.

.3 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.8 REGULATORY REQUIREMENTS

.1 Fire Door and Panel Construction: Conform to ASTM E2074.

1.9 DELIVERY, STORAGE, AND PROTECTION

.1 Package, deliver and store doors in accordance with AWMAC.

.2 Accept doors on site in manufacturer's packaging. Inspect for damage.

.3 Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.10 WARRANTY

.1 Warranty Period for all supplied materials, equipment and installation is two (2) years from the date of Service Commencement.

.2 Warranty to include replacing and refinishing due to defects or faulty workmanship.

.3 Include coverage for delamination of veneer, warping beyond specified tolerances, defective materials, and telegraphing core construction.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable Materials/Products:

.1 Lynden Door Inc., Models:

.1 LD2000 with particle board core. (To match existing)

.2 Other manufacturers offering products meeting or exceeding specified products and requirements may be considered, including:

.1 Masonite/Premdor.

.2 Or approved alternative.

.3 Substitutions: Refer to Section 01 62 50.

2.2 DOOR TYPES

.1 Flush Interior Doors:

.1 Non-Rated: 45 mm thick; solid core, 5 ply door construction, acoustic rated where indicated.

2.3 DOOR CONSTRUCTION

.1 Core (Solid, Non-Rated): AWMAC Section 1300, Type PC - Particleboard manufactured from recycled wood products; formaldehyde-free; moisture resistant polyurethane resin.

.2 Core (Solid): AWMAC Section 1300, Type FD rating as indicated.

.3 Stiles: Minimum 32 mm (nominal, before trim) hardwood matching face veneer.

.4 Rails: Minimum 50 mm (nominal, before trim) compatible hardwood.

.5 Door Edging: No. 2 Edge.

2.4 FLUSH DOOR FACING

.1 Plastic Laminate Facing (Interior): NEMA LD-3, General Purpose

.1 Pattern: To Match Existing

.2 Door Edge Finishing: Solid Maple edge stained to match Plam.

2.5 ADHESIVE

.1 Facing Adhesive: Type I - waterproof low VOC emitting, formaldehyde free.

2.6 ACCESSORIES

.1 Glazing Stops: Wood, of same species as door facing shape, butted corners; prepared for countersink style tamper proof screws.

2.7 FABRICATION

.1 Fabricate non-rated doors in accordance with AWMAC Quality Standards requirements.

.2 Vertical Exposed Edge of Stiles: Provide AWMAC No. 2 door edges of same species as veneer facing.

.3 Fit door edge trim to edge of stiles after applying veneer facing.

.4 Bond edge banding to cores.

.5 Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware.

.6 Factory fit doors for frame opening dimensions identified on shop drawings.

.7 Provide edge clearances in accordance with AWMAC.

.8 Provide double bevels on both hinge and strike door edges for double-acting doors.

2.8 FINISHES

.1 Factory Finished Doors:

.1 Where scheduled, factory finish doors in accordance with AWMAC Quality Standard to the following finish designations:

1. Factory finish doors in accordance with AWMAC Standards.

.2 Factory finish doors in accordance with approved sample.

.3 Seal door top edge with colour sealer to match door facing. Edge solid maple stained to match Plam-1.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that opening sizes and tolerances are acceptable.

.2 Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

.3 Verify existing hardware that may be reused.

.4 Glass upper panel shall match existing size in current door.

3.2 INSTALLATION

.1 Install non-rated doors in accordance with AWMAC Quality Standards requirements.

.2 Trim non-rated door width by cutting equally on both jamb edges.

.3 Trim door height by cutting bottom edges to a maximum of 12 mm.

.4 Machine cut for hardware.

.5 Coordinate installation of doors with installation of frames specified in Section 08 11 13 and hardware specified in Section 08 71 00.

.6 Coordinate installation of glass and glazing.

.7 Where pre-finished doors are trimmed on site, trimmed edges, including top and bottom edges, are to be sealed on site with conversion varnish coloured to match factory finish on door facing, for reasons of infection control.

3.3 INSTALLATION TOLERANCES

.1 Conform to AWMAC requirements for fit and clearance tolerances.

.2 Conform to AWMAC Section 1300 requirements for maximum diagonal distortion.

3.4 ADJUSTING

.1 Adjust door for smooth and balanced door movement.

.2 Adjust closer for full closure.

3.5 SCHEDULES

.1 See Door Schedule on drawings.

END OF SECTION

Part 1 General

1.1 RELATED SECTION

.1 Section 08 11 13 – Standard Metal Frames.

.2 Section 08 14 16 – Flush Wood Doors.

.3 Division 26: Electrical wiring for magnetic strikes, electric releases and electric locks.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/Builders Hardware Manufacturers Association (BHMA)

.1 ANSI A117.1-2009, Standard for Accessible and Usable Buildings and Facilities.

.2 ANSI/BHMA A156, Series of Standards.

.3 ANSI/BHMA A156.10-2011, Power Operated Pedestrian Doors.

.4 ANSI/BHMA A156.1-2016, Butts and Hinges.

.5 ANSI/BHMA A156.12-2013, Interconnected Locks and Latches.

.6 ANSI/BHMA A156.13-2012, Mortise Locks and Latches, Series 1000.

.7 ANSI/BHMA A156.14-2013, Sliding and Folding Door Hardware.

.8 ANSI/BHMA A156.15-2015, Release Devices – Closer Holder, Electromagnetic and Electromechanical.

.9 ANSI/BHMA A156.16-2013, Auxiliary Hardware.

.10 ANSI/BHMA A156.17-2014, Self Closing Hinges and Pivots.

.11 ANSI/BHMA A156.18-2016, Materials and Finishes.

.12 ANSI/BHMA A156.19-2013, Power Assist and Low Energy Power Operated Doors.

.13 ANSI/BHMA A156.2-2011, Bored and Preassembled Locks and Latches.

.14 ANSI/BHMA A156.26-2012, Continuous Hinges.

.15 ANSI/BHMA A156.3-2014, Exit Devices.

.16 ANSI/BHMA A156.4-2013, Door Controls – Closers.

.17 ANSI/BHMA A156.6-2010, Architectural Door Trim.

.18 ANSI/BHMA A156.8-2015, Door Controls – Overhead Stops and Holders.

.2 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA)

.1 CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction): standard hardware location dimensions.

.3 Builders Hardware Manufacturers Association (BHMA)

.1 Directory of Certified Products.

.4 Door and Hardware Institute (DHI)

.1 Sequence and Format for the Hardware Schedule.

.2 ANSI/DHI A115.IG, Installation Guide for Doors and Hardware.

1.3 PRE-INSTALLATION MEETINGS

.1 Pre-Installation Meetings: convene pre-installation meeting aligning with regular site meetings to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's warranty requirements.

1.4 SUBMITTALS

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

.1 Submit manufacturer's printed product literature, specifications, and data sheets.

.2 Hardware List:

.1 Submit contract hardware list in accordance with Door Hardware Schedule on Drawings.

.2 Indicate specified hardware, including make, model, material, function, size, finish, and other pertinent information.

.3 Coordinate Division 28 Security Contractor, Division 26 Electrical Contractor and Division 8 Door and Hardware Contractors to jointly prepare, submit, and obtain certified approval from the Consultant shop drawings for work related to door access control systems prior to undertaking the on-site work. The joint submission will clarify and assign responsibility between these Divisions for labour and materials associated with the supply and installation of electronic and physical components for doors and access control.

.3 Keying Schedule:

.1 Review owners keying requirements and Submit keying schedule prepared by or under the supervision of qualified Architectural Hardware Consultant (AHC), detailing Owner's final keying instructions for locks, including schematic keying diagram and index each key set to unique door designations. Keying of new hardware is to work with existing cylinder keying of the site, as directed.

.4 Closeout Submittals

.1 Provide operation and maintenance data for door closers, locksets, door holders, electrified hardware, and fire exit hardware for incorporation into manual specified in Section 01 77 00 - Closeout Procedures.

1.5 MAINTENANCE MATERIAL

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 77 00 - Closeout Procedures.

.2 Supply two sets of wrenches for door closers, locksets, and fire exit hardware.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

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

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

.2 Storage and Protection:

.1 Store finishing hardware in locked, clean, and dry area.

1.8 WASTE DISPOSAL AND MANAGEMENT

.1 Separate and recycle waste materials.

1.9 WARRANTY

.1 Provide written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

.2 Failures include, but are not limited to, the following:

.1 Structural failures including excessive deflection, cracking, or breakage.

.2 Faulty operation of operators and door hardware.

.3 Deterioration of metals, metal finishes, and other materials beyond normal weathering.

.3 Warranty Period: From date of Substantial Performance, and as follows:

Hardware Type	Warranty Term
Locks, latches, and cylinders	2 years
Closers	25 years
Hinges	1 year
Panics	3 years
Miscellaneous	1 year
Electrical Hardware:	5 years

Part 2 Products

2.1 HARDWARE ITEMS

.1 Use one manufacturer's products only for similar items.

.2 Hardware sets noted below provide intent and key hardware requirements. Furnish all necessary electronic hardware and wiring to provide an operable system.

.3 The reuse of some of the existing hardware from the door being removed will be permitted. (the door handing is reversed)

2.2 DOOR HARDWARE

.1 As scheduled in Door Hardware Schedule.

.1 Material - General

.1 General products of the following manufacturers are approved equals for the type of hardware listed. Product numbers of the first-named manufacturers are the ones generally used in the finish hardware schedule.

.2 Butt Hinges:

.1 McKinney TA2714 & TA3786 series NRP – No Substitutions

.3 Locksets, Latchsets and Privacy sets:

1. Schlage L Series No Substitutions
2. Schlage ND Series No Substitutions

.4 Cylinders:

.1 Standard cylinders - Schlage F keyway - No substitutions.

.2 High Security cylinders – Schlage Primus – No substitutions.

.5 Electric Strikes:

.1 See list below.

.6 Magnetic Locks:

.1 See list below.

.7 Thresholds, Door Seals and Door Bottoms:

.1 AK Draftseal

.2 Pemko

.8 Power Supplies:

.9 Automatic Operators

.1 See list below.

2.3 KEYING

.1 All standard cylinders to be supplied keyed alike in Schlage F keyway to client for keying by their locksmith.

.2 Primus cylinders to be supplied keyed to Owners requirements.

.3 Supply Schlage F keyway key blanks

.4 Ship standard Schlage cylinders, Primus cylinders and key blanks direct from manufacturer to client.

.5 Contact client administration to obtain the name of the person responsible for receiving all keys and cylinders.

.6 Provide temporary construction cylinders c/w identical keying and 6 keys for FMO.

.7 Plugs to be 6 pin G Cylinders zero pinned to comply with FMO requirements.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Furnish metal door frame and wood door manufacturers with complete instructions and templates for preparation of their work to receive hardware.

.3 Furnish manufacturers' instructions for proper installation of each hardware component.

3.2 INSTALLATION

.1 Install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association.

.2 Use only manufacturer's supplied fasteners. Failure to comply may void manufacturer's warranties and applicable licensed labels. Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

3.3 ADJUSTING

.1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.

.2 Lubricate hardware, operating equipment, and other moving parts.

.3 Adjust door hardware to provide tight fit at contact points with frames.

3.4 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacture's instructions.

.3 Remove protective material from hardware items where present.

3.5 SCHEDULE

Existing hardware maybe reused if handing work for the item.

Hardware Items as listed from the existing current door.				
Quantity	Code/Item	Model #	Finish	
	S01	D1-926		
	This Door shall be interlocked such that both opposite operators cannot be activated when other door is open.			
3	Hinges	TA786 114 X 114	26D	CMC
1	Lockset	8237 LNJ LC	32D	CSA
2	Core	20-740-XP	626	CSC
2	Cylinder	20-061 50-231 B520-296 ICX	626	CSC
1	Electric Strike	1006 KD-630	630	CHS
1	Smart Pac II	2005		HEIS
1	Auto Operator	6100 X 1 DOOR	628	VA01
1	Door Contact	MSS-26CL	Brown	VA01
1	Magnalock	M62	US32D	CSN
2	Push Button	PB22	US32D	CSN
1	Mortise Keyswitch	MKA	US32D	CSN
1	Body Guard	IOBODYGUARDIIIC		BEIS
1	Door Control Module	CR4		SEDS
1	Sensor	10SSII34		BEIS
1	Gasketing	188S-BK (1XW 2XH)	AA	
1	Perimeter Seal	870AA (1XW 2XH)	AA	

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Glass and glazing for sections referencing this section for Products and installation.

1.2 RELATED SECTIONS

.1 Section 01 74 21 – Construction Waste Management and Disposal.

.2 Section 07 92 00 - Joint Sealants: Sealant and back-up material.

.3 Section 08 14 16 – Flush Wood Doors: Glazing in doors.

.4 Section 08 43 13 – Aluminum Windows

1.3 REFERENCES

.1 ANSI Z97.1-04e1 - Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

.2 ASTM C542-05 - Specification for Lock-Strip Gaskets.

.3 ASTM C864-05 - Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

.4 ASTM C920-05 - Elastomeric Joint Sealants.

.5 ASTM C1036-06 - Flat Glass.

.6 ASTM C1193-05a - Use of Joint Sealants.

.7 ASTM D412-06a -Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension.

.8 ASTM D1149-99 - Test Method for Rubber Deterioration - Surface Ozone Cracking in a Chamber.

.9 ASTM E84-07 - Test Method for Surface Burning Characteristics of Building Materials.

.10 CAN/CGSB 12.1-M90 - Tempered or Laminated Safety Glass.

.11 CAN/CGSB 12.3-M91 - Flat, Clear Float Glass.

.12 CGSB 19-GP-5M - Sealing Compound, One Component, Acrylic Base, Solvent Curing (Incorporating Amendment No. 1)

.1 GANA (Glass Association of North America)

.2 Glazing Manual (2004).

.13 FGMA Sealant Manual.

1.4 PERFORMANCE REQUIREMENTS

.1 Interior windows and sidelights shall be constructed of tempered glass, except where wired glass is required by the requirements of the B.C. Building Code.

1.5 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

1.6 QUALITY ASSURANCE

.1 Perform Work in accordance with GANA Glazing Manual, for glazing installation methods.

Part 2 Products

2.1 FLAT GLASS MATERIALS – Doors

.1 Safety Glass: CAN/CGSB-12.1, clear Laminated Tempered; 6 mm minimum thick.

2.2 GLAZING COMPOUNDS

.1 Silicone Sealant: CAN/CGSB 19.13 single component; chemical curing; capable of water immersion without loss of properties; non-bleeding, non-staining, cured Shore A hardness of 15 to 25.

2.3 MANUFACTURERS - GLAZING ACCESSORIES

.1 Setting Blocks: ASTM C864, Silicone, 80 to 90 Shore A durometer hardness tested to ASTM D2240, length of 25 mm for each square metre of glazing or minimum 100 mm x width of glazing rabbet space minus 1.5 mm x height to suit glazing method and pane weight and area.

.2 Spacer Shims: ASTM C864, Silicone, 50 to 60 Shore A durometer hardness tested to ASTM D2240, minimum 75 mm long x one half the height of the glazing stop x thickness to suit application.

.3 Glazing Tape: Preformed butyl compound; 10 to 15 Shore A durometer hardness tested to ASTM D2240; coiled on release paper; black colour.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 70 50: Verify existing conditions before starting work.

.2 Verify that openings for glazing are correctly sized and within tolerance.

3.2 PREPARATION

.1 Clean contact surfaces with solvent and wipe dry.

.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.3 Prime surfaces scheduled to receive sealant.

.4 Install sealant in accordance with manufacturer's written instructions.

3.3 CLEANING

.1 Section 01 74 11: Cleaning installed work.

.2 Remove glazing materials from finish surfaces.

.3 Remove labels after Work is complete.

.4 Clean glass and adjacent surfaces.

3.4 PROTECTION OF FINISHED WORK

.1 After installation, mark pane with an 'X' by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Gypsum board and joint treatment.

.2 Gypsum interior sheathing.

.3 Light gauge metal stud wall framing.

1.2 RELATED SECTIONS

.1 Section 01 74 21 – Construction Waste Management and Disposal.

.2 Section 07 84 00 - Firestopping.

.3 Section 07 92 00 - Joint Sealants: Acoustic sealants.

1.3 REFERENCES

.1 ASTM C475/C475M-02 - Joint Compound and Joint Tape for Finishing Gypsum Board.

.2 ASTM C645-07a - Non-Structural Steel Framing Members.

.3 ASTM C754-04 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.

.4 ASTM C1002-07 - Steel Self-Piercing, Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.5 ASTM C1047-05 - Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.6 ASTM C1396/C1396M-06a - Gypsum Board.

.7 ASTM E90-04 - Test Method for Laboratory Measurement of Airborne-Sound Transmission Loss of Building Partitions and Elements.

.8 CAN/ULC S101-04 - Methods of Fire Endurance Tests of Building Construction and Materials.

.9 CAN/ULC S102-03 - Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.10 GA-216-07 (Gypsum Association) - Application and Finishing of Gypsum Panel Products.

.11 GA-600-06 (Gypsum Association) - Fire Resistance Design Manual.

.12 GA-801-07 (Gypsum Association) - Handling and Storage of Gypsum Panel Products: A Guide for Distributors, Retailers, and Contractors.

.13 ULC - Fire Resistance Directory.

.14 CSA Z317-13 Infection Control During Construction or Renovation of Health Care Facilities

1.4 SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data:

.1 Provide data on metal framing, gypsum board, cementitious backer board, joint tape, and joint compound.

.2 Provide MSDS on all products within the wall assembly.

1.5 QUALITY ASSURANCE

.1 Perform Work in accordance with GA-214, GA-216, and GA-600.

.2 Installer Qualifications: Company specializing in performing the work of this section with minimum five (5) years experience.

.3 Handling Gypsum Board: Comply with GA-801.

.4 Gypsum Board materials supplied for use on this project shall not contain hydrogen sulphide, sulphur dioxide, sulphur or any sulphur by-products.

1.6 REGULATORY REQUIREMENTS

.1 Conform to applicable code for fire rated assemblies in conjunction with 09 22 16 as follows:

.1 Fire Rated Partitions: Listed assembly by ULC listed Design Assembly and as detailed.

.2 Fire Rated Ceilings: Listed assembly by ULC listed Design Assembly and as detailed.

.3 Fire Rated Structural Column Framing: Listed assembly by ULC listed Design Assembly as scheduled or detailed.

1.7 WARRANTY

.1 Period for all supplied materials, equipment and installation is two (2) years from the date of Substantial Completion.

.2 Warranty: Include coverage to correct defective work and for failure to meet specified requirements.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 The following Manufacturers of gypsum drywall are deemed to be acceptable for the supply of gypsum drywall for this project:

.1 Canadian Gypsum Company (US Gypsum)

.2 Certainteed Gypsum Canada Inc.

.3 Georgia Pacific.

.4 Westroc Inc.

.5 Winroc.

2.2 CEILING SUSPENSION SYSTEM

.1 Main Runner Channels:

.1 Cold formed steel channels with rust inhibitive coating.

.2 Size: 38 x 12 mm.

.3 Gauge: 1.22 mm

.2 Hanger Rods and Tie Wires:

.1 Wire: 3.6 mm galvanized wire.

.2 Rods: 4.8 mm diameter zinc coated or cadmium plated steel rods with rust inhibitive coating.

.3 Inserts: Be able to develop full strength of hangers they support.

.4 Tie wires: Minimum 1.22 mm, soft annealed galvanized wire, two strands for attaching furring to main runners.

.5 Use materials of sizes to match existing in areas of patching.

2.3 GYPSUM BOARD MATERIALS

.1 Standard board: to ASTM C1396/C1396M, regular and Type X, 12 and16 mm, 1 220 mm wide x maximum practical length, ends square cut, edges square or bevelled to suit installation.

2.4 ACOUSTIC ACCESSORIES

.1 Acoustic Insulation: As specified under Section 07 21 16 - Blanket Insulation.

.2 Acoustic Sealant: As specified under Section 07 92 00 - Joint Sealants.

2.5 ACCESSORIES

.1 Corner Beads: GA-216; Metal corner bead.

.2 Edge Trim: GA-216; Type J or U casing bead.

.3 Joint Materials: GA-216

.1 Joint Tape: ASTM C475 and ASTM C840, 50.8 mm spark perforated paper tape, made from 100% recycled paper, of type recommended by manufacturer of gypsum board products. Fiber glass tape is not acceptable.

.2 Joint compound: ASTM C475 and ASTM C840, asbestos-free, all-purpose, premixed: Low-VOC, free of antifreeze, vinyl adhesives, preservatives, biocides, and other slow-releasing compounds, casein, latex base; slow setting; bedding and finishing compounds of type recommended by manufacturer of gypsum board. Standard of acceptance: CGC "Durabond" Setting Compound; Georgia-Pacific "Ready Mix" Sandable 20, 45, 90 Setting Compound; BPB Canada "ProFin" Joint Compounds or equivalent.

.3 Gypsum Board and Sheathing Fasteners: ASTM C1002, Type S12 and GA-216.

.4 Cementitious Board Fasteners: Board manufacturer's purpose made screws, corrosion resistant steel, self-drilling points, counter-sink heads to prevent strip-out, for steel substrate.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that site conditions are ready to receive work and opening dimensions are as indicated on reviewed shop drawings.

3.2 FURRING FOR FIRE RATINGS

.1 Install furring as required for fire resistance ratings indicated and to GA-600 requirements.

3.3 GYPSUM BOARD INSTALLATION

.1 Install gypsum board in accordance with GA-216 and GA-600.

.2 Erect single layer board with ends and edges occurring over firm bearing.

.3 Erect single layer fire rated gypsum board, with edges and ends occurring over firm bearing.

.4 Use screws when fastening gypsum board to metal furring or framing.

.5 Double Layer Applications: Secure second layer to first with fasteners.

.6 Place second layer parallel to first layer. Offset joints of second layer from joints of first layer.

.7 Place control joints consistent with lines of building spaces.

.8 Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.

.9 Install backing board over metal studs in accordance with manufacturer's written instructions.

.10 Apply gypsum board to curved walls in accordance with GA-216.

.11 Install J or U casing bead where gypsum board butts to dissimilar materials.

3.4 JOINT TREATMENT

.1 Finish in accordance with GA-214 Level 1, 3, or 4 as scheduled.

.2 Feather coats on to adjoining surfaces so that camber is maximum 0.8 mm.

.3 Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile.

.4 Fill and finish joints and corners of cementitious backing board.

3.5 TOLERANCES

.1 Maximum Variation of Finished Gypsum Board Surface from True Flatness: 3 mm in 3 m in any direction.

3.6 SCHEDULES

.1 Level of finish for final decoration for walls and ceilings:

.1 Level 1: Above finished ceilings concealed from view.

.2 Level 4: Walls and partitions exposed to view.

.3 Level 4: Ceilings exposed to view.

.4 Level 5: Walls, partitions and ceilings exposed to view and scheduled to receive semigloss or gloss paint finish, or high build epoxy coatings.

.2 Match existing construction is areas of infill panels and patching required around relocated items ie: doors and ceiling diffusers.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Resilient sheet flooring adhesive-applied to interior concrete substrates with resilient integral flash-cove base.

.2 Resilient tactile warning areas.

1.2 RELATED SECTIONS

.1 Section 01 74 21 – Construction Waste Management and Disposal.

.2 Section 03 35 00 - Concrete Finishing – surface levelling

.3 Section 09 21 16 - Gypsum Board Assemblies: Wall materials to receive application of base.

.4 Section 01 74 11 – Cleaning

1.3 REFERENCES

.1 ASTM E84-07 - Test Method for Surface Burning Characteristics of Building Materials.

.2 ASTM F1913-04 - Vinyl Sheet Floor Covering Without Backing.

.3 CAN/ULC S102-03 - Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.4 SUBMITTALS FOR REVIEW

.1 Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colours available.

.2 Samples:

.1 Submit two (2) samples, 300 x 300 mm in size illustrating colour and pattern for each floor material for each colour specified.

.3 Shop Drawings: Indicate seaming plans, control joints, borders and patterns.

1.5 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.6 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials: Provide three (3) sq m of flooring, 3 m of base of each material specified.

1.7 DELIVERY, STORAGE, AND PROTECTION

.1 Protect roll materials from damage by storing on end.

.2 Store all materials within the manufacturer's product data sheet temperature range.

1.8 WARRANTY

.1 Warranty Period for all supplied materials, equipment and installation is five (5) years from the date of Substantial Completion.

.2 Warranty to include replacing and refinishing due to defects or faulty workmanship.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 Store materials for three days prior to installation in area of installation to achieve temperature stability.

.2 Maintain air temperature structural base temperature between 18o C and 22o C for three (3) days, 72 hours, prior to, during, and after installation of materials.

.3 Maintain relative humidity required by flooring manufacturer and adhesive manufacturer three (3) days, 72 hours, prior to, during, and after installation of materials.

Part 2 Products

2.1 MATERIALS - RESILIENT VINYL SHEET FLOORING (SV-1)

.1 Vinyl Sheet without Backing: ASTM F1913:

.1 Granit by Johnsonite, a Tarkett Company

.2 Total Thickness: 2.0 mm.

.3 Colour and pattern through total thickness.

.4 Colour: **To Match Existing**

.5 Static Coefficient of Friction: ASTM D 2047 > 0.5

.6 Static Load Limit: ASTM F 970 /modified, 250 psi

2.2 MATERIALS – DEMARCATION LINE

.1 Tarkett, IQ Granit SD 2.0.

.1 Granit YELLOW 0417

2.3 MATERIALS - INTEGRAL (FLASH-COVE) BASE (FC)

.1 Same material as adjacent flooring material, butterfly outside corners, to heights indicated with PVC cove former specified in this section.

2.4 SUBSTITIONS

.1 Not permitted.

2.5 ACCESSORIES

.1 Subfloor Filler and Leveler:

.1 Cementitious underlayment, trowelable, non-shrink, water-resistant, minimum compressive strength 4200 psi (29 MPa) after 28 day cure. Premix requiring only the addition of water.

.2 Use manufacturer's recommended primers on all surfaces to receive cementitious underlayment.

.3 Gypsum based products are not acceptable.

.4 Acceptable material: Elsro Ardex K-55 Microtec, Mapei Plani/Patch, EP Para-Patch System.

.2 Subfloor Crack filler:

.1 Epoxy type high-strength, self-leveling joint filler acceptable to flooring manufacturer. Acceptable product: Mapei Planibond JF, or approved alternate.

.3 Primer: Water-based, VOC limit 50 grams/liter, suitable for porous and non-porous substrate conditions. Use product acceptable to flooring manufacturer to suit flooring product and substrate conditions.

.4 Adhesives:

.1 Water resistant, two-component urethane or epoxy ahesive applicable for specific material on applicable substrate above, acceptable to flooring manufacturer. VOC limit 50 grams/liter for vinyl flooring.

.2 For sheet flooring integral cove base: manufacturer's recommended flash-cove adhesive. Resilient cove base adhesive not acceptable for integral cove base installations.

.5 Edging and Reducing Strips:

.1 Flooring manufacturer's proprietary tapered vinyl edging.

.2 Colour: To match floor finish.

.3 Acceptable Manufacturer: Johnsonite, Roberts, Rehau, Flexco.

.4 Location: Termination of resilient flooring to other finish.

.6 Heat Welding Rods: By same manufacturer as flooring, colour-matched welding rod as selected by Consultant.

.7 Seam sealer: Type recommended by manufacturer for chemical weld seams.

.8 Cove former: PVC Cove Former: Purpose made, PVC, 20 mm size.

.9 Integral Cove Cap:

.1 Flooring manufacturer's proprietary flexible PVC cap purpose made to accommodate flooring thickness, colour as selected by the Consultant from manufacturer's complete range of available colours, number of colours to match number of floor colours and types.

.2 Custom form to suit curved corners.

.10 Flooring protection: heavy-duty, non-staining, kraft paper.

.11 Silicone sealant: one component, mildew resistant silicone, as specified in Section 07 92 00 - Joint Sealants.

.12 Sealer and Wax: Types recommended by flooring manufacturer for material type and location.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

.2 Once work has commenced by this section it is a sign of acceptance of the substrate.

3.2 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify concrete floors are dry to a maximum moisture content of 7 percent, and exhibit negative alkalinity, carbonization, or dusting.

.3 Ensure sub-floors are dry by using test methods recommended by flooring manufacturer.

.4 Ensure sub-floors are structurally sound, free from alkali, dust, solvents, paint, wax, oil, grease, asphalt, adhesives, sealing compounds and other extraneous foreign materials.

.5 Ensure ink from felt-tipped pens and other markers that may transmit through flooring materials have been removed or effectively sealed.

.6 Ensure lower wall surfaces are free of substances that may impair adhesion of new adhesive and finish materials.

3.3 PREPARATION

.1 Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

.2 Existing flooring is to be cut in as few edges and seams as possible, for the full width of the room, or hallway, to integrate the new work seamlessly with the existing. Damaged flooring will result in a full strip across the room or hallway to be replaced, rather than a small patch, in order to provide colour continuity.

.3 Prohibit traffic until filler is cured.

.4 Remove existing resilient flooring, paint and other materials from substrate surface. Remove old adhesives to prevent residual, old flooring adhesives from bleeding through to new flooring and/or interfering with the bonding of new adhesives and subfloor filler using solvents or strippers applied in accordance with manufacturer's instructions.

.5 Clean surface to remove dirt, oil, grease and stains. Clean with cold water and detergent solution using fibre brush. Rinse floor with clean water and allow surface to dry.

.6 Remove paint using paint remover applied to manufacturer's written instructions. Rinse surfaces with clean water.

.7 Grind smooth low spots, cracks, control joints, holes, and other defects to remove unsound areas and fill with subfloor filler to achieve smooth, flat, sound, hard surface. In renovation areas allow for 100% coverage of subfloor filler in areas to receive new flooring to achieve smooth, flat surface flush with adjacent subfloor surfaces.

.8 Apply filler, trowel and float to leave smooth, flat, hard surface free of trowel marks, bumps, voids, etc. Prohibit traffic until filler cured.

.9 Make transitions between different flooring materials smooth, level, and flush by building up subfloor with smooth gradual ramping of filler.

.10 Ensure sub-floor filler is fully bonded to substrates. Remove and replace unsound areas.

.11 Vacuum clean substrate.

.12 Prime or seal sub-floor to flooring manufacturer's printed instructions.

.13 Wall surfaces at integral cove bases: On masonry and other irregular surfaces, fill voids behind base with filler/wall patch to form a smooth, level, and flush surface. Prime or seal wall surface behind base to flooring manufacturer's printed instructions before installing integral cove base.

.14 For rooms with walls to receive flashcove base: coordinate work with millwork supplier to provide flashcove along the base of all floor-mounted millwork cabinets.

3.4 INSTALLATION – GENERAL

.1 Apply adhesives uniformly, using recommended trowel. Do not spread more than can be covered by flooring before initial set takes place. If adhesive over dries remove and re-coat affected areas.

.2 During and after installation roll flooring with roller to ensure full adhesion. Use roller of weight recommended by flooring manufacturer.

.3 Cut flooring neatly and tight to fixed objects. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

.4 Install feature strips, borders, graphics and floor markings indicated. Fit joints tightly.

.5 Install flooring in pan type floor access covers. Maintain floor pattern.

.6 Provide sheet flooring within the perimeter ring of mechanical clean outs to match adjacent flooring material.

.7 Continue flooring over areas which will be under removable equipment.

.8 Extend resilient flooring into alcoves, reveals, closets, and similar openings.

.9 Continue flooring through areas to receive movable type partitions without interrupting floor pattern.

.10 Terminate flooring at centerline of door in openings where adjacent floor finish or colour is dissimilar.

.11 Seal around pipe up stands, cutouts, and joints with mildew resistant silicone sealant. Make watertight.

.12 Where flooring materials are scribed to fixed objects seal joint with mildew resistant silicone sealant. Make watertight.

.13 Seal joints between flooring and door and sidelight frames with Type F sealant specified in Section 07 92 00. Make watertight.

.14 Seal flooring around full perimeter of floor drains with two-part polyurethane adhesive. Install flooring into drain collar and install fastening clamp and strainer.

.15 Install edge protection strips at unprotected or exposed edges where flooring terminates. Install vinyl/rubber edge protection strips with contact adhesive.

3.5 INSTALLATION - RESILIENT VINYL SHEET FLOORING

.1 Lay flooring with joints and seams parallel to building lines to produce minimum number of seams.-**to match existing.**

.2 Run sheets in direction of traffic.

.3 Install sheet flooring parallel to length of room. Provide minimum of 1/3 full roll width. Double cut sheet joints and provide straight, even joints.

.4 Heat weld joints in accordance with manufacturer's printed instructions.

3.6 INSTALLATION - INTEGRAL (FLASH-COVED) COVE BASE

.1 Fabricate sheet flooring coved bases of same material and thickness as adjacent sheet flooring.

.2 Form from one piece of material with integral border. Heights and border widths as indicated. Where border widths are not indicated they shall be minimum 150 mm onto floor surface. - **to match existing.**

.3 Provide adequate material width for vertical portion of cove base to account for variations in floor levelness while maintaining a minimum height of 150 mm measured at high point of floor surface, unless indicated otherwise.

.4 Using a Laser Level strike a dead-level line on wall surfaces for the top edge of the cove base 150 mm above floor measured at high point of floor surface. Trim excess material to ensure top edge is installed dead level and straight along entire length of wall surfaces

.5 Use longest practical lengths to minimize joints. Use single piece between corners or obstructions such as door frames. Where vertical joints occur, align with field joints.

.6 Bond integral cove base to floor and wall surfaces with flooring adhesive. Linoleum paste or cove base adhesive not acceptable. Apply adhesive with 100% coverage.

.7 Dry fit flash cove base: cut and fit material to required lengths. Miter-cut inside and outside corners.

.8 Outside corners: use a butterfly corner plug, back grooved, snugly fit. Use same seaming method used for adjacent flooring.

.9 Inside corners: wrap as per manufacturer's instructions. Use same seaming method used for adjacent flooring.

.10 Install cove base with PVC cove former.

.11 Where cove base extends beyond projecting surfaces at floor line such as door frames, taper cove former 300 mm back from projection to provide flush cove at face of projection.

.12 Install cove base with top edge covered with cap strip. Miter-cut cap strips at inside and outside corners and file cut edges smooth. Ensure cap strips are straight, level and securely fastened or bonded to wall surface.

.13 Mask upper wall surface to avoid excess adhesive above contact line.

.14 Provide continuous bead of Type F sealant specified in Section 07 92 00 along the top.

.15 Where wall protection is scheduled (white rock) carry base up an additional 75mm under the wall protection panels. Install bead of sealant along bottom edge of panels.

3.7 INSTALLATION - EDGING AND REDUCING STRIPS

.1 Install to all exposed edges of flooring materials and where meeting flooring of different thickness. Cement edging using contact bond adhesive.

3.8 REMEDIAL WORK

.1 Patch and repair existing resilient flooring and base materials where indicated, and as required for alteration and renovation work of this project.

.2 For patchwork, use new materials to match existing materials as closely as possible with respect to type, colour, pattern, etc. Submit samples to Consultant for approval prior to installation.

.3 Where new openings have been cut in existing walls and partitions patch flooring at new doorway openings.

.4 Where doors have been removed patch and repair flooring and wall base where openings have been filled in with new construction.

.5 Patch flooring where existing partitions, millwork cabinets, equipment, etc. have been removed and subfloor exposed.

.6 Where partitions and wall furring have been removed or demolished patch exposed subfloor.

.7 Patch and repair existing flooring where new partitions have been installed over existing flooring. Provide new wall base on new partitions and wall furring.

3.9 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 Provide initial cleaning and maintenance of resilient flooring and base installed on project.

.3 Confirm initial cleaning materials and methods with Owner's future maintenance requirements.

.4 Clean floor, base and wall surfaces without damage. Remove excess adhesives, scuff marks or other soiled areas.

.5 Clean, seal and wax floor and base surface to flooring manufacturer's instructions.

.6 Vinyl sheet flooring: wash, rinse, and dry buff to satin sheen.

.7 Slip-resistant sheet vinyl flooring: wet scrub and rinse clean.

.8 Resilient base: wash, rinse, and wipe clean.

3.10 PROTECTION OF FINISHED WORK

.1 Prohibit traffic on floor for minimum 48 hours after installation.

.2 Prohibit heavy rolling loads for 72 hours after installation.

.3 Protect new floors from time of final set of adhesive until time of Substantial Performance.

.4 Remove and recycle protective covering at time of Substantial Performance of the Work in accordance with Section 01 74 21 – Construction Waste Managing and Disposal.

.5 Prohibit traffic after installation of flooring in accordance with manufacturer's product data and installation sheets.

3.11 SCHEDULE

.1 Refer to drawings room finish schedule.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Surface preparation and field application of paints and coatings.

1.2 RELATED SECTIONS

.1 Section 01 74 21 – Construction Waste Management and Disposal.

1.3 REFERENCES

.1 MPI (Master Painters Institute) - Specifications Manual.

1.4 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements indicating special surface preparation procedures, substrate conditions requiring special attention.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Section 01 78 40: Maintenance and extra material requirements.

.2 Extra Stock Materials:

.1 Provide 4 liters (1 gallon) of each type and color of paint from same production run (batch mix) used in unopened cans, properly labeled and identified for Owner’s later use in maintenance.

1.6 QUALITY ASSURANCE

.1 Applicator Qualifications:

.1 Provide the work of this Section, executed by a competent installer having:

.1 Minimum of 5 years experience in the application of products, systems and assemblies specified.

.2 All materials, preparation and workmanship shall conform to requirements of the latest edition of the Architectural Painting Specification Manual by the Master Painters Institute (MPI) (hereafter referred to as the MPI Painting Manual) as issued by the local MPI Accredited Quality Assurance Association having jurisdiction.

.3 All paint manufacturers and products used shall be as listed under the Approved Product List section of the MPI Painting Manual.

.4 Products of This Section: Manufactured to ISO 9000 certification requirements.

1.7 REGULATORY REQUIREMENTS

.1 Conform to applicable code for flame and smoke rating requirements for finishes.

1.8 DELIVERY, STORAGE, AND PROTECTION

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

.3 Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, colour designation, and written instructions for mixing and reducing.

.4 Store paint materials at minimum ambient temperature of 7 degrees C and a maximum of 32 degrees C, in ventilated area, and as required by manufacturer's written instructions.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 Section 01 35 43: Environmental conditions affecting products on site.

.2 Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

.3 Minimum Application Temperatures for Latex Paints: 7 degrees C for interiors; unless required otherwise by manufacturer's written instructions.

.4 Minimum Application Temperature for Varnish and Finishes: 18 degrees C for interior unless required otherwise by manufacturer's written instructions.

.5 Provide lighting level of 860 lx measured mid-height at substrate surface.

1.10 WARRANTY

.1 Warranty Period for all supplied materials, equipment and installation is two (2) years from the date of Substantial Completion.

.2 Warranty to include replacing and refinishing due to defects or faulty workmanship.

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 Only materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, etc.) listed in the latest edition of the MPI Approved Product List (APL) and for interior systems, listed as Institutional Low-odor, Low-VOC or High Performance Architectural Latex systems are acceptable for use on this project. All such material shall be from a single manufacturer for each system used.

.3 Indoor Air Quality - Interior applications: Use only materials having a minimum MPI "Environmentally Friendly" E2 or E3 rating based on VOC (EPA Method 24) content levels.

.4 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.

.5 Paints and materials to be lead and mercury free and shall have a low VOC content where possible or where required by authorities having jurisdiction.

.6 Where required, paints and coatings shall meet the flame spread requirements of local authorities having jurisdiction.

.7 No recycled content paints and primers will be allowed on interior applications.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify that surfaces are ready to receive work as instructed by the product manufacturer.

.3 Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

.4 Test shop applied primer for compatibility with subsequent cover materials.

.5 Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

.1 Plaster and Gypsum Wallboard: 12 percent.

.2 Interior Wood: 15 percent, measured in accordance with ASTM D2016.

3.2 PREPARATION

.1 Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

.2 Correct defects and clean surfaces which affect work of this section. Remove existing coatings that exhibit loose surface defects.

.3 Seal with shellac and seal marks which may bleed through surface finishes.

.4 Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

.5 Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

.6 Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

.7 Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.

3.3 APPLICATION

.1 Apply products to manufacturer instructions.

.2 Do not apply finishes to surfaces that are not dry.

.3 Apply each coat to uniform finish.

.4 Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

.5 Sand wood lightly between coats to achieve required finish.

.6 Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.

.7 Allow applied coat to dry before next coat is applied.

.8 Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

.9 Prime concealed surfaces of interior woodwork with primer paint.

.10 Prime concealed surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

3.4 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

.1 Refer to Section 23 05 53 and Section 26 05 53 for schedule of colour coding and identification banding of equipment, duct work, piping, and conduit.

.2 Paint shop primed equipment. Paint shop prefinished items occurring at interior areas.

.3 Remove unfinished louvres, grilles, covers, and access panels on mechanical and electrical components and paint separately.

.4 Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are prefinished.

.5 Paint interior surfaces of air ducts, and convector and baseboard heating cabinets that are visible through grilles and louvres with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvres, grilles, and convector and baseboard cabinets to match face panels.

.6 Paint exposed conduit and electrical equipment occurring in finished areas.

.7 Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

.8 Colour code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated. Colour band and identify with flow arrows

.9 Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.5 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 Collect waste material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.6 SCHEDULE - COLOURS

.1 Colours: Refer to Interior Finishes List

.2 Locations: Refer to Drawings.

3.7 Interior Surfaces

.1 Unless otherwise specified, all interior painting work to be in accordance with MPI Premium Grade finish requirements.

.3 Structural steel and metal fabrications: columns, beams, joists:

.1 INT 5.1R - High performance architectural latex semi-gloss level finish.

.4 Steel - high heat: (boilers, furnaces, heat exchangers, breeching, pipes, flues, stacks, etc., with temperature range as noted):

.1 INT 5.2A - Heat resistant enamel finish, maximum 205 degrees C.

.2 INT 5.2B - Heat resist ant aluminum paint finish, maximum 427 degrees C.

.3 INT 5.2C - Inorganic zinc rich coating, maximum 400 degrees C.

.4 INT 5.2D - High heat resistant coating, maximum 593 degrees C.

.5 Galvanized metal: doors, frames, railings, misc. steel, pipes, overhead decking, and ducts.

.1 INT 5.3M - High performance architectural latex; gloss level G4.

.6 Plaster and Gypsum Board (gypsum board, drywall, and other sheet gypsum materials):

.1 INT 9.2B - High performance architectural latex; gloss level G4.

.7 Bituminous coated surfaces: cast iron pipe, concrete, etc.:

.1 INT 10.2A - Latex semi-gloss level finish.

3.8 Site Quality Control

.1 Painted surfaces will be considered to lack uniformity and soundness if any of the following defects are apparent at time of field review when viewed from a distance of 1220 mm from the painted surface:

.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

.2 Painted surfaces will be considered as deficient if any of the following defects are apparent at time of field review, regardless of viewing distance.

.1 Damage due to touching before paint is sufficiently dry or any other contributory cause.

.2 Damage due to application on moist surfaces or caused by inadequate protection from the weather.

.3 Damage or contamination of paint due to windblown contaminants (dust, sand blast materials, salt spray, etcetera)

.3 Painted surfaces found as unacceptable shall be replaced or repaired at no cost to the Owner or Consultant:

.1 Small affected areas may be touched up

.2 Large affected areas or areas without sufficient dry film thickness of paint shall be repainted.

.3 Runs, sags or damaged paint shall be removed by scraper or by sanding before application of new paint coats.

3.9 Protection

.1 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.

3.10 RESTORATION

.1 Clean and re-install all hardware items that were removed before painting operations were undertaken, ensuring that tagged or labelled items are returned to the exact position from which they were removed.

.2 Clean, prime and re-paint all bolts, nuts and fasteners after torqueing or re-tightening following specified paint finish.

.3 Remove protective coverings and warning signs as soon as possible after operations cease.

.4 Protect freshly painted surfaces from paint droppings and dust to approval of Consultant. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Consultant.

3.11 Cleanup

.1 Remove all paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.

.2 Keep work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.

.3 Remove combustible rubbish materials and empty paint cans each day and safely dispose of it in accordance with requirements of authorities having jurisdiction.

.4 Clean equipment and dispose of wash water or solvents, and other cleaning and protective materials (rags, drop cloths, masking papers, etcetera), paints, thinners, paint removers and strippers in accordance with the safety requirements of authorities having jurisdiction.

END OF SECTION

Part 1 General

1.1 CONFORMANCE

.1 The General Conditions, Supplements and Amendments shall govern this Division (read in conjunction with Instructions to Tenderers / Bidders). This section covers items common to all sections of Division 21, 22, 23 and 25,and is intended to supplement the requirements of Division 01.

1.2 WORK INCLUDED

.1 This project is deemed to be a post-disaster design.

.2 Provide complete, fully tested and operational mechanical systems to meet the requirements described herein, in complete accordance with applicable codes and ordinances.

.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.

.5 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 Follow manufacturer's recommended installation details and procedures for equipment, supplemented by requirements of Contract Documents.

.7 The most stringent requirements of this and other mechanical sections shall govern. Should inconsistencies exist such as the drawings disagreeing within themselves or with the specifications, the better quality and/or greater quantity of work or materials shall be estimated upon, performed and furnished unless otherwise ordered by the Consultant in writing during the bidding period.

.8 Drawings and specification are complimentary in nature and combined, create a complete set of construction documents. Any item called for by one and not by the other shall be interpreted as being called for by both.

.9 Any discrepancy between drawings and specifications leaving in doubt the true intent of work shall be brought to the attention of the Consultant immediately.

.10 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.

.11 Provide seismic restraints for all required equipment, piping and ductwork.

.12 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

.13 "Consultant" shall mean Stantec Consulting Ltd.

1.3 CODES, BYLAWS, STANDARDS AND APPROVALS

.1 Where multiple versions of the same code are published, the most recent version shall be applied, unless noted otherwise by building codes and local by-laws.

.2 Divisions 21, 22, 23, and 25 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.

.3 The latest revision of each code and/or standard shall generally apply unless building codes reference a previous version, or otherwise specified in the contract documents.

.4 Where multiple standards apply, the most stringent requirement shall be incorporated into the work.

.5 Where the contract documents indicate requirements more stringent requirement than any applicable code and/or standard, the contract documents shall be implemented.

.1 By-laws

.1 Local Building By-laws (City of Nelson).

.2 Regional District of Kootenay Boundary

.2 Canadian Standards Association

.1 CAN/CSA-B51 Boiler, Pressure Vessel and Pressure Piping Code.

.2 CAN/CSA-B52 Mechanical Refrigeration Code.

.3 CAN/CSA-B149.1 Natural Gas and Propane Installation Code.

.4 CAN/CSA B214 Installation Code for Hydronic Heating Systems.

.5 CAN/CSA-C22.1 Canadian Electrical Code, Part I

.6 CAN/CSA-C22.2 Test methods for electrical wires and cables

.7 CAN/CSA-S350 Code of Practice for Safety in Demolition of Structures

.8 CAN/CSA-Z305.8 Medical Supply Units.

.9 CAN/CSA-Z317.1 Special requirements for plumbing installations in healthcare facilities

.10 CAN/CSA-Z317.2 Special Requirements for Heating, Ventilation, and Air-Conditioning (HVAC) Systems in Healthcare Facilities.

.11 CAN/CSA-Z317.13 Infection Control during Construction, Renovation, and Maintenance of Healthcare Facilities

.12 CAN/CSA-Z7396.1 Medical Gas Pipeline Systems – Part 1: Pipelines for medical gases, medical vacuum, medical support gases, and anaesthetic gas scavenging systems

.3 Medical Research Council of Canada

.1 Laboratory Biosafety Guidelines

.4 National Association of Pharmacy Regulatory Authorities (NAPRA)

.1 Model Standards for Pharmacy Compounding of Non-hazardous Sterile Preparations

.1 https://napra.ca/sites/default/files/2017-09/Mdl_Stnds_Pharmacy_Compounding_NonHazardous_Sterile_Preparations_Nov2016_Revised_b.pdf

.2 Model Standards for Pharmacy Compounding of Hazardous Sterile Preparations

.1 https://napra.ca/sites/default/files/2017-09/Mdl_Stnds_Pharmacy_Compounding_Hazardous_Sterile_Preparations_Nov2016_Revised_b.pdf

.3 Model Standards for Pharmacy Compounding of Non-sterile Preparations

.1 https://napra.ca/sites/default/files/documents/Mdl_Stnds_Pharmacy_Compounding_Nonsterile_Preparations_March2018_FINAL.pdf

.5 National Fire Protection Association

.1 NFPA 13 Standard for the Installation of Sprinkler Systems
.2 NFPA 90B Standard for the Installation of Warm Air Heating and Air-Conditioning Systems
.3 NFPA 91 Exhaust Systems for Air Conveying of Vapors, Gases, Mists and Noncombustible Particulate Solids
.4 NFPA-99 Health Care Facilities
.5 NFPA 101 Life Safety Code®

.6 Province of British Columbia
.1 B.C. Building Code
.2 B.C. Plumbing Code
.3 B.C. Fire Code
.4 B.C. Safety Authority Safety Standards Act
.5 B.C. Safety Authority Power Engineers, Boiler, Pressure Vessel and Refrigeration Safety Regulation
.6 B.C. Amendment to Canadian Electrical Code
.7 B.C. Electrical Safety Regulation
.8 B.C. Electrical Safety Branch Bulletins
.9 B.C. Elevating Devices Safety Regulation
.10 B.C. Occupational Health & Safety (OHS) Regulations
.11 WorkSafeBC
.12 R.S.B.C. c39 Safety Standards Act

.7 Underwriter's Laboratories of Canada
.1 CAN/ULC-S110 Test for Air Ducts
.2 CAN/ULC-S111 Fire Test for Air Filter Units

.8 SMACNA Publications
.1 SMACNA 001 Guidelines for seismic restraints of mechanical systems
.2 SMACNA 006 HVAC Duct Construction Standards, Metal and Flexible
.3 SMACNA 008 IAQ Guidelines for Occupied Buildings Under Construction
.4 SMACNA 012 HVAC Air Duct Leakage Test Manual
.5 SMACNA 014 HVAC Systems Commissioning Manual
.6 SMACNA Fire, Smoke, and Radiation Damper Installation Guide

.9 Miscellaneous Standards
.1 ASHRAE Standard 62 Ventilation for Acceptable Indoor Air Quality
.2 ASHRAE/IES Standard 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings
.3 ASHRAE Standard 202 The Commissioning Process for Buildings and Systems.
.4 ASHRAE/NIBS Guideline 0 The Commissioning Process
.5 ASHRAE Guideline 1.1 HVAC&R Technical Requirements For The Commissioning Process
.6 ASHRAE Guideline 1.3 Building Operations and Maintenance Training for The HVAC&R Commissioning Process
.7 ASHRAE Guideline 1.4 Procedures for Preparing Facility Systems Manuals

.8 Thermal Insulation Association of Canada – TIAC Best Practices Guide

.9 British Columbia Insulation Contractors Association – BC Insulation Contractors Association (BCICA) Standards Manual

.10 Environment Canada Canadian Environment Protection Act

.11 Environmental Protection Agency EPA 625 Radon Prevention in the Design and Construction of Schools and Other Large Buildings

.12 NIBS Guideline 3 Building Enclosure Commissioning Process BECx

.13 ASTM E2813-12e1 Standard Practice for Building Enclosure Commissioning

1.4 SUSTAINABILITY

.1 Follow instructions and initiatives such as pollution preventions and recycling of materials, packaging and debris.

.2 HVAC & R equipment shall contain zero CFC or HCFC based refrigerants, and zero use of Halons in fire suppression equipment.

.3 For all Adhesives and Sealants Material Safety Data Sheets (MSDS) highlighting the materials Volatile Organic Compound (VOC) levels.

.4 During construction, meet or exceed the recommended Design Approaches of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction.

.5 Protect stored on-site or installed absorptive materials from moisture damage.

.6 If air handling units are used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 must be used at each return air grille, as determined by ASHRAE 52.2.

.7 Mechanical rooms should not be used to store construction or waste materials.

.8 During construction, all openings in supply, return and exhaust HVAC systems shall be protected from dust infiltration. Provide temporary ventilation as required.

.9 Duct Cleaning: Clean and sanitize all supply and return ductwork to ensure that dust and contaminants are effectively removed and contained. Sequence ductwork cleaning in a way that avoids re-contamination.

1.5 ALTERNATE PRICES

.1 Refer to Division 1 General Instructions.

.1 Alternative Price #4: Provide alternative price for the work to connect the re-heat loop to the existing heat pump loop as indicated on drawing M602 – Hydronic Schematic.

1.6 SEPARATE PRICES

.1 Refer to Division 1 General Instructions.

1.7 UNIT PRICES

.1 Refer to Division 1 General Instructions.

1.8 CASH ALLOWANCES

.1 Refer to Division 1 General Instructions.

.1 Cash Allowance #3: Controls – and addendum will follow to provide additional information on the cash allowance to be held for the Division 25 (Controls) scope of work.

1.9 STANDARD OF ACCEPTANCE

.1 Means that an item named and specified by manufacturer and/or catalogue number forms part of specification and sets standard regarding performance, quality of material and workmanship and when used in conjunction with a referenced standard, shall be deemed to supplement the standard.

.2 Acceptable Product manufacturers are listed in the list of Equipment Manufacturers in Section 23 99 65.

.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, if 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.

1.10 ADDITION OF ACCEPTABLE MANUFACTURERS

.1 Material/products considered to satisfy the specification, but of a manufacturer other than those named in Section 23 99 65 Acceptable Products/Manufacturers may be submitted to the Consultant 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 only be by formal addendum.

1.11 TENDER INQUIRIES

.1 All contractor queries during the tender period shall be made in writing to the consultant. Contractor queries will be collected, and suitable addenda will be issued for clarification. No verbal information will be issued by the consultant's office during tender. All tender queries may be e-mailed, faxed, mailed or couriered to the consultant's office. No telephone questions will be answered.

1.12 EQUIPMENT LIST

.1 Within ten (10) days after the award of contract submit a completed Equipment List, showing the equipment manufacturer’s name with model number, material included in the Tender, and names of subtrades. The equipment schedules shall be used for this purpose.

.2 The equipment list shall be a full list of equipment and materials intended for installation.

1.13 DETAILED PRICE BREAKDOWNS

.1 Tender Price Breakdown:

.1 Within ten (10) days after the award of contract submit price breakdowns

.2 Submit a separate breakdown for each section of the mechanical work

.2 Proposed Change, Notice of Change, Contemplated Change, etc.:

.1 Provide detailed itemized time and materials breakdowns to assess and evaluate each item indicated in the request for quotation. Indicate number of hours and labour rates, along with quantity of materials and unit costs.

.2 Each supplier and sub-contractor shall be detailed separately.

.3 Indicate mark-ups and allowances separately.

1.14 PROGRESS CLAIMS

.1 For each progress claim, submit a progress claim summary

.2 Submit detailed price breakdowns for each section of the mechanical work listed on the Progress Claim Summary Form and for each change order item being claimed.

.3 This procedure is to allow for any necessary deficiency holdbacks on items, which do not become apparent until the systems are commissioned.

1.15 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. Consider the lead time for the review of operating and maintenance manuals, commissioning, verification of system operation by the Consultant and the demonstration and instruction to the Owner.

.3 The schedule shall include but not limited to the following items:

.1 Installation and testing of piping systems and equipment;

.2 Installation and cleaning of duct systems and equipment'

.3 Chemical cleaning and treatment of piping'

.4 Control system installation;

.5 Air / Water balancing;

.6 Connection of electrical services to equipment by electrical contractor;

.7 Start-up of mechanical equipment and systems;

.8 Check-out of control systems;

.9 Commissioning of mechanical, plumbing and fire protection systems;

.10 Demonstration of systems and equipment to Consultant;

.11 Demonstration of systems and equipment to Owner;

.12 Preparation of maintenance manuals and as-built drawings and

.13 Submission of the various documents required prior to substantial performance.

1.16 RESPONSIBILITIES

.1 Visit the site before tendering. Examine all local and existing conditions on which the work is dependent. No consideration will be granted for any misunderstanding, of work to be done, resulting from failure to visit the site.

.2 Ensure that equipment does not transmit noise and/or vibration to other parts of the building, as a result of poor installation practice.

.3 Where the Contract Documents do not contain sufficient information for the proper selection of equipment for bidding, notify the Consultant during the tendering period. If clarification is not obtainable, allow for the most expensive arrangement. Failure to do this shall not relieve the Contractor of responsibility to provide the intended equipment.

.4 Examine carefully the mechanical, electrical, structural and architectural drawings and confirm that the work under this Sub-Contract can be satisfactorily carried out without changes to the building as shown on these plans.

.5 Be responsible for prompt installation of this work in advance of concrete pouring or similar work. Provide and set sleeves where required.

.6 During freezing weather, protect all materials in such a manner that no harm can be done to installations already in place and/or to materials and equipment on the job.

.7 On completion of the work, all tools and surplus and waste materials shall be removed, and the work left in a clean and perfect condition.

1.17 COORDINATION

.1 Check drawings and specifications 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 Consultant's written approval.

.2 The drawings indicate the general location and route to be followed by the piping and ductwork. Where details are not shown on the drawings or only shown diagrammatically, the pipes and ductwork shall be installed in such a way as to conserve head room and interfere as little as possible with the free use of space through which they pass. Service lines shall run parallel to building lines. All ducts and pipes in the ceiling shall be kept as tight as possible to beams or other limiting members at high level. All pipes and ducts shall be coordinated in elevation to ensure that they are concealed in the ceiling or structural space provided unless detailed otherwise on drawings.

.3 Work out jointly all interference problems on the site with other trades and coordinate all work before fabricating or installing any material or equipment. Where necessary produce interference drawings showing exact locations of mechanical equipment within service areas, shafts and the ceiling space. Ensure that all materials and equipment fit into the allotted spaces and that all equipment can be properly serviced and replaced, if and when required. Advise the Consultant of space problems before fabricating or installing any material or equipment. On completion of the work demonstrate to the Consultant that all equipment installed can be properly and safely serviced and replaced where applicable. Remove and replace improperly installed equipment to satisfaction of the Consultant at no extra cost. Extras for improper coordination and removal of equipment to permit remedial work will not be allowed.

.4 When open web structural joists are used, obtain structural shop drawings to ensure adequate space is available for installation of pipes and ductwork.

1.18 HOISTS AND SCAFFOLDS

.1 Provide all necessary exterior and interior movable or roller scaffolds, platforms, fall protection equipment, lifts and ladders required for the installation of the mechanical work. Confirm with WorkSafeBC requirements OSH Regulation Part 1: Fall Protection for all work on the roof. https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-regulation/part-11-fall-protection

1.19 INSPECTION OF WORK

.1 The Consultant representative will field review all work prior to it being concealed. All piping below ground must be approved prior to covering.

.2 All work shall be approved by all authorities having jurisdiction including the City of Nelson.

.3 All openings shall be sealed appropriately in particular in fire rated walls and floors. Sealing shall be inspected / reviewed prior to covering.

1.20 REQUESTS FOR INFORMATION

.1 Where the Contractor determines that more information is required to complete the scope of work, submit a written “Request for Information” to the consultant before making assumptions as to intent.

1.21 PROVISION FOR FUTURE EQUIPMENT AND CONSTRUCTION

.1 Leave clear spaces designated for future equipment or building expansion. Were dotted lines indicate future installation of ducting, equipment etc., plan for the installation under this contract and ensure clear accessible, unhindered access to the space is allowed for.

.2 Where contract documents don’t clearly indicate the future expansion requirements, but known services are required, submit a written “Request For Information”.

.3 Where space is indicated as reserved for future equipment or services, leave such space clear and install piping, raceways and equipment so that connections can be made to future apparatus or building.

.4 Identify provisions and service terminations for future on Record Drawings.

1.22 PERMITS

.1 Obtain all required permits and pay all fees therefore and comply with all Provincial, Municipal, and other legal regulations and by-laws 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.

1.23 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 Division 25 for Control System warranty requirements.

.4 Furnish a written warranty stating that all work executed under this Division will be free from defects of material and workmanship for a period of one (1) year from the date of substantial performance, which shall include one (1) complete summer and one (1) complete winter of uninterrupted operation. Warranty shall include any part of equipment, units or structures furnished hereunder that show defects in the works under normal operating conditions and/or for the purpose of which they were intended.

.5 The above parties further agree that they will at their own expense promptly investigate any mechanical or control malfunction, and repair or replace all such defective work, and all other damages thereby which becomes defective during the time of the guaranty-warranty.

1.24 ENERGY CONSUMPTION

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

1.25 INFECTION CONTROL

.1 Refer to Division 1 for infection control measures.

.2 Conform to the requirements of CSA Z-317.2 Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Healthcare Facilities.

.3 Coordinate with General Contractor and other trades.

.4 Maintain negative pressurization, at all times, in the work area. Exhaust shall be directed to the exterior and filtered.

1.26 ASBESTOS

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

1.27 ASBESTOS DURING RENOVATIONS

.1 If the Contractor, during renovations, should discover asbestos (or material suspected to be asbestos) on piping, ductwork, etc., he shall immediately cease all work in that area and contact the General Contractor or Owner's representative.

.2 The General Contractor or Owner's representative will take immediate appropriate action to verify presence of friable asbestos. The Contractor will not be entitled to a claim for any delays resulting from the investigation of or removal of asbestos.

.3 Refer to Division 2 for removal and disposal of asbestos.

.4 All work performed on systems with asbestos insulation must be reported to WorkSafeBC before work commences.

.5 Removal of all asbestos products shall be carried out in accordance with the applicable codes by a contractor experienced in this specialty.

1.28 WORKMANSHIP

.1 Workmanship shall be in accordance with well-established practice and standards accepted and recognized by the Consultant and the Trade.

.2 The Consultant 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 Consultant.

1.29 PERFORMANCE VERIFICATION OF INSTALLED EQUIPMENT

.1 Installed mechanical equipment whose performance is questioned by the Consultant, may be subject to performance verification as specified herein.

.2 When performance verification is requested, equipment shall be tested to determine compliance with specified performance requirements.

.3 The Consultant will determine by whom testing shall be carried out. When requested, the contractor shall arrange for services of an independent testing agency.

.4 Testing procedures shall be reviewed by the Consultant.

.5 Maintain building comfort conditions when equipment is removed from service for testing purposes.

.6 Promptly provide the Consultant with all test reports.

.7 Should test results reveal that originally installed equipment meets specified performance requirements, Owner will pay all costs resulting from performance verification procedure.

.8 Should test results reveal that equipment does not meet specified performance requirements, equipment will be rejected, and the following shall apply:

.1 Remove rejected equipment. Replace with equipment, which meets requirements of Contract Documents including specified performance requirements.

.2 Replacement equipment will be subject to performance verification as well; using the same testing procedures on originally installed equipment.

.3 Contractor shall pay all costs resulting from performance verification procedure.

1.30 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 Consultant 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.

1.31 SEQUENCE OF WORK

.1 Before interrupting major services notify Interior Health Facility Maintenance, through the General Contract and Project Manager, well in advance. Arrange an acceptable schedule for the interruptions.

.2 Please not that all work associated

.3 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.

.4 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.

1.32 BUILDING OPERATION DURING CONSTRUCTION

.1 In order to minimize operational difficulties for the building staff, the various trades must cooperate with Interior Health throughout the entire construction period and particularly ensure that noise is minimized. Please note that the site is an active regional hospital.

.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.

1.33 EXISTING SERVICES

.1 Work includes changes to existing building and changes at junction of old and new construction. Route pipes, ducts, conduits, and other services to avoid interference with existing installation.

.2 Relocate existing sprinkler, pipes, ducts, conduits, bus ducts and any other equipment or services required for proper installation of new work, including as required for temporary removal and re-installation to suit new installation work.

.3 Protect all existing services encountered, even when the removal of concealing surfaces reveals existing services other than what is shown on the drawings.

.4 Work with the Interior Health staff to trace the originating source and points served. Obtain instructions from the Consultant if existing services require relocation or modifications, other than those already indicated in the Contract Documents.

.5 Remove existing plumbing fixtures, hydronic heating elements, piping, ductwork, wiring, and equipment to suit new construction. Cut back and cap drain, vent and water outlets, conduits and electrical outlets, not being used, at the main branches whenever possible..

.6 Arrange work to avoid shutdowns of existing services. Where shutdowns are unavoidable, obtain the Owner's approval of the timing, and work to minimize any interruptions.

.7 Shutdowns, to permit connections, will be carried out by Interior Health maintenance staff. Contractor to assume that all shutdown will need to occur after hours that impact other departments or spaces in the building.

.8 In order to maintain existing services in operation, temporary relocations and/or bypasses of piping and ductwork may be required.

.9 Be responsible for any damages to existing systems by this work.

.10 The interruption of utility services to permit tie-ins shall be arranged through the Owner's 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. Interior Health 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.

1.34 SPECIFIC WORK THAT WILL IMPACT EXISTING SPACES:

.1 **Exhaust ductwork routing to the penthouse** – To provide low level exhaust in the HD anteroom and HD cleanroom to meet NAPRA guidelines, a new exhaust fan is to be added. The exhaust ductwork runs over existing active hospital spaces. Coordinate work schedule with owner and assume that all work is to occur after hours. Contractor must clean the area of work at the conclusion of each work-day. Work in the spaces adjacent to the pharmacy shall be held to the same standard. Contractor must understand the implications of working inside an active hospital and schedule appropriately.

1.35 SHOP DRAWINGS AND PRODUCT DATA

.1 General

.1 The term "Shop Drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Trade Contractor to illustrate details of a portion of Work.

.2 Shop drawings shall be reviewed, signed and processed as described in in Division 1, Submittals.

.3 Submit shop drawings to the Consultant as listed in 23 99 65 (HVAC) Equipment Manufacturers.

.4 Submit shop drawings 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.

.5 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.

.6 Work affected by submittal shall not proceed until the review process is complete.

.7 Installed materials and equipment shall meet specified requirements regardless of whether shop drawings are reviewed by the Consultant.

.8 Shop drawings shall include the Contractor's stamp, signed by Contractor's authorized representative, certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.9 Shop drawings shall be reviewed by the General Contractor and Mechanical Sub-Contractor indicating that the shop drawings have been reviewed, coordinated with the work and that the shop drawings are submitted without qualifications. Shop drawings shall bear the ‘reviewed’ stamp dated and initialed by the General Contractor and Mechanical Sub-Contractor prior to submitting the shop drawings to the consultant. Shop drawings, which do not bear the contractors and sub-trades ‘reviewed’ stamp, initials and date will be rejected and sent back as ‘not reviewed’.

.10 Submit samples, in addition to drawings, of all items, which in the Consultant's judgment, can be better examined for capacity, quality, finish or detail by sample rather than by drawings. Samples shall be submitted before equipment or material is ordered.

.11 Adjustments made on Shop Drawings by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

.12 Make changes in Shop Drawings as Consultant may require, consistent with Contract Documents. When resubmitting, notify Consultant in writing of any revisions other than those requested.

.13 If upon review, no errors or omissions are discovered or if only minor corrections are made, copies will be returned, and fabrication and installation of Work may proceed. If Shop Drawings are rejected, noted copy will be returned and re-submission of corrected Shop Drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.14 If shop drawings are rejected technically after 3 submissions, the Contractor at no additional expense to the Owner shall revert to the specified product and manufacturer for this project.

.2 Content

.1 Submissions shall include transmittal letter containing:

.1 Date, Project title and number;

.2 Name and address of:

.1 Trade Contractor;

.2 Supplier and

.3 Manufacturer

.3 Identification and quantity of each shop drawing, product data and sample and other pertinent data as required

.2 Information shall include and be given in S.I. units

.1 Imperial Units can be included in addition to the S.I. units.

.3 Provide title sheet;

.4 The project name shall be identified (KBH Pharmacy & Ambulatory Care Project).

.5 Identify each piece of equipment as related to specification section and project equipment schedules;

.6 Data shall be specific and technical;

.7 Information shall include all scheduled data;

.8 Information shall include a space for Interior Health Asset Number;

.9 Material for maintenance and operating manuals is not suitable and

.10 Advertising literature, is not required and will be removed or rejected;

.11 The shop drawings/product data shall include:

.1 Clearly mark submittal material using arrows, underlining or circling to show differences from specified ratings, capabilities and options being proposed. Cross out non-applicable material. Specifically note on the submittal specified features such as special tank linings, pumps, seals, material, or painting.

.2 Dimensioned construction drawings with plans and sections showing size, arrangement and necessary clearances, with mounting point loads.

.3 Weights of all major equipment for review by the appropriate Consultant.

.4 Mounting arrangements.

.5 Detailed drawings of bases, supports and anchor bolts.

.6 Capacity and performance characteristics indicated on performance curves for fans and pumps.

.7 Sound Power Data, where requested.

.8 Motor efficiencies on motors 1 H.P. and larger.

.9 List of the manufacturers and figure numbers for all valves, traps and strainers.

.10 Control explanation and internal wiring diagrams for packaged equipment.

.11 Control system drawings including a written description of control sequences relating to the schematic diagrams. Refer to additional requirements in Division 25.

.3 Electrical Equipment List

.1 Submit as a shop drawing, an electrical equipment list for any equipment supplied by the mechanical contractor or his subtrades. The list is to be submitted in a timely fashion so that the electrical contractor can utilize the list as a final check prior to ordering motor control centres, starters, or disconnects. The list is to indicate the following:

.1 The horsepower size and number of motors.

.2 The minimum circuit amps (MCA) for packaged equipment such as roof top units.

.3 The voltage and phase of the motors.

.4 Whether or not a starter or a disconnect is included as part of the package.

.4 Format

.1 Submit electronic copy (pdf format) of Shop Drawings for each requirement requested in specification Sections and as Consultant may reasonably request. If electronic copy is not feasible, submit hard copies as necessary.

.2 Include sufficient blank space to allow for review comments and multiple consultant electronic stamps.

.3 An assembly of related components, e.g. grilles, registers and diffusers or plumbing fixtures, shall be submitted with a cover sheet with the contents indicated, identified by tag and model number.

.5 Coordination

.1 Where mechanical equipment requires electrical connections, power or other services, the shop drawings shall also be circulated through the Electrical Contractor or other "services" contractor(s) prior to submission to the Consultants.

.6 Keep one (1) copy of shop drawings and product data, on site, available for reference.

1.36 DUCT AND PIPE MOUNTED CONTROL EQUIPMENT

.1 The following automatic control equipment will be **supplied** by the Controls Contractor but installed by the appropriate trade sections of the Mechanical Contract:

.1 Automatic control valves;

.2 Temperature control wells;

.3 Pressure tappings;

.4 Flow switches;

.5 Automatic control dampers and

.6 Static pressure sensors.

1.37 MAINTENANCE OF BEARINGS

.1 "Turn over" rotating equipment at least once a month from delivery to site until start-up.

.2 "Run-in" sleeve type bearings in accordance with manufacturer's written recommendation. After "run- in", drain, flush out and refill with new charge of oil or grease as required and recommended by the manufacturer.

.3 Protect bearings, shafts and sheaves against damage, corrosion and dust accumulation during building construction.

1.38 DEMOLITION

.1 Reference Standards

.1 Unless otherwise specified, carry out demolition work in accordance with CAN/CSA-S350, Code of Practice for Safety in Demolition of Structures.

.2 Existing Conditions

.1 Visit and examine the site and note all characteristics and irregularities affecting the work of this section.

.3 Protection

.1 Cease operations and notify the Prime Consultant immediately for special protective and disposal instructions when any asbestos materials are uncovered during the work of this section.

.2 Prevent debris from blocking surface drainage inlets and mechanical and electrical systems, which remain in operation.

.4 Salvageable Materials

.1 Except as otherwise indicated, salvageable materials from areas of demolition shall become the property of the Owner at his discretion. All material removed from the building not handed over to the Owner for salvage under this project shall be removed from site and disposed of as required by any applicable disposal regulations.

.5 Existing Services

.1 Disconnect and cap all mechanical services in accordance with requirements of local authority having jurisdiction.

.2 Maintain all building services as required during demolition/removal of existing.

.6 Demolition

.1 Carry out demolition in a manner to cause as little inconvenience to the adjacent occupied building area as possible. Coordinate the activity with the Owner and/or the Consultant.

.2 Carry out demolition in an orderly and careful manner.

.3 All removal of existing equipment, pipes and ductwork that may affect occupied areas of the building to be done outside of regular office hours or as scheduled with the Owner.

1.39 SALVAGE

.1 All piping, ducting 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, such as fans and motors, air terminals, plumbing fixtures, and valves, shall be carefully removed. Interior Health (IH) shall have first right of refusal.

.1 If the IH accepts any items, the Contractor shall move those items to the IH's designated storage place on site. These items shall not become the property of the Contractor. Obtain a written receipt from IH detailing each of the items handed over.

.2 If IH declines any items, the Contractor shall remove those items from the site. The Contractor shall be responsible for all costs of removal and disposal of the materials and equipment that are not accepted by the Owner.

1.40 REUSED EQUIPMENT

.1 Where existing equipment is being relocated and re-used, check and report on the condition to the Consultant before reinstallation.

1.41 TEMPORARY HEATING

.1 If it is desired to use the building's mechanical systems to provide temporary heat during construction, submit a formal request, with full details, to FMO and the Consultant. Obtain written permission from Interior Health FMO and the Consultant prior to any building systems being utilized.

.2 The existing air handling supply unit shall not be used for temporary heat.

.3 Use of permanent systems for temporary heat shall not modify terms of warranty.

.4 During the temporary heating period, comply with the following conditions:

.1 Maintain the systems.

.2 Lubricate all equipment operated.

.3 Operate systems only with cleaned piping systems.

.4 Maintain chemical treatment of piping systems.

.5 Keep mechanical rooms broom clean.

.6 Operate fans at proper resistance with filters installed. Change filters at regular intervals.

.7 Operate with proper safety devices and controls installed and fully operational.

.8 Where air systems are used during temporary heating, provide filter media on return and exhaust air outlets.

.9 Where hydronic systems are used, all terminal heating devices shall be brought o "as-new" condition before Substantial Performance review is requested.

.5 Before handing the systems over to the Owner, comply with the following conditions:

.1 Bring equipment to as-new conditions.

.2 Where pumps are used for temporary heating, replace mechanical seals, regardless of condition, with new mechanical seals. All bearings for equipment used shall be checked, re-greased, oiled and cleaned to bring it back to an "As-New" condition.

.3 Replace all panel type air filters installed under this contract with new filters.

.4 Re-clean ductwork and heating/cooling coils as necessary and provide a report from the approved duct cleaning agency certifying that the ductwork is clean.

1.42 TEMPORARY OR TRIAL USAGE

.1 Temporary or trial usage by the Owner of mechanical equipment supplied under this contract shall not represent acceptance.

.2 Repair or replace permanent equipment used temporarily.

.3 Repair or otherwise rectify damage caused by defective materials or workmanship during temporary or trial usage.

1.43 SPARE PARTS

.1 Provide spare parts as follows:

.1 One set of packing for each pump;

.2 One casing joint gasket for each size pump;

.3 One head gasket for each heat exchanger;

.4 One glass for each gauge glass installed;

.5 One set of air filters for each filter bank installed (pre and final filters) and

.6 One box of 6 cartridge filters for each water filter installed;

1.44 PROJECT CLOSE-OUT REQUIREMENTS

.1 The project closeout requirements are specifically listed in each section of this specification. The following is a summary of those requirements. Refer to detailed specifications in each section for further requirements. Also refer to Section 23 99 60 Mechanical Forms for list of required HVAC, Plumbing and Fire Systems substantial completion submissions.

.2 Items designated with an asterisk (*) are required to be submitted one week prior to required date of Schedule C-B. All life safety systems must be operational and tested and demonstrated to Consultant prior to issuance of Schedule C. This includes, but not limited to, items such as, sprinklers, seismic supports etc.

.1 Controls:

.1 Controls system completion report (check sheets).

.2 Controls system final electrical approval certificate.

.3 As built control drawings.

.4 Control training signed off by Owner (Indicate dates of training in letter and attendance).

.5 List of control manuals and documents turned over.

.6 Printed copy of control program and database. Printed to disk in word format acceptable.

.7 Disc of control system database.

.8 Calibration report for refrigeration, carbon monoxide and CO sensors.

.9 Airflow station start up and calibration report.

.10 Provide historical trend log data for all control points.

.1 Trend logs shall cover a one-week period with hourly samples for all points.

.2 Points shall be grouped together on graphs where applicable, e.g all points connected to an air handling unit, or heat exchanger shall be together.

.3 The controls contractor shall review each set of trend data and provide detailed high level written commentary regarding performance of each item, including suggestions for improvement.

.4 Submit trend log graphs to the Commissioning agency for detailed review and comment.

.5 Submit trend logs with detailed comments from both agencies to the Consultant after verification of proper operation of all control sequences.

.2 Heating / Cooling

.1 Registration certificates for all pressure vessels.

.2 Pressure test reports for heating and refrigeration lines.

.3 Vibration isolation report.

.4 Seismic inspection report.

.5 Valve tag chart.

.6 As built drawings.

.7 Welding certificate and x-ray reports.

.8 Flushing and cleaning of piping report.

.3 HVAC

.1 As built drawings.

.2 Duct cleaning certificate.

.3 Bio-Safety and Laminar Air Flow Workstation equipment and compounding room verification / air balance

.4 Miscellaneous

.1 Identification Schedules.

.2 Seismic Engineer’s Letters of Assurance;

.3 Demonstrations to Owner signed off by Owner;

.4 List of incomplete or deficient work prepared by each sub trade;

.5 Contractor's Letter of Guarantee;

.6 Signed-off substantial completion inspection report;

.7 Power Smart documentation for VSDs etc.;

.8 List of spare parts signed off by Owner and

.9 Sustainability documentation.

Other reports including:

.10 Manufacture start-up reports;

.11 Air and Water Balance;

.12 Commissioning;

1.45 SUBSTANTIAL PERFORMANCE REQUIREMENTS

.1 The contractor shall submit the following documentation to the Consultant 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 project architect, project manager or Certified Professional. It is the contractor's responsibility to provide all documentation to the Consultant in a timely manner. If all documentation is not received, the Consultant 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 Before the Consultant is requested to inspect 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.

.3 A complete list of incomplete or deficient items shall be provided. If, in the opinion of the Consultant, this list indicates the project is excessively incomplete, a substantial completion inspection will not be performed.

.3 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 Consultant;

.6 All demonstrations to the owner have been completed and

.7 All documents required in Section 23 99 60 have been submitted.

.4 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 Penetrations through Separations;

.3 Seismic engineer's letter of assurance and final inspection report;

.4 Certificate of Substantial Performance;

.5 Signed off copy of final inspection report;

.6 Sprinkler and fire alarm test verification, sprinkler materials and test certificate

.7 Plumbing inspection report / card and

.8 Certificate of Backflow Prevention Device.

1.46 DEFICIENCY HOLDBACKS AND DEFICIENCY INSPECTIONS

.1 Work under this Division which is still outstanding when substantial performance is certified will be considered deficient and a sum equal to at least twice the estimated cost of completing that work will be held back.

.2 It is expected that outstanding work will be completed in an expeditious manner and the entire holdback sum will be retained until the requirements for Total Performance of Division 21, 22, 23 and 25 work have been met and verified.

Part 2 Products

2.1 ACCESS DOORS

.1 Supply flush mounted access doors, for installation by Building Trades in furred ceilings and walls, to permit servicing of mechanical equipment and accessories, inspection of life safety or operating devices, and where specifically indicated.

.2 Refer to Specifications Section 08 31 13 for additional access hatch requirements.

.3 Unless otherwise noted, access doors shall be minimum: 600mm x 600mm [24" x 24"] for body entry; 300mm x 450mm [12" x 18"] for hand entry; 200mm x 200mm [8" x 8"] for cleanout access.

.1 Access doors in building surfaces shall be at least as large as duct access panels accessed through them and shall be oversized when necessary. Size to suit masonry modules when located in a masonry wall.

.4 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 paneled, feature or special finish walls, without prior approval of the Consultant.

.1 Access doors in rated fire separations and firewalls shall have a compatible fire rating and a ULC label with tamper-proof latch, self-closing.

.5 Access Doors – Non-secure:

.1 Constructed of steel, prime coated, except:

.1 Constructed of stainless steel in areas finished with tile or marble surfaces

.2 Constructed of stainless steel with neoprene gasketed door in damp and high humidity areas

.2 Flush mounted with 180^{o} opening door, round safety corners, concealed hinges, plaster lock and anchor straps and tabs to suit wall or ceiling construction type.

.3 Generally fitted with screwdriver operated latches, except:

.1 in areas subject to security risks (Public Corridors, Psychiatric Patient Areas, Public Washrooms), provide keyed cylinder locks with similar keys.

.2 Allan key cam locks

.4 Plaster or wet wall construction: flush with wall or ceiling type with concealed flange.

.5 Tile, ceramic tile, marble, terrazzo, plaster or wet wall construction in washrooms and other special areas: flush with wall or ceiling type with concealed flange.

.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.

.8 Access doors are not required in removable ceilings. Provide coloured marking devices after completion of ceilings, at four corners of each panel below point requiring access. Colour code markers to show service or device above.

.9 At time of instruction of owners operating staff, hand-over and obtain signed receipt for 4 sets of each type of key used to lock access doors.

.10 Standard of Acceptance: Maxam, Milcor, Acudor

2.2 OPERATING AND MAINTENANCE MANUALS

.1 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.

.2 Comply with requirements indicated in Division 1.

.3 Request the manufacturer’s 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, the Architect and the Mechanical Consultant. In addition, the names of the General Contractor, Mechanical, Sheet Metal, 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 List of Mechanical Design Drawings;
- .2 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 and (where applicable) water chillers and chilled water distribution systems.
  - .3 Description of actions to be taken in event of equipment failure.
- .3 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.
- .4 Equipment Suppliers;
  - .1 Local source of supply for replacement parts for each piece of equipment.
- .5 Systems Balancing Reports;
  - .1 Air system balance report.

.2 Water system balancing report.

.6 Electrical Switchgear;

.1 Electrical switchgear schedule, indicating circuit number, panel location and disconnect location for each item of equipment.

.7 Shop Drawings;

.1 Copies of all final "reviewed" shop drawings including fan and pump performance data including performance curves with the operating point indicated. Shop drawings shall be complete with Consultants review stamp or 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 Troubleshooting information.

.8 Equipment 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.

.9 Guarantees, Certificates and Miscellaneous Reports;

.1 Back flow device test reports.

.2 Checklists for start-up

.3 Certificate of Testing and Balancing

.4 Certificate of Duct Cleanliness

.5 Certificate of Penetrations through separations

.6 Certificate of Seismic Restraint Installation

.7 Certificate of Vibration Isolation Installation

.8 Checklists for Demonstrations

.9 Certificate of Substantial Performance

.10 Chemical cleaning and treatment report for piping systems.

.11 Chlorination report

.12 Commissioning reports/checklists.

.13 Duct leakage test reports.

.14 Equipment performance test results

.15 Extended warranty certificates.

.16 Sprinkler flushing certificate

.17 Sprinkler Contractor's materials and test certificate.

.18 Plumbing inspection certificate.

.10 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 the Control Sections for Building Management System manual requirements.

.7 Submit a draft copy of the Manual to the Consultant 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 three (3) final copies to the Consultant 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 (3) post hard back Acco expansion style "Fliplock" binders, with stamped lettering on the front cover and spine showing the following:

.1 Name of Project [KLH Pharmacy Upgrade]

.2 Name of Manual - "Operating and Maintenance Manual Mechanical Systems"

.3 Volume - "X" of "Y"

.10 Digital format manuals shall be supplied on USB drives.

.1 The digital version content and organization for each manual shall be arranged in a manner identical to the hard copy version.

.2 Utilize Portable Document Format (PDF).

.3 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.

.4 The final Digital copies are to be copied to CD media with a custom CD label.

.5 The custom CD label shall include: Project Name, Location of Project, Date of Assembly, name of Mechanical Consultant, and shall be titled “Operating & Maintenance Manual for Mechanical Systems.”

.6 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.

.7 Scanning Requirements:

.1 All pages contained within the hard copy manual are to be scanned and/or digitized to Adobe Acrobat 11 (or later) PDF. Include table of contents with links to the referenced pages.

.2 Provide a minimum 300 DPI for all scanned pages.

.3 All scanned material may be searched for text with minimum 60% Optical Character Recognition (OCR).

.4 All scanned shop drawings are to be scanned to a minimum 216mm x 279mm [8.5” x 11”] size. If the original page size is 279mm x 432mm [11” x 17”], the digital copy shall also be 279mm x 432mm [11” x 17”].

.5 Rotation of scanned page images/texts shall be displayed within +/- 20 degrees.

.8 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

.6 Link the system descriptions to the referenced schematic drawings.

.7 Insert internet links and internal document links to mechanical equipment manufacturers / suppliers / contractors official websites; and to mechanical equipment shop drawings.

.8 Use the following colour code for links: internet links shall be light blue with underline, internal document links shall be dark blue (excludes AutoCAD schematic links), and links to other PDF files shall be dark green.

.9 It is the responsibility of the mechanical contractor to provide high quality documentation for scanning.

.10 The digital version of the manuals and the hard cover version shall be prepared by the same company.

.11 Digital Manual shall be reviewed by the Mechanical Consultant for content and

.12 All information within the hard copy manual shall be included within the Digital Manual. At the Owner's / Consultant's discretion the following exceptions may be made so that the manual may be available for use by the Owner at an earlier date:

.1 The final Balance Report may be provided as a later submission in 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 Portable Document Format (PDF). In this case, the Commissioning Report(s) may be kept separate from the Digital Manual.

2.3 RECORD DRAWINGS

.1 Comply with requirements indicated in Division 1 – Project Record Documents.

.2 Maintain one hard copy set of contract drawings, including all supplementary and revision drawings on site, solely for the purpose of recording, in red, any change and/or deviation from the Contract Drawings as it occurs. Include elevations and detailed locations of buried services.

.3 The set of drawings will be provided to the contractor by the Consultant at the contractors cost.

.4 The marked-up set of drawings will be reviewed on site monthly by the consultant during the construction process. This review will form a requirement for approval of the monthly progress claim.

.5 Back filling shall not occur until underground services dimensions are marked on the on-site record set.

.6 The Record Drawings shall include, but not limited to, the following changes and shall be recorded daily:

.1 Size, location, arrangement, routing and extent of ductwork, piping, terminal units, equipment, fixtures, clean-outs, valves, rough-in, etc. above and below

grade inside the building and including dimensioned locations of buried piping from building walls

.2 Location of fire dampers.

.3 Location of back flow preventers.

.4 Location of water hammer arrestors.

.5 Water lines: Invert elevations to be recorded at each junction, changes of direction and every 30 m [100 ft.] run.

.6 Sanitary Sewers: Invert elevations and locations to be recorded at each clean-out.

.7 Storm Drains & Sewers: Invert elevations to be recorded at each manhole, clean-out, changes of direction and every 30 m [100 ft.] run.

.8 All services located below ground level and in or below a building slab.

.9 All valve stations, trap stations, coils dampers and ductwork not easily accessible.

.10 Location, tagging, and numbering of all valves as specified in Section 23 05 53

.7 Drafting:

.1 Refer to Division 1 for cost of preparing record drawings.

.2 Obtain the services of the Consultant or an approved Revit draftsperson to transfer all changes to amend the Revit files in the latest version of Revit.

.3 Include all details from revision drawings, addenda, and change orders. Label each drawing in the lower right corner in letters of at least 12mm [1/2"] high as follows:

.1 "AS BUILT DRAWINGS," Contractors name and date.

Part 3 Execution

3.1 CONCEALMENT

.1 Conceal all piping, ductwork and conduit in partitions, walls, crawlspaces and ceiling spaces, unless otherwise noted.

.2 Do not install piping and conduit in outside walls or roof slabs unless specifically directed, in which case, install them with the building insulation between them and the outside face of the building.

3.2 ACCESSIBILITY

.1 Install all work so as to be readily accessible for adjustment, operation and maintenance. Furnish access doors where required in building surfaces for installation by building trades. Refer to item "Access Doors."

3.3 PIPING EXPANSION

.1 Install piping with all necessary changes of direction, expansion loops, anchors and guides so that expansion and contraction will not overstress the piping and equipment piping connections.

.2 Expansion loops shall be of all welded construction with long radius elbows; cold sprung 50% and located between anchors.

.3 Anchors shall be fabricated from mild steel plate and structural steel angle and channel sections, in accordance with ANSI B.31.

3.4 PROTECTION OF WORK

.1 Protect equipment and materials, stored or in place, from the weather, moisture, dust and physical damage.

.2 Mask machined surfaces. Secure covers over equipment openings and open ends of piping, ductwork and conduits, as installation work progresses.

.3 Equipment having operating parts, bearings or machined surfaces, showing signs of rusting, pitting or physical damage will be rejected.

.4 Refinish damaged or marred factory finish.

.5 Air systems to have air filters installed before fans are operated. Install new air filters before system acceptance.

3.5 CUTTING, PATCHING, DIGGING, CANNING, AND CORING

.1 Lay out all cutting, patching, digging, canning and coring required to accommodate the mechanical services. Coordinate with other Divisions.

.2 Refer to structural drawings for permissible locations of openings and permissible opening sizes in concrete floors and walls. Openings through structural members of the building shall not be made without the approval of the Consultant.

.3 Be responsible for correct location and sizing of all openings required under Division 21, 22, 23 and 25, including pipe sleeves and duct openings. Allow oversized openings for fire dampers and pipe penetrations where insulation is specified.

.4 Verify the location of existing service runs and steel reinforcing within existing 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 The performance of actual cutting, patching, digging, canning and coring is specified under other Divisions.

.6 Be responsible for all cutting, patching, digging, canning and coring required to accommodate the mechanical services.

.7 All openings shall be core drilled or diamond saw cut.

3.6 SERVICE PENETRATIONS IN RATED FIRE SEPARATIONS

.1 Provide pipe sleeves for all piping passing through fire-rated walls and floors. Sleeves to be concentric with pipe.

.2 Submit shop drawings(s) of listed assemblies for each type of penetration through a rated assembly.

.3 All piping, tubing, ducts, wiring, conduits, etc. passing through rated fire separations shall be smoke and fireproofed with ULC approved materials in accordance with CAN4-S115-11 (R2016) and ASTM E814 standards and which meet the requirements of the Building code in effect. This includes new services, which pass through existing rated separations, and all existing services, which pass through a new rated separation or existing separations whose rating has been upgraded.

.4 Sleeves shall be sized to suit fire stopping methods employed for bare pipes, conduits, insulated pipes, and bare and insulated ducts without fire dampers, and

.5 Sleeves shall be sized to suit conditions of approval given in manufacturers installation instructions for fire and smoke dampers.

.6 Fire resistance rating of installed firestopping assembly shall not be less than fire resistance rating of surrounding assembly indicated on Architectural drawings.

.7 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.

.8 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions in formed, sleeved or cored penetrations.

.9 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 for firestopping use. Installation shall be implemented in full compliance with the certified installation procedures. Standard of Acceptance: FGC Fireguard Corp. DONUT Firestop for flat surfaces; 3M Brand (Intumescent) Fire Barrier, Dow Corning Fire Stop Intumescent Wrap for Q-deck.

.10 Sleeves for fire-rated floor slabs in wet or dry areas shall be as noted on the Standard Details.

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

.12 Sleeves for interior partition (i.e. drywall) shall be as noted on the Standard Details.

.13 Sleeves for interior concrete or block walls shall be steel pipe or removable plastic pipe.

3.7 SERVICE PENETRATIONS IN NON-RATED SEPARATIONS

.1 Pipes and ducts passing through separations that have no fire resistance (non-rated separations) do not require a sleeve, but the insulation at the separation shall be wrapped with 0.61 [24 ga] thick galvanized sheet steel band to which to apply the flexible caulking compound to, to achieve a tight seal.

.2 Sleeves for concrete perimeter walls and foundation walls shall be cast iron sleeve or Schedule 40 steel pipe with annular fin continuously welded at midpoint and protruding 150 mm [6”] beyond sleeve diameter. Annular fin shall be embedded into centre of wall.

.3 Sleeves for non-rated floor slabs in wet or dry areas shall be steel pipe.

.4 Sleeves for interior concrete or block walls shall be steel pipe or removable plastic pipe.

3.8 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.

3.9 LINK SEALS

.1 Fit each pipe passing through floor slab in contact with ground or basement walls below grade with link seal between sleeve and bare pipe.

.2 Submit manufacturer’s literature and schedule showing location, service, inside diameter of wall opening, sleeve length and pipe outside diameter.

.3 Link seal:

.1 Manufactured from modular synthetic rubber links with stainless steel hardware.

.2 Loosely assembled with bolts to form continuous rubber belt around pipe, with pressure plate under each bolt head and nut.

.3 Constructed to provide electrical insulation between pipe and sleeve.

.4 Installation

.1 Determine inside diameter of each wall opening or sleeve before ordering seal.

.2 Position seal in sleeve around pipe and tighten bolts to expand rubber links until watertight seal is obtained.

3.10 ACCESS DOORS

.1 Install access doors at all concealed cleanouts, traps, unions, expansion joints, valves, control valves, air vents, water hammer arrestors, special equipment, trap primers, vacuum breakers and any other equipment for which subsequent periodic access will be required during the life of said equipment.

.2 Locate access doors so that all concealed items are readily accessible for adjustment, operation, maintenance and replacement.

.3 Do not locate access doors in feature walls or ceilings without the prior approval of the Consultant. Locate in service areas and storage rooms wherever possible.

3.11 ESCUTCHEONS AND PLATES

.1 Provide on pipes passing through finished walls, partitions, floors and ceilings.

.2 Plates shall be stamped steel, split type, chrome plated, or stainless steel, concealed hinge, complete with springs, suitable for external dimensions of piping/insulation. Secure to pipe or finished surface. For all pipes passing through suspended ceilings and uninsulated piping passing through walls. Outside diameter shall cover opening or sleeve.

.3 Where pipe sleeve extends above finished floor, escutcheons or plates shall clear sleeve extension.

.4 Do not install escutcheons and plates in concealed locations.

3.12 EQUIPMENT SUPPORTS, PLATFORMS, LADDERS, AND BASES

.1 Provide stands and supports for equipment and materials supplied.

.2 Supports:

.1 Fabricate platforms, gratings, ladders, piping and equipment supplementary supporting steel, and trench and pit covers, from steel and provided by this Division.

.2 Concrete housekeeping bases for mechanical equipment which are in direct contact with floor slab, to be provided by this Division.

.3 Concrete bases for equipment supported on vibration isolation materials (inertia pads), to be provided by this Division.

.4 Construct equipment supports of structural steel or steel pipe. Securely brace. Employ only welded construction. Bolt mounting plates to the structure.

.5 Support ceiling hung equipment with rod hangers and/or structural steel.

.6 Work to be done by firms specializing in these fields.

.7 Submit shop drawings for steel and concrete work, prepared by licensed Professional Engineers.

.3 Concrete bases for housekeeping pads:

.1 Lay out concrete bases and curbs required under Divisions 21, 22, 23 and 25. Coordinate with Division 3. All concrete work is under Division 3.

.2 Constructed using plywood form work and 20 Mpa [3000 lb] concrete.

.3 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 Dowel to concrete floor slab with not less than 13 mm [1/2”] diameter steel rods.

.5 Plan dimensions:

.1 200 mm [8”] larger all around than base of apparatus for seismically restrained equipment, and

.2 finished to make smooth, neat surfaces with corners chamfered 25 mm [1”].

.3 Provide a deep seal trap path for the air handling unit.

.6 Height conforming to following table;

.1 Equipment:

.1 Motorized: 150mm [6”]

.7 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.

.4 Installation:

.1 Locate supporting steel to permit removal of parts for service or repair, and to allow clear access to valves, fittings, and equipment,

.2 Set equipment on supporting frames and brackets and install hangers, anchor bolts, vibration mountings and snubbers.

.3 Set equipment base plates on housekeeping pads on minimum 13 mm [1/2”] epoxy grout and fill hollow portion of base with concrete.

.4 Install anchor bolts, vibration mountings and snubbers between equipment and housekeeping pad, or inertia pad and housekeeping pad.

.5 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.6 Provide anchorage, dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.7 Make field connections with bolts to CAN/CSA-S16.1, or weld.

.8 Supply items for casting into concrete or building into masonry to appropriate trades together with setting templates.

.9 Touch-up field welds, bolts and burnt or scratched surfaces after completion of erection with primer.

.10 Where gratings or trench covers are cut in field or damaged, touch up with zinc rich paint.

.11 Hot equipment subject to thermal expansion:

.1 Fasten equipment to building structure to accommodate thermal expansion in accordance with manufacturer's instructions. In the absence of such instructions, fasten equipment support legs as follows unless otherwise noted,

.1 rigidly fasten one support point which is closest to piping connections,

.2 for supports located on the same transverse or longitudinal axis, provide guides with vertical restraint tabs, aligned in direction of fixed support point,

.3 Provide 3mm [1/8"] thick PTFE (Teflon) glide pads beneath each support leg.

3.13 EQUIPMENT RESTRAINT

.1 It is the entire responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

3.14 EQUIPMENT INSTALLATION

.1 Provide unions and flanges to permit equipment maintenance and disassembly and to minimize disturbance to piping and duct systems and without interfering with building structure or other equipment.

.2 Provide means of access for servicing equipment including permanently lubricated bearings.

.3 Pipe equipment drains to floor drains.

.4 Line up equipment, rectangular cleanouts and similar items with building walls wherever possible.

3.15 ANCHOR BOLTS AND TEMPLATES

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

3.16 MISCELLANEOUS METALS

.1 Be responsible for all miscellaneous steel work relative to Division 21, 22, 23, 25 of the Specifications, including but not limited to:

.1 Hanging, support, anchoring, guiding and relative work as it applies to piping, ductwork, fans and mechanical equipment.

.2 Earthquake restraint devices - refer to Section 23 05 49.

.3 Access platforms, ladders, and catwalks.

.4 Pipe anchor and/or support posts.

.5 Ceiling ring bolts - secure to structure or steel supports.

.6 All steel work shall be primed and undercoat painted ready for finish under Division 9. Refer to drawings for details.

3.17 FLASHING

.1 **New Wall Penetrations:** Flash and counter flash where mechanical equipment passes through weather or waterproofed walls.

.2 **Existing Wall Penetrations:** Remove and replace the existing flashing and counterflashing for all existing ducts being removed and replaced with new ductwork ducts that are re-using existing wall penetrations. penetrate the exterior wall where the

.3 Flash floor drains over finished areas with lead 250 mm [10”] clear on sides with minimum 900 x 900 mm [36’” x 36”] sheet size. Fasten flashing to drain clamp device.

.4 Provide curbs for mechanical roof installations (New Duplex Hazardous Exhaust Fan) 200 mm [8”] minimum high above roof insulation. Flash and counterflash with galvanized steel, soldered and made waterproofed.

3.18 DIELECTRIC COUPLINGS

.1 On all "OPEN" systems provide wherever pipes of dissimilar metals are joined.

.2 Provide insulating unions for pipe sizes 50mm [2”] and under and flanges for pipe sizes 65mm [2.5”] and larger.

.3 Provide felt or rubber gaskets to prevent dissimilar metals contact.

.4 Standard of Acceptance: Capital, Walter Vallet, EPCO.

3.19 LUBRICATION OF EQUIPMENT

.1 Lubricate all new equipment prior to being operated, except sealed bearings, which shall be checked.

.2 Use the lubricant recommended by the manufacturer for the service for which the equipment is specified.

.3 Extend lubricating connections and sight glasses to the outside of housings, where lubricating positions are not readily accessible.

.4 Submit a check list, showing that all operated equipment has been lubricated prior to and during any temporary heating period and the demonstration and instruction period.

3.20 PAINTING

.1 Clean exposed bare metal surfaces supplied under Division 21, 22, 23 and 25 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 After equipment has been installed and piping and insulation is completed, clean rust and oil from exposed iron and steel work provided under this Division, whether or not it has been factory prime painted.

.3 Paint all pipe hangers and exposed sleeves, in exposed areas, with a rust inhibiting primer, as they are installed.

.4 Repaint all marred factory finished equipment supplied under Division 21, 22, 23 and 25, which is not scheduled to be repainted, to match the original factory finish.

.5 In "occupied" areas of building touch up any damage to prime coat resulting from shipping or installation and leave ready for final painting under Finishes, Division 9.

.6 In "un-occupied" areas of the building such as mechanical equipment rooms, boiler rooms, fan rooms, crawl spaces, pipe tunnels and penthouses:

.1 paint exposed galvanized metal surfaces with one coat of zinc dust galvanized primer and one coat of 100% Alkyd base enamel in an approved colour; and

.2 paint exposed iron or steel work with one coat of chrome oxide phenolic base primer and one coat of 100% Alkyd base enamel in an approved colour.

.7 Fire protection piping shall be painted for identification purposes over their entire lengths throughout all exposed areas and in the mechanical room(s) as follows: Fire: Red, C.G.S.B. 509-102

.8 Coordinate with Division 9.

.9 Painting of all equipment and materials, supplied under Division 21, 22, 23 and 25, installed in mechanical equipment areas and inside finished areas of the building or exposed outside the building, is included under Division 9 of the Specification.

.10 Painting by Division 9 shall be in accordance with the following Colour Schedule for Mechanical Equipment Areas:

Item	Primer (Note **)	Colour Finish
Air Handling Units	1. Damp-proof Red 2. Zinc Chromate	Grey
Ductwork, Plenums and Miscellaneous Steel	Clear blue undercoat	White (2 coats)
Exposed Misc. Metal (supplied under this contract)	1. Damp-proof Red 2. Zinc Chromate	To be determined on site
Fan Casings and Bases	1. Damp-proof Red 2. Zinc Chromate	Grey
Guards – Belt and Coupling	1. Damp-proof Red 2. Zinc Chromate	To match equipment
Handrails	Red Primer	Aluminum
Motors (electric)		To match associated equipment
Piping (uninsulated)		
• safety valve vents (steam Humidification)	Red Primer	Aluminum (high temp.)
• steam and associated condensate (Humidifier Drain)	Red Primer	Aluminum (high temp.)
• services other than above	Red Primer	White
Valve Bodies (uninsulated)	Red Primer	Aluminum (high temp.)
• services other than above	Red Primer	To match associated piping

Note ** 1. denotes first primer coat and 2. denotes second primer coat.

3.21 EQUIPMENT PROTECTION AND CLEAN-UP

.1 Protect equipment and material in storage, on site and after installation until final acceptance. Leave factory covers in place. Take special precautions to prevent entry of foreign material into working parts of piping and duct systems.

.2 All mechanical equipment stored on site shall be kept in a dry, heated and ventilated storage area.

.3 Thoroughly clean piping, ducts and equipment of dirt, cuttings, and other foreign material.

.4 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.

.5 Provide, install and maintain 30% efficient temporary filters to return and exhaust air openings from ceiling spaces to prevent air born dust from entering ducts, plenums and coils. Install filters to return air grilles when fans are operated, and building is not at a clean condition.

3.22 FINAL CLEANING AND ADJUSTMENTS

.1 Conduct final cleaning.

.2 Thoroughly clean exterior surface of exposed piping, and vacuum external surfaces of exposed ducts and interior surfaces of air handling units. Clean strainers in piping systems and install clean filters in air handling systems.

.3 Remove tools and waste materials on completion of work and leave work in clean and perfect condition.

.4 Calibrate components and controls and check function and sequencing of systems under operating conditions.

.5 Supply lubricating oils and packing for proper operation of equipment and systems until work has been accepted.

3.23 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. Use forms in Section 23 99 60 for this purpose.

.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 All air filters installed.

.5 Pump and fan drives properly aligned by a journeyman millwright.

.6 All mechanical equipment rooms, including plenums, vacuum cleaned.

3.24 START-UP AND PERFORMANCE REPORTS

.1 Required reports

.1 Provide the following Start-Up and Performance Testing reports:

.1 Equipment start-up report

.2 Authorities report

.3 Acoustic survey report

.4 Controls / BMS operation report

.2 Equipment start-up report

.1 Provide a test report in spreadsheet format which summarizes the following data for each piece of equipment which is powered or has automatic controls:

.1 equipment ID and name,

.2 motor rotation (bump test) - result and initialed by contractor,

.3 equipment Start-Up report status - status and initialed by contractor,

.4 manufacturer Start-Up report status – status and initialed by contractor,

.5 test completion date.

.2 Provide a test report in spreadsheet format which summarizes the following data for testing of piping systems:

.1 system name

.2 system limits (if system is not tested in its entirety),

.3 type of test (pneumatic, hydrostatic),

.4 pressure at start of test,

.5 pressure at end of test,

.6 duration of test,

.7 contractor dated and initialed,

.8 expansion tank initial pressure,

.9 expansion tank final pressure,

.10 backflow preventers have been tested - status and initialed by contractor,

.11 pressure relief valves installed – record setpoint and initialed by contractor.

.3 Equipment/System Start-Up Test Report

.1 Provide a separate start-up report for each piece of the following equipment. The SMACNA “Systems Ready to Balance Check List”, where applicable, may be used for this report.

.1 HVAC Units

.2 Duct Systems

.3 Pumps

.4 Refrigeration Equipment

.5 Hydronic piping systems

.6 Steam humidification piping systems

.7 Sprinkler systems (to NFPA 13)

.4 Manufacturer’s Start-Up Test

.1 Provide a separate start-up report for each piece of the following equipment, utilizing the manufacturer’s start-up check list. This report may be prepared by the manufacturer’s service representative:

.1 chemical water treatment - pipe cleaning,

.2 chemical water treatment - passivating and inhibition,

.3 refrigeration equipment,

.4 adjustable frequency drives,

.5 Building Automation Systems.

.3 Authorities review

.1 Submit copies of authorities-having-jurisdiction inspection and test reports, including:

.2 Plumbing and drainage municipal inspector reports

.3 BC Safety Authority for pressure vessel and piping inspection reports

.4 ESA field certification reports

.4 Acoustic survey

.1 Provide acoustic survey test report:

.5 Controls / Building Management System

.1 Provide controls test reports.

.6 Report Submissions

.1 Deficiencies

.1 Immediately report to Consultant, any deficiencies in the systems or equipment performance resulting in design requirements being unobtainable.

.2 Draft report

.1 On completion of the start-up, testing, adjusting and balancing of all systems, submit to the Consultant, two (2) typewritten copies of a full report on all tests, adjustments, and balancing performed.

.2 Attachments including systems schematics with numbered terminals for referring to data above.

.3 Spot checks

.1 After review of the Draft Report by the Consultant and at the Consultants direction, retest up to 30% of all measurements in locations as directed by the Consultant, at no cost extra to the contract.

.2 If results indicate unusual testing inaccuracy, omissions, or incomplete balancing/adjustment, in the opinion of the Consultant, re-balance entire affected system(s) at no increase in Contract Price.

.4 Interim report

.1 After completion of any retesting described above, submit an electronic copy in PDF format.

.5 Final report

.1 Submit to Consultant following completion of alternate season testing and balancing. Submit in Adobe PDF in the same formats as the initial report specified above.

.6 Additional testing

.1 The Consultant may request such additional testing in connection with this project as he deems necessary.

.2 Perform additional testing and balancing at the rates quoted. Costs will be deducted from the Mechanical Subcontractor's allowance for the additional Testing and Balancing work as approved by the Consultant.

3.25 ACOUSTIC TESTING

.1 Scope

.1 Conduct acoustic (noise) measurements.

.2 Qualifications

.1 Acoustic measurements and analysis to be performed under supervision of recognized expert with an established reputation in this field.

.3 Acoustic survey

.1 Provide acoustic performance testing in accordance with SOR 5.3.7.20.

.4 Report format

.1 Reports to incorporate approved standard forms.

.2 Provide a one (1) page summary for each room/space test and include:

.1 date and time of test,

.2 background and operating test results,

.3 RC bandwidth results for 63 through 8000 Hz in both tabular and graphical formats.

.3 Include reduced architectural floor plan drawings, identifying test locations.

.4 Submit four hard copies of acoustic reports.

.5 Submit two soft copies of acoustic reports in Adobe Acrobat PDF format.

.5 Verification

.1 Reported measurements will be verified.

.2 Provide instrumentation and manpower to verify results of up to 10% of reported measurements.

.3 Number and location of verification measurements to be at discretion of Engineer.

3.26 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.

.1 The demonstration shall include:

.2 Operation and sequencing of all automatic control dampers and automatic temperature control devices.

.3 Operability of randomly selected smoke / fire dampers.

.4 Operation and maintenance requirements of all air, gas and water systems and equipment under each mode of operation including:

.1 Automatic controls.

.2 Chilled water and condenser water systems.

.3 Fans.

.4 Coils.

.2 Provide instruction during regular work hours prior to acceptance and turn-over to operating staff for regular operation.

.3 Use Operating and Maintenance manuals for instruction purposes.

.4 Submit the proposed instructional agenda for approval.

.5 Finalize demonstration and instructions by obtaining a signed statement from the Owner that the demonstration and instructions have been given satisfactorily.

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 project is deemed to be a post-disaster design.

1.2 APPLICABLE CODES AND STANDARDS

.1 Motors to be designed, manufactured, and tested in accordance with standards of:

.1 NEMA, ANSI, IEEE, and ASTM,

.2 conform with applicable sections of NEMA Standard No. MG-1 Motors and Generators.

1.3 QUALITY ASSURANCE

.1 Motors shall be UL listed and CSA certified.

.2 Full Voltage Start Applications:

.1 All motors shall be in accordance with NEMA standards, and CSA C390-93, or the latest version insofar as it is applicable. Motors also shall comply with the applicable portions of the Canadian Electrical Code.

.3 Variable Frequency Drive and soft start applications:

.1 All motors shall be in accordance with NEMA standards (MG-1) Part 31, and inverter duty class, or the latest version insofar as it is applicable. Motors also shall comply with the applicable portions of the Canadian Electrical Code.

.2 Motors connected to VFD(s) shall be wound using inverter spike resistant magnet wire capable of 1600V.

.4 The noise level of each motor shall comply with NEMA standards, less than 80 dBA at 1 meter.

.5 Provide all motors with thermal overload protection. Coordinate with Electrical contractor.

1.4 SUBMITTALS

.1 Submit data of test method used and motor efficiencies with shop drawings.

Part 2 Products

2.1 ELECTRIC MOTORS - GENERAL

.1 Provide motors for all mechanical equipment.

.2 Test performance equal to or better than level required by Energy Efficiency regulations when tested to CSA 390 M Energy Efficiency Test Methods for Three Phase Induction Motors, or IEE 112b Standard Test Procedure for Polyphase Induction Motors and Generators.

.3 Motor nameplate rating:

.1 Not less than input brake horsepower of driven equipment at specified operating condition,

.2 Suitable for starting conditions.

.4 Motor Characteristics:

.1 Frequency: 60 Hz

.2 Voltage:

.1 Motors less than 373 W [½ HP]: 120 volt, single phase

.2 Motors 1/2 H.P. and larger to be 3 phase power and for the scheduled voltage. Confirm electric voltage, phase and starter requirements with the electrical specification.

.3 Speed: 1800 RPM unless specifically scheduled otherwise.

.5 All motors shall be designed and manufactured to operate with ±10% voltage and ±5% frequency variations of the nameplate ratings. Combined voltage and frequency variation shall not exceed ±10%.

.6 Motors powered by variable speed drive controllers shall be EEMAC Class B with Type F insulation, shall have a 1.15 service factor and shall be suitable to be driven by PWM variable speed drive controllers. The motor manufacturer shall submit in writing confirmation that the motors are designed to withstand voltage peaks of 1400 volts and a voltage rate of rise of 2000 volts / microsecond at a frequency of 20 kHz.

.7 Motors will be rated for a 1.15 service factor in a 40°C ambient environment.

.8 Provide all motors with terminal boxes, suitable for power connections.

.9 Provide screw adjustable bases on all belt-connected motors.

.10 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.

.11 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.

.12 All motors 10 hp and larger that are controlled by a VFD are to use a dielectric grease bearings and a grounding kit with a system of brass or stainless steel brushings.

2.2 ELECTRIC MOTORS – PREMIUM EFFICIENCY

.1 All motors shall be provided with NEMA Design Type B, premium efficiency classification with non-wicking leads.

.2 All motor efficiencies shall comply with ASHRAE 90.1, minimum.

.3 Premium efficiency **open drip-proof** motors shall have the following typical full load efficiencies (nominal):

HP	Premium Efficient - Minimum Efficiency (%)		
	3600 RPM 2 Pole	1800 RPM 4 Pole	1200 RPM 6 Pole
1	77.0	85.5	82.5
1.5	84.0	86.5	86.5
2	85.5	86.5	87.5
3	86.5	89.5	88.5
5	86.5	89.5	89.5
7.5	88.5	91.0	90.2
10	89.5	91.7	91.7

.4 Premium efficiency **totally enclosed** fan cooled motors shall have the following typical full load efficiencies (nominal).

HP	Premium Efficiency - Minimum Efficiency (%)		
	3600 RPM 2 Pole	1800 RPM 4 Pole	1200 RPM 6 Pole
1	77.0	85.5	82.5
1.5	84.0	86.5	87.5
2	85.5	86.5	88.5
3	86.5	89.5	89.5
5	88.5	89.5	89.5
7.5	89.5	91.7	91.0
10	90.2	91.7	91.0

2.3 THREE PHASE MOTORS FOR SERVICE WITH SPEED DRIVES

.1 Motors 745 W (1 HP) and larger suitable for pulse width modulated wave form.

.2 General:

.1 Totally Enclosed Fan Cooled (TEFC), NEMA T frame assembly

.2 NEMA Premium efficiency, inverter duty type,

.3 suitable for horizontal, vertical or belt-driven mounting

.4 NEMA Design B, squirrel cage, induction type

.5 Fabricated and nameplated in accordance with NEMA MG-1 Part 31 for;

.1 200% of full load starting torque

.2 Class F triple build winding insulation

.3 continuous duty

.4 40°C (104°F) ambient temperature

.6 1.15 service factor,

.7 3 leads for single voltage service.

.8 Motor designed for grounding of stray rotor currents by application of electrically conductive bearing grease or rotor bearing brush assembly.

2.4 ENCLOSURE, ALL MOTORS

.1 Construction:

.1 cast iron, aluminum, or rolled steel construction,

.2 drain openings,

.3 shouldered lifting eye bolts,

.4 bi-directional, spark-proof, abrasion and corrosive resistant fan keyed to shaft,

.5 compression type grounding lug or double ended cap screw of silicon bronze, mounted in conduit box by drilling and tapping into motor frame

.2 Motor nameplate:

.1 Type 316 stainless steel,

.2 Mounted on enclosure with stainless steel fastening pins,

.3 information as described in NEMA Standard MG-1-20.60,

.4 motor bearing part numbers and motor wiring diagram indicated.

.3 Protective coating;

.1 primer and 4-5 mils epoxy overcoat on external surfaces, and corrosion resistant coating of epoxy paint on internal surfaces, shaft, rotor, stator iron, and end bells.

.2 shaft extension protected with rust preventive strippable coating capable of being peeled off or unwrapped.

.4 Motor termination boxes/leads:

.1 cast iron diagonally split, pipe tapped for conduit,

.2 attached to motor frame with cadmium plated hex head cap screws,

.3 arranged for conduit entry from either side or bottom,

.4 gaskets between box and motor frame and between halves of box,

.5 cover secured with cadmium plated hex head cap screws,

.6 box assembled to motor,

.7 motor leads in conduit box;

.1 identified in accordance with ANSI C6.1 ,

.2 with same insulation class as windings,

.3 sized in accordance with EASA recommended minimum ampacity values.

.8 motor leads between motor frame and termination box to pass through tight fitting neoprene rubber seal.

2.5 THREE PHASE MOTOR CONSTRUCTION FOR AFD (ADJUSTABLE FREQUENCY DRIVES)

.1 Motor stator winding:

.1 made up with copper magnet wire coated with moisture resistant Class F, non-hygroscopic varnish with thermal rating of not less than 150°C for 30,000 hours life when tested in accordance with IEEE No. 57.

.2 insulation resistance greater than 100 megaohms when measured at 25°C. Measured with 1000-volt megger for 600V motors and 500-volt meggar for 208V motors.

.3 held in stator slots that have had sharp edges and burs removed prior to winding insertion.

.4 coils phase insulated using Nomex paper, laced down.

.5 connection leads mechanically secured and silver soldered.

.6 designed for operation in either direction of rotation.

.2 Motor bearings:

.1 anti-friction single shield, vacuum-degassed steel ball bearings with

.1 extended pipe zerk fitting, and ½-lb relief fitting for external lubrication while machine is in operation.

.2 bearing shield on motor winding side of bearing.

.3 rated fatigue life of L'-10 (B-10) 150,000 hours for direct coupled applications and 50,000 hours for belted applications.

.4 belted rating based on radial loads and pulley sizes from NEMA MG1-14.43.

.5 high quality bearing seal or Forsheda shaft slinger on outer or shaft end of bearing.

.2 lubricated at factory, after assembly, using zerk fittings to fill grease chamber and pipe extension

.3 Motor shafts and rotors

.1 Shafts:

.1 precision machined from high-strength carbon steel

.2 "standard long" for units 200-hp and smaller, for both direct connected drive duty and V-belt drives.

.2 rotor assemblies to be die cast aluminum, keyed, and shrunk or pressed to shaft using full shaft diameter for full length of rotor.

.3 shaft extension run out not to exceed 0.001" dial indicator reading measuring at right angles to shaft axis.

2.6 MOTOR OVERCURRENT PROTECTION

.1 Provide motor thermal protection devices in motors.

.2 Three phase motors 37 kW (50 HP) and larger:

.1 Winding sensors:

.1 three (3) Positive Temperature Coefficient (PTC) temperature sensors, one in each motor winding, wired in series, and compatible with Siemens model 3RN10 12 control unit

.2 Connected to trip the motor starter, VFD or control device on an overheating condition.

2.7 SLIDING BASES FOR MOTORS WITH BELT DRIVES

.1 Construction:

.1 fabricated from steel as a single unit with double supported slide and two adjusting bolts.

.2 finished with coating as specified above for motor exterior.

2.8 PERMISSIBLE VIBRATION

.1 Vibration velocity to be not more than 0.05 inches/second measured at bearing housing.

2.9 SOUND PRESSURE LEVEL:

.1 Not more than 85dbA, measured at 3 metres in accordance with IEEE publication No. 85.

.2 Motor manufacturer to ensure that motor is compatible with type of adjustable frequency generation to be supplied, and that system will be capable of providing rated torque over frequency range from 15 to 60 hz while operating within motor temperature rise specification.

.3 Motor to be capable of operating between 60 Hz and 90 Hz with torque reducing at drive frequency above 60 Hz

2.10 SHAFT COUPLINGS

.1 Shaft couplings shall be of the pin or jaw neoprene insert type, gear type, or flexing steel insert type and shall allow coupling inserts to be easily removed without disassembly of the equipment.

2.11 DRIVE AND COUPLING GUARDS

.1 Provide removable protective guards on all exposed V-belt drives and shaft couplings in accordance with OSHA and WorkSafeBC requirements.

.2 Guards for drives shall have:

.1 1 mm [18-gauge] expanded metal screen welded to 25 mm [1"] steel angle frame.

.2 1.5 mm [16-gauge] 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-gauge] thick galvanized frame and 1.2 mm [18-gauge] thick expanded mesh face.

.6 Provide guards on all unprotected fan inlets and outlets. Guards to be provided by fan manufacturer.

.1 Minimum 20 mm (: in) galvanized wire mesh or expanded metal screen with net free area of guard not less than 80% of fan opening

.7 Secure guards to equipment allowing for ease of removal.

.8 Prime coat guards and finish paint to match equipment.

2.12 TESTING

.1 Test motor in accordance with IEEE 112 "Polyphase Induction Motors and Generators" to conform with NEMA MG-1.

.2 Additional tests may be performed on a random sampling of units supplied for the project as follows;

.1 insulation test to establish capability to withstand continuous phase-to-ground RMS voltage of 1000 volts minimum for 30 minutes.

.2 winding to withstand 2500 volt AC phase-to-ground for one second.

.3 surge comparison test using 3000 volts AC phase-to-phase with submission of detailed comparison wave forms.

.4 shaft runout tests with results taken after motor is completely assembled.

.5 measurement of full load amperes, watts, power factor, RPM, and locked rotor current at rated voltage.

.6 verification of vibration status through velocity readings in inches/second taken at both ends of motor.

Part 3 Execution

3.1 ELECTRIC MOTORS

.1 Unless otherwise noted starters and protection devices will be included under the Electrical Division of the Specification.

.2 Assist Division 26 to ensure proper connection, correct thermal overload protection and correct motor controls.

.3 Where starters are included in this Division as an integral part of packaged equipment, they shall contain thermal overload protection in all ungrounded lines.

.4 Equipment, which has more than one voltage rating, shall be fed from a single power source through a disconnect switch.

.5 If delivery of specified motor will delay delivery or installation of any equipment, install an acceptable motor for temporary use. Final acceptance of equipment will not be given until specified motor is installed.

3.2 SHIPPING

.1 Ship motors from factory;

.1 packed in Styrofoam or similar material or

.2 fastened to hardwood skid or pallet for fork truck handling

.3 protected against dirt and moisture during transit and outdoor storage.

.4 clearly identified with permanent ink marking on packing.

.2 Motors attached to equipment:

.1 protected against dirt and moisture during transit and outdoor storage.

.2 rotated by hand at one-month intervals.

3.3 SETTING AND ALIGNMENT

.1 Employ a journeyman millwright to align all V-belt drives and/or shaft coupling drives prior to initial start-up. The millwright shall also check that centrifugal fan wheels are properly centered on fan shafts.

.2 Align shaft couplings, using a dial indicator, to within +/-0.051 mm [0.002"] after grouting is complete and the piping system is operational.

.3 Align V-belt drives using a straight edge.

.4 Submit a certificate from the millwright employed, certifying that all shaft couplings and V-belt drives have been aligned and centrifugal fan wheels centered prior to initial start-up and checked again after final system balance adjustment.

END OF SECTION

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 APPLICABLE CODES AND STANDARDS

.1 This project is deemed to be a post-disaster design.

.2 Comply with:

.1 CSA C22.1 Canadian Electrical Code.

.3 Reference Standards:

.1 IEEE Standard 519 IEEE Guide for Harmonic Content and Control

.2 UL 508C Power Conversion Equipment

.3 NEMA ICS 7.0 AC Adjustable Speed Drives

.4 IEC 16800 Parts 1 and 2.

1.3 QUALITY ASSURANCE

.1 Manufacturer specializing in development and production of the products specified in this Section.

.2 Product:

.1 Variable Frequency Drive (VFD) and options UL listed as a complete assembly,

.2 VFD's that require the customer to supply external fuses are not acceptable,

.3 VFD and options tested to ANSI/UL Standard 508 and listed by a nationally recognized testing agency such as UL or ETL, subject to the drives are suitable for use on nominal voltages up to 600 V AC with a nominal supply range of ±5%.

1.4 SHOP DRAWINGS

.1 Submit for VFD’s in addition to the requirements of Division 01:

.1 Outline dimensions, conduit entry locations and weight,

.2 Control and power wiring diagrams,

.3 Complete technical product description including a list of options provided,

.4 A detailed statement of non-compliance issues to this specification, absent which the vendor and/or contractor shall be liable to provide all additional components required to meet this specification,

.5 Termination diagrams for electrical contacts, relays, thermostats, timers and components in control circuits shown.

1.5 PRODUCT SUPPORT

.1 Manufacturer to have factory trained application engineering and service personnel locally available at the installation locations and/or available through a toll free 24/365 technical support line.

1.6 WARRANTY

.1 VFD shall be warranted for twenty-four (24) months from date of certified start-up by manufacturer’s representative, not to exceed 30 months from date of shipment, but in no instance less than twelve (12) months from hand-over of equipment to the Owner (start of the Work warranty period).

.2 The warranty shall include all parts, labor, travel time and expenses.

Part 2 Products

2.1 GENERAL

.1 Provide the following:

- .1 Electronic pulse width modulating design for speed control of NEMA Design B induction motors,
- .2 CSA listed, mounted in CSA Standard C22.1 Type 1 NEMA 3R enclosure,
- .3 Door or frame mounted interlocked disconnect switch, padlockable, to disconnect all input power from the drive and all internally mounted options,
- .4 Manually controlled bypass,
- .5 Provide Externally connected line/load reactors mounted in the VFD enclosure, if available, or provide a separate NEMA 3R enclosure for the line/load reactor.
- .6 Operating voltage:
  - .1 +30%, -35% of nominal supply voltage range to drive,
  - .2 Protection circuitry to lock-in drive or bypass over this voltage tolerance,
  - .3 As per associated equipment
- .7 Environmental operating conditions:
  - .1 Temperature: 0 - 40°C (32 - 104 F) continuous,
  - .2 Altitude: 0 - 1000 m (0 - 3300 ft) above sea level,
  - .3 Humidity: up to 95% relative humidity non-condensing.
- .8 Cooling fans:
  - .1 Designed for easy replacement, and without requiring removing the VFD from the wall or removal of circuit boards,
  - .2 Operate only when required; VFD cycles the cooling fans on and off as required.
- .9 Seismic rated:
  - .1 Drive and bypass package seismic certified,
  - .2 Seismic importance factor of 1.5 rating is required,
  - .3 Rating certification based upon actual shake table test data as defined by ICC AC-156.
- .10 Manufacturer:
  - .1 VFD’s manufacturer by a 3rd party and “brand-labeled” are not acceptable.

.2 Connect drives to BMS for control and monitoring.

2.2 PERFORMANCE REQUIREMENTS

.1 Capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without tripping or component damage (flying start),

.2 Ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip.

.3 Programmable number of restart attempts, trial time, and time between attempts,

.4 Drive overload rating:

- .1 110% of its normal duty current rating for 1 minute every 10 minutes,
- .2 130% overload for 2 seconds

.5 Maximum input current rating of the VFD: not more than 3% greater than the output current rating,

.6 Input and output current ratings must be shown on the VFD nameplate.

.7 Include a coordinated ac transient surge protection system consisting of 4-120 joule rated mov's (phase to phase and phase to ground), a capacitor clamp, and 5% impedance reactors.

.8 Power mis-wiring detection and alarm on drives up to 75 hp.

2.3 POWER CONDITIONING

.1 5% input reactor. May be built-in as part of the drive or supplied as a separate reactor or in combination with the drive's reactor

.2 5% output reactor. May be built-in as part of the drive or supplied as a separate reactor or in combination with the drive's reactor,

.3 Input impedance reactors to reduce the total harmonic current demand (tdd) to a maximum of 45% tdd measured at the drive line terminals composed of either:

.1 Dual (positive and negative DC bus) link, or

.2 5% AC link, or

.3 Single DCink and an AC link.

.4 Input transient protection,

.5 RFI filter,

.6 Output LC filter for drives with motor feeders exceeding 10 meter (30 ft) developed length between drive and motor, matched to motor.

.7 Additional standalone harmonic filter shall be supplied where noted below. Where harmonic filters are installed, the input reactor shall not be required; however, the output reactor is still required.

2.4 EQUIPMENT AND MOTOR PROTECTION

.1 Under and over voltage protection, phase loss protection and phase unbalance protection,

.2 Current limiting device adjustable from 70% to 100% of rated motor current,

.3 Ground fault protection,

.4 Inherent short circuit protection for line to line and line to ground faults giving safe shut down without damage to power circuit devices,

.5 Instantaneous electronic over-current protection,

.6 Internal over-temperature protection,

.7 Motor stall protection.

2.5 VFD BYPASS

.1 VFD's shall be configured with hand-off-auto override capability.

.2 Provide integral factory wired and mounted bypass such that the controlled motors can be manually put into operation bypassing the VFD.

.3 Bypass to consist of a motor contactor and overload relay rated for the connected load. The bypass must have its own isolating device to allow corrective work on the VFD whilst operating in the bypass mode. Bypass contactor and VFD must be fully interlocked to prevent both outputs being enabled simultaneously. Control of the bypass will be by means of an enclosure door mounted VFD Bypass selector and Start Stop pushbuttons. Two door mounted lamps shall be provided to indicate operating mode (VFD or Bypass).

.4 For applicable fans, the hand position shall override the normal BMS control output but not the FFPC control output or the freeze protection interlock. When the VFD is bypassed for maintenance or due to failure the controlled motor shall operate as if in

hand position such that the FFPC control output and the freeze protection interlock (if applicable) are not overridden.

2.6 OPERATOR INTERFACE KEYPAD AND DISPLAY

.1 Provide capabilities to connect drives to BMS for control and monitoring.

.2 Same interface across motor rating range,

.3 Digital display with keypad,

.4 Keypad includes “hand-off-auto” selections and manual speed control,

.5 Fault reset and "help" buttons on the keypad,

.6 Loss-of-load alarm,

.7 Keypad:

- .1 Backlit LCD display,
- .2 Complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable),
- .3 Faults displayed in English words,

.8 Help button access to "on-line" assistance for programming and troubleshooting, including a minimum of 14 programming assistants:

- .1 Start-up
- .2 Parameter
- .3 PID
- .4 Reference
- .5 I/O
- .6 Serial communications
- .7 Option module
- .8 Panel display
- .9 Low noise set-up
- .10 Maintenance
- .11 Troubleshooting
- .12 Drive optimizer

.9 Operating values displayed in engineering (user) units, with a minimum of three values displayed at one time from the following:

- .1 Output frequency
- .2 Motor speed (RPM, %, or engineering units)
- .3 Motor current
- .4 Motor torque
- .5 Motor power (kW)
- .6 DC bus voltage
- .7 Output voltage

.10 Control functions:

- .1 Three (3) programmable critical frequency lockout ranges to prevent VFD from operating the load continuously at an unstable speed, fully adjustable, from 0 to full speed.
- .2 Two (2) PID set point controllers allowing pressure or flow signals to be connected directly to the VFD;

.1 VFD microprocessor for the closed-loop control,

.2 250 mA of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others,

.3 PID set point adjustable from the VFD keypad, analog inputs, or over the communications bus,

.4 Two (2) independent parameter sets for the PID controller and the capability to switch between the parameter sets via a discrete input, serial communications or from the keypad.

.3 The independent second PID loop able to utilize the second analog input and modulate one of the analog outputs to maintain the set point of an independent process (i.e.. Valves, dampers, etc.),

.4 All set points, process variables, etc. To be accessible from the serial communication network,

.5 Programmable "Sleep" and "Wake up" functions to allow the drive to be started and stopped from the level of a process feedback signal.,

.6 "Bumpless Transfer" of speed reference when switching between "Hand" and "Auto" modes

.7 Programmable loss-of-load (broken belt / broken coupling) Form-C relay output and over the serial communications bus, with programmable time delay for motor start-up,

.8 Programmable underload and overload curve functions to allow user defined indications of broken belt or mechanical failure / jam condition causing motor overload,

.9 Loss of input reference (4-20 mA or 2-10V); user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the VFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user with alarm output to a Form-C relay output and over the serial communication bus,

.10 Password protection against parameter changes.

.11 Input Connections:

.1 Analog; two (2) programmable inputs for current or voltage signals,

.2 Discrete; six (6) programmable inputs for interfacing with external devices;

.1 Programmable to initiate upon an application or removal of 24VDC or 24VAC.

.3 Run permissive circuit for damper or valve control:

.1 When the damper or valve is fully open, a damper normally open dry contact (end-switch) closes, and the closed end-switch is wired to a discrete input and allows VFD motor operation,

.4 Safety interlock circuits:

.1 Two (2) separate safety interlock inputs,

.2 When either safety is opened, the motor coasts to stop and associated damper/valve commanded to close,

.3 Keypad displays "start enable 1 (or 2) missing" and the safety input status transmitted over the serial communications bus.

.12 Output Connections:

.1 Analog; two (2) programmable outputs for 0-20mA, 4-20 mA, or 0-10VDC;

.1 Each programmable as a minimum to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, Active Feedback.

.2 Discrete: three (3) programmable, digital Form-C relay outputs;

.1 Programmable on and off delay times and adjustable hysteresis,

.2 Rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC. At least one contact shall be rated for 2A at 120VAC. If a separate interposing relay is required, it shall be wired to the VFD by the controls contractor or the equipment supplier where part of a packaged assembly,

.3 Maximum voltage 300 VDC and 250 VAC with continuous current rating of 2 amps RMS,

.4 True Form-C type contacts; open collector outputs are not acceptable.

.3 Run command circuit for damper or valve control:

.1 Functions regardless of the source of a run command (keypad, input contact closure, time- clock control, or serial communications),

.2 Form-C relay closure that will signal the damper to open (VFD motor does not operate),

.13 Programmable Time Delay functions:

.1 VFD start delay and a keypad indication that this time delay is active,

.2 A Form C relay output provides a contact closure to signal the VAV boxes open; this will allow VAV boxes to be driven open before the motor operates,

.3 Field programmable from 0 - 120 seconds,

.4 Start delay active regardless of the start command source (keypad command, input contact closure, time-clock control, or serial communications), and when switching from drive to bypass

.14 Speed Control functions:

.1 Seven (7) programmable preset speeds,

.2 Two (2) independently adjustable accel and decel ramps with 1 - 1800 seconds adjustable time ramps.

.3 Minimum speed setting adjustable from 0 to 70%,

.4 Maximum speed setting adjustable from 50 to 110%,

.5 Rotating motor restart routine to match frequency and actual speed before accelerating to set speed.

.6 Acceleration/deceleration ramp adjustable from 10 to 100 seconds for 0 to 100% speed,

.7 Motor flux optimization circuit to automatically reduce applied motor voltage to the motor to optimize energy consumption and reduce audible motor noise;

.1 Selectable software for optimization of motor noise, energy consumption, and motor speed control.

.8 Carrier frequency control circuit to reduce the carrier frequency based on actual VFD temperature that allows higher carrier frequency settings without derating the VFD.

.15 Programming:

.1 Built-in time clock in the VFD keypad with battery backup of 10 years minimum life span,

.2 Time clock date and time stamp faults and records operating parameters at the time of fault. On battery failure, the VFD automatically reverts to hours of operation since initial power up,

.3 Time clock programmable to control start/stop functions, constant speeds, PID parameter sets and output Form-C relays,

.4 Discrete input that allows an override to the time clock (when in the off mode) for a programmable time frame,

.5 Four (4) separate, independent timer functions that have both weekday and weekend settings,

.6 Utilize pre-programmed application macro's specifically designed to facilitate start-up,

.7 Application macros provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time, and

.8 Two user macros to allow the end-user to create and save custom settings.

.16 Fireman’s override input:

.1 On receipt of a contact closure from the fire / smoke control station, the VFD operates in one of two selectable modes:

.1 Operate at a programmed predetermined fixed speed ranging from -500 HZ (reverse) to 500 HZ (forward), or

.2 Operate in a specific fireman's override PID algorithm that automatically adjusts motor speed based on override set point and feedback; setpoint adjusted over the serial communications bus.

.2 Operating mode overrides all other inputs (analog/digital, serial communication, and all keypad commands), except safety run interlocks, and force the motor to run in one of the two modes above.

.3 "override mode" displayed on the keypad.

.4 Upon removal of the override signal, the VFD resumes normal operation, without the need to cycle the normal discrete input run command

.17 Building automation system integration:

.1 Eia-485 port as standard for the following protocols which are resident in the base VFD;

.1 BACnet MS/TP

.2 BACnet IP

.3 Lonworks

.4 Modbus

.2 The use of third party gateways and multiplexers is not permitted.

.3 All protocols certified by the governing authority including:

.1 BTL listing for BACnet,

.2 Lonmark functional profile 6010, for both mandatory and optional items.

.4 Use of non-certified protocols is not permitted.

.5 BACnet interface:

.1 Eia-485, MS/TP interface operating at 9.6, 19.2, 38.4, or 76.8 kbps,

.2 Connection tested by the BACnet testing labs (BTL) and be BTL listed,

.3 Conforms to the BACnet standard device type of an application specific controller (B-ASC),

.4 Interface support all bibbs defined by the BACnet standard profile for a B-ASC including, but not limited to:

.1 Data sharing - read property - b.

.2 Data sharing - write property - b.

.3 Device management - dynamic device binding (who-is; i-am).

.4 Device management - dynamic object binding (who-has; i-have).

.5 Device management - communication control - b.

.5 if additional hardware is required to obtain the BACnet interface, the VFD manufacturer to provide one BACnet gateway per drive; multiple VFDs sharing one gateway shall not be acceptable.

.6 Serial communication capabilities in VFD mode include:

.1 Run-stop control,

.2 Speed set adjustment,

.3 Proportional/integral/derivative PID control adjustments,

.4 Current limit,

.5 Accel/decel time adjustments,

.6 Lock and unlock the keypad,

.7 Allow the BMS to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature.

.8 BMS capable of monitoring the VFD relay output status, discrete input status, and all analog input and analog output values.

.9 All diagnostic warning and fault information,

.10 Remote VFD fault reset.

.7 Digital and analog output control:

.1 BMS may control digital and analog outputs via the serial interface; this control is independent of any VFD function,

.2 The analog outputs may be used for modulating chilled water valves or cooling tower bypass valves,

.3 Form-C relay outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation,

.4 Discrete inputs capable of being monitored by the BMS system, including monitoring of which (of up to 4) safeties are open.

.5 One output shall be configured to close (or open) a 2A, 120VAC contact when the motor output is greater than 40%. The contact will drop off when the motor output drops below 30%.

.8 Independent PID loop

.1 May be used for cooling tower bypass value control, chilled water value / hot water valve control, etc.

.2 Both the VFD PID control loop and the independent PID control loop continue functioning even if the serial communications connection is lost,

.3 As default, the VFD keeps the last good set point command and last good DO & AO commands in memory in the event the serial communications connection is lost and continue controlling the process.

2.7 HARMONIC FILTERS

.1 Harmonic filters are not required for this project.

Part 3 Execution

3.1 VARIABLE FREQUENCY DRIVES

.1 Install variable frequency drives in accordance with manufacturer's requirements.

.2 Where a separate disconnect is installed between the drive and the controlled equipment, provide interlock wiring between disconnect status contact switch, and VFD, to prevent drive from operating if disconnect switch is open.

.3 Conduct impact vibration test to determine first natural harmonic of driven equipment, and program VFD skip speed function to prevent operation at this speed.

.1 Nominal skip speed range equal to ± 5% of measured harmonic frequency, or as determined on site.

.4 Provide power wiring, conduit and branch circuit protection to line side of VFD, selected for drive input current.

.5 Mount all loose VFD provided as part of this contract.

.6 Coordinate wiring with Division 26

3.2 CLEANING

.1 Do not start-up drives until local area has been brought to final clean, floors are sealed, and any drywall in the same space is sanded and painted.

3.3 START-UP AND TESTING

.1 If such heating equipment is to be used prior to final construction clean, provide temporary magnetic starters, or, provide enclosures around the drives and pressurized the enclosures with a source of clean air.

.2 Provide the services of a certified factory authorized representative for the start-up of each drive. Complete and submit a certified start-up form filled out for each drive.

3.4 DEMONSTRATION AND TRAINING

.1 Provide the services of a factory trained manufacturer's representative to provide training to owners' staff. Include in training:

.1 Installation instructions,

.2 Programming of VFD,

.3 Operation of VFD,

.4 At-site servicing of VFD

.5 Replacement of VFD keypad controller

.6 Manual and automatic operation of bypass, if applicable.

.7 Serial communications

.8 BMS over-ride for catastrophic event control and fireman's smoke control override.

.2 Provide a computer-based training CD/DVD to the owner at the time of project closeout for the above topics.

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 SHOP DRAWINGS / PRODUCT DATA

.1 Submit manufacturer's catalogue literature for;

- .1 Flow indicators
- .2 Thermometers
- .3 Pressure gauges

.2 Include schedule of thermometers, and pressure gauges showing for each instrument:

- .1 identification number,
- .2 location,
- .3 type,
- .4 range and
- .5 accessories.

.3 Each equipment shop drawing shall be identified with a unique Interior Health Asset Number provided by the Interior Health FM group. The contractor shall track these numbers and included them on all shop drawing submissions and red-line documentation of the drawings.

.4 Equipment schedules include a blank column for redlining the final confirmed Interior Health asset tracking number

1.3 APPLICABLE CODES AND STANDARDS

.1 ASME B40.200 Thermometers, Direct Reading and Remote Reading

.2 ASME B40.100 Pressure Gauges and Gauge Attachments

.3 ASME PTC 19.3 TW – Thermowells

.4 CSA B51 Boiler and Pressure Vessel Code

Part 2 Products

2.1 GENERAL

.1 Selection criteria:

- .1 normal operating reading to be between half and two thirds of full scale range
- .2 expected maximum and minimum readings to be within scale range.
- .3 thermometers to have both Celsius and Fahrenheit scales.
- .4 pressure gauges to have both kPa and psig scales.

2.2 FLOW INDICATORS

.1 Construction:

- .1 visual flow indication.
- .2 equipped with dual flow scale calibrated in l/s and USGPM.
- .3 protected against accidental breakage of the glass indicator.
- .4 in-line type for pipe sizes up to 40mm [1.5”].

2.3 THERMOMETERS – PIPING (DIGITAL)

.1 Direct reading thermometers

.2 Solar powered 178mm [7”] industrial, variable angle type, passivated thermistor, cast aluminum epoxy coated case, with solar cell and 11mm [7/16”] LCD display.

.3 Remote reading thermometers

.4 115 mm [4.5”] liquid filled, or gas activated type, stainless steel capillary, stainless steel spring armour, stainless steel bulb and phenolic, cast aluminum, or stainless-steel case for surface mounting.

2.4 THERMOMETER WELLS

.1 Construction:

.1 Body material:

.1 in copper pipe: brass.

.2 in steel pipe: stainless steel.

.2 threaded connection, manufactured from bar stock or forged brass with cap and chain, compatible with temperature sensors used.

.3 pressure rating: 2000 kPa (300 psig) at 121°C (250°F)

.4 C.R.N. registered

2.5 THERMOMETERS - DUCT/PANEL MOUNTED

.1 Minimum Requirements:

.1 Mercury content is not acceptable

.2 All thermometers to be in accordance with Canadian General Standards Board CGSB 14-GP-2a.

.3 Duct mounted dial type - solid liquid filled with remote capillary element.

.4 Panel mounted dial type (surface) type - vapour filled direct mounting.

.5 Panel mounted dial type (flush) type - remote liquid filled capillary element.

.2 Case:

.1 Dial type - cast aluminum, black enamel steel or stainless steel with stainless steel or chrome-plated face ring.

.3 Scale:

.1 Dial type - nominal 115mm [4.5”] unless otherwise indicated.

.2 White background with temperature range in black.

.3 Dual Celsius and Fahrenheit scale.

.4 Standard of Acceptance: Marsh, Moeller, Trerice, Weiss, Weksler, Winters.

2.6 PRESSURE GAUGES - PIPING

.1 Minimum Requirements:

.1 All gauges to be in accordance with ANSI B40.1 Grade "A" level.

.2 115mm [4.5"] cast aluminum, black steel or stainless-steel case, with stainless steel or chrome plated face ring.

.3 White background with pressure range in black.

.4 Dual kilopascal and psig scale.

.5 Phosphor bronze bourdon tube, silver brazed tip and socket

.6 6mm [1/4"] lower connection.

.7 Rotary type bushed movement, silicone dampened to prevent pointer oscillation.

.8 Gauges to be registered with Provincial Boiler and Pressure Vessel Safety Branches with CRN number.

.9 ULC listed for use on fire protection systems.

.10 Accuracy shall be 1% off full scale over the middle half of the scale.

.2 Accessories:

.1 Install a needle valve ahead of each gauge.

.2 Install an anti-syphon loop (suitable for steam pressure) ahead of each gauge on steam systems.

.3 Standard of Acceptance: Marsh, Moeller, Trerice, Weiss, Weksler, Winters.

2.7 TEST PLUGS FOR PRESSURE / TEMPERATURE

.1 Provide 6mm [1/4"] solid brass test plug fitting c/w brass chain where indicated.

.2 Test plugs shall be capable of receiving either a pressure or temperature 3mm [1/8"] O.D. Dual seal core shall be Nordel suitable for temperature of 177°C [350°F] and shall be rated zero leakage from vacuum to 6895kPa [1000psi).

.3 Provide 1 master test kit containing two test pressure gauge of suitable range, one gauge adaptor, 3mm [1/8"] O.D. probe and two stem pocket testing thermometers of suitable range.

.4 Standard of Acceptance: Sisco P/T Plugs, Flow Design - Superseal.

Part 3 Execution

3.1 GENERAL

.1 Install thermometers and gauges so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading thermometers and gauges.

.2 Install engraved lamicoid nameplates as specified in Section 23 05 53 Identification, identifying medium.

3.2 THERMOMETERS

.1 Install in wells on all piping.

.2 Install the separable well so as to minimize the restriction to flow and, if necessary, install in a section of oversized pipe.

.3 Install wells where indicated for use with test thermometers.

.4 Install in locations as indicated and on inlet and outlet of: Heating coils.

.5 Use extensions where thermometers are installed through insulation.

3.3 PRESSURE GAUGES

.1 Install in following locations: Heating coils, and other locations as indicated on the drawings.

.2 Use extensions where pressure gauges are installed through insulation.

.3 Where a single gauge is used to measure multiple points provide needle valves to isolate each point, including pressure gauge.

.4 Install needle valves on pressure gauges: For differential pressure gauge, provide needle valve on each sensing line.

.5 Install pressure snubbers on pressure gauges at suction and discharge sides of coil pumps

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 piping.

1.2 APPLICABLE CODES AND STANDARDS;

.1 ASME B31.1 Pressure Piping Code

.2 Manufacturers Standardization Society of Valve and Fittings Industry (MSS)

.1 MSS SP-58 Pipe Hangers and Supports - Materials Design and Manufacture

.2 MSS SP-69 Pipe Hangers and Supports - Selection and Application

.3 MSS SP-77 Guidelines for Pipe Support Contractual Relationships

.4 MSS SP-90 Guidelines for Terminology for Pipe Hangers and Supports

1.3 CONCRETE ANCHORS

.1 As per the BC Building Code, power-actuated or drop in fasteners shall not be used to resist tension forces for the support or restraint of the piping systems or their components. All fasteners shall be reviewed and approved by the Supporting Professional Engineer for Seismic Restraints prior to installation.

1.4 GENERAL

.1 This project is deemed a be post-disaster design.

.2 Provide hangers and supports to secure equipment in place, prevent vibration, protect appropriate against damage from earthquake, maintain grade, provide for expansion and contraction and accommodate insulation.

.3 The contractor shall arrange and pay for the services of a BC registered professional engineer to provide all required engineering services necessary for the complete design, sizing and detailing of all anchors and anchor supports to structure required for the project. Submit details to the Consultant for review.

.4 Provide insulation protection saddles on all insulated piping.

.5 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP58.

.6 Set inserts in position in advance of concrete work. Use grid system in equipment rooms.

.7 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.

.8 Do not suspend from metal deck.

.9 Hangers for copper pipe shall be copper plated or plastic dipped unless pipe hangers bear on piping insulation (cold services).

.10 Hangers and strut located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A123. All hanger hardware shall be hot dip galvanized or stainless steel. Zinc plated hardware is not acceptable for outdoor or corrosive use.

.11 Hangers and strut located in corrosive areas shall be type 316 stainless steel with stainless steel hardware.

1.5 SPECIAL REQUIREMENTS FOR SUPPORTS

.1 In certain locations in the project there may numerous large pipes that are required to be suspended from the slab above. The Contractor shall install the anchors and supports in

an approved manner to ensure the entire installation (seismic, gravity and lateral forces) will be compliant with the BC Building Code.

.2 Cast-In-Place Anchors:

.1 Anchors, Bolts, Nuts, and Washers: Bolts and studs, nuts, and washers shall conform to ASTM A307, Grade A, and ASTM A449, ASTM A563, and ASTM F436, as applicable. Hot-dip galvanized bolts and studs including associated nuts and washers in accordance with ASTM A153.

.3 Drilled-In Anchors:

.1 Installer Qualifications

.1 Drilled-in anchors shall be installed by a Contractor with at least five years of experience performing similar installations.

.4 Installer Training:

.1 Conduct a thorough training with the manufacturer or the manufacturer's representative for the Installer on the project. Training shall consist of a review of the complete installation process for drilled-in anchors, to include but not limited to:

.1 hole drilling procedure

.2 hole preparation & cleaning technique

.3 adhesive injection technique & dispenser training / maintenance

.4 rebar dowel preparation and installation

.5 proof loading/torqueing

.5 Field Quality Control:

.1 Testing: 25% of each type and size of drilled-in anchor shall be proof loaded by an independent testing laboratory. Adhesive anchors and capsule anchors shall not be torque tested unless otherwise directed by the Engineer. If any of the tested anchors fail to achieve the specified torque or proof load all anchors shall be tested, unless otherwise instructed by the Engineer.

.2 Tension testing should be performed in accordance with ASTM E488.

.3 Torque shall be applied with a calibrated torque wrench.

.4 Proof loads shall be applied with a calibrated hydraulic ram. Displacement of adhesive and capsule anchors at proof load shall not exceed D/10, where D is the nominal anchor diameter.

1.6 SHOP DRAWINGS

.1 Submittals shall include:

.1 upper attachment.

.2 hanger rods.

.3 pipe attachment.

.4 riser clamps.

.5 shields and saddles.

.6 inserts.

.2 Submit details for supports, guides, and anchors for glass, fibre-reinforced plastic, and plastic piping systems.

.3 Submit design drawings for custom fabricated trapeze hangers, sealed by a professional engineer licensed in the project location jurisdiction.

.1 Shop drawing details shall include:

.1 construction detail drawings for each loading condition,

.2 span deflection calculations,

.3 building attachment load calculations and type.

.2 Provide services of engineer who sealed the custom trapeze hanger shop drawings to conduct a general review of the completed installation on site.

.3 Each equipment shop drawing shall be identified with a unique Interior Health Asset Number provided by the Interior Health FM group. The contractor shall track these numbers and included them on all shop drawing submissions and red-line documentation of the drawings.

.4 Equipment schedules include a blank column for redlining the final confirmed Interior Health asset tracking number

Part 2 Products

2.1 ATTACHMENTS

.1 Concrete:

.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.

.3 All inserts shall be ICBO approved. Use only ICBO design load ratings.

.4 Inserts for cast-in-place concrete: galvanized steel wedge. ULC listed for pipe NPS 3/4 through NPS 8

.1 Standard of Acceptance: Grinnell/Anvil Fig. 281

.5 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

.1 Standard of Acceptance: Grinnell/Anvil, plate fig. 49, socket fig. 290, expansion case fig. 117

.6 Drilled, adhesive type:

.1 Adhesive anchor consisting of anchor rod assembly with a capsule containing a two-component adhesive, resin and hardener.

.2 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.

.3 Rod assemblies shall extend a minimum of 50 mm [2"] into the concrete slab below the housekeeping bases.

.4 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.

.5 Refer to manufacturer's recommendations for tightening torques to be applied to inserts.

.2 Steel Beam (bottom flange):

.1 Cold piping NPS 2 and under: malleable iron C clamp

.1 Standard of Acceptance: Grinnell/Anvil fig. 61

.2 Cold piping NPS 2-1/2 and larger and all hot piping: malleable iron beam clamp

.1 Standard of Acceptance: Grinnell/Anvil fig. 292.

.3 Steel Beam (top):

.1 Cold piping NPS 2 and under: malleable iron "top of beam" C clamp

.1 Standard of Acceptance: Grinnell/Anvil Fig. 61.

.2 Cold piping NPS 2-1/2 and larger and all hot piping: steel jaw, hook rod with nut, spring washer and plain washer

.1 Standard of Acceptance: Grinnell/Anvil fig. 227.

.4 Steel Joist:

.1 Cold piping NPS 2 and under: steel washer plate with double locking nuts

.1 Standard of Acceptance: Grinnell/Anvil fig. 60.

.2 Cold piping NPS 2-1/2 and larger and all hot piping: steel washer plates with double locking nut, carbon steel clevis and malleable iron socket

.1 Standard of Acceptance: Grinnell/Anvil: washer plate, fig. 60; clevis, fig. 66; socket, fig. 290.

.5 Steel Channel or Angle (bottom):

.1 Cold piping NPS 2 and under; malleable iron C clamp

.1 Standard of Acceptance: Grinnell/Anvil fig. 86.

.2 Cold piping NPS 2-1/2 and larger and all hot piping; universal channel clamp

.1 Standard of Acceptance: Grinnell/Anvil fig. 226.

.6 Steel Channel or Angle (top):

.1 Cold piping NPS 2 and under: malleable iron "top of beam" C clamp

.1 Standard of Acceptance: Grinnell/Anvil fig. 61.

.2 Cold piping NPS 2-1/2 and larger and all hot piping: steel jaw, hook rod with nut, spring washer and plain washer

.1 Standard of Acceptance: Grinnell/Anvil fig. 227.

2.2 MIDDLE ATTACHMENTS (ROD)

.1 Carbon steel black (electro-galvanized/cadmium plated for mechanical rooms) continuous threaded rod

.1 Standard of Acceptance: Grinnell/Anvil fig. 146 or Myatt fig. 434.

2.3 PIPE ATTACHMENTS

.1 Cold piping, steel or cast iron: hot piping steel, with less than 25 mm [1"] horizontal movement; hot piping, steel, with more than 300 mm [12"] middle attachment (rod) length: adjustable clevis

.1 Standard of Acceptance: Grinnell/Anvil fig. 260.

.2 Cold copper piping; hot copper piping with less than 25 mm [1"] horizontal movement; hot copper piping with more than 300 mm [12"] middle attachment (rod) length: adjustable clevis copper plated

.1 Standard of Acceptance: Grinnell/Anvil fig. CT-65.

.3 Suspended hot piping, steel and copper, with horizontal movement in excess of 25 mm [1"]; hot steel piping with middle attachment (rod) 300 mm [12"] or less; pipe roller

.1 Standard of Acceptance: Grinnell/Anvil fig. 174 or Grinnell/Anvil fig. 181 up to NPS 6 and Grinnell/Anvil fig. 171 NPS 8 and larger.

.4 Bottom supported hot piping, steel and copper: pipe roller stand

.1 Standard of Acceptance: Grinnell/Anvil fig. 271.

.5 Spring hangers; where required to offset expansion on horizontal runs which follow long vertical risers

.1 Standard of Acceptance: Grinnell/Anvil fig. 171 single pipe roll hanger with Grinnell/Anvil fig. 178.

2.4 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized carbon steel

.1 Standard of Acceptance: Grinnell/Anvil fig. 261 or Myatt fig. 182.

.2 Copper pipe: carbon steel copper finished

.1 Standard of Acceptance: Grinnell/Anvil fig. CT-121.

2.5 SADDLES AND SHIELDS

.1 Cold piping NPS 2 and under: protection shield with pipe insulation under shield with uninterrupted vapour barrier

.1 Standard of Acceptance: Kingspan “K Block” – high density insulation

.2 Cold piping NPS 2-1/2 and over: protection shield with high density insulation under shield with uninterrupted vapour barrier

.1 Standard of Acceptance: Kingspan “K Block” – high density insulation.

.3 Hot piping NPS 3 and under: insulation over pipe hanger.

.4 Hot piping NPS 4 and over: protective saddle with insulation under saddle

.1 Standard of Acceptance: Grinnell/Anvil fig. 160 to 166.

2.6 TRAPEZE HANGERS

.1 Performance:

.1 Manufactured:

.1 to product load listings.

.2 Custom fabricated:

.1 maximum deflection between supports: 1/250 (0.4%) of span

.2 minimum factor of safety : 5 times load to ultimate tensile or compressive strength.

.2 Construction:

.1 Carbon steel shapes, to suit load application:

.1 hollow steel section,

.2 equal leg EI section, or

.3 double C channel “strong-back”, with welded clips.

.3 Hanger rods:

.1 as specified above, and

.2 minimum two support rods,

.3 rods selected for minimum factor of safety of 5 times load to ultimate tensile or compressive strength of rod.

.4 Pipe restraint:

.1 restrain pipes from lateral movement with:

.1 bolt-on angle brackets or pipe U-bolts for manufactured hangers,

.2 welded-on angles for fabricated hangers.

.5 Finish:

.1 electro-galvanized finish in mechanical rooms and outdoors.

.2 black steel finish in other areas.

2.7 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

.1 Standard of Acceptance: Grinnell/Anvil fig. 262 or 263.

.2 Channel type support

.1 Standard of Acceptance: Burndy, Canadian Strut, Cantruss or Unistrut - (arrangement to be acceptable to B.C. Boiler Inspection Department).

2.8 FLOOR SUPPORTS

.1 Do not support piping from the floor unless specifically indicated.

2.9 VARIABLE LOAD SUPPORTS

.1 Performance:

.1 Selected for piping loads and estimated travel under service conditions.

.2 Construction:

.1 carbon steel housing and spring,

.2 pre-compressed spring,

.3 load indicator,

.4 welding to ASME Section IX

.5 welded attachment points

.6 finish: semi gloss primer coat.

2.10 CONSTANT LOAD SUPPORTS

.1 Performance:

.1 maintains constant support load under variable hanger displacements.

.2 selected for piping loads and estimated travel under service conditions, with a minimum safety factor of 25 mm (1 in) extra travel or 20% of total travel, whichever is greater.

.2 Construction:

.1 to WW-H-171E, ANSI/MSS SP-69 and 58

.2 carbon steel housing and spring,

.3 combination hanger moment arm and balancing spring design,

.4 horizontal and vertical arrangements,

.5 load adjustment and load indicator scale,

.6 factory set for load and travel,

.7 welding to ASME Section IX

.8 welded attachment points

.9 finish: semi gloss primer coat.

2.11 RODING FOR MECHANICAL JOINT PIPE

.1 Plain end cast iron and asbestos cement drain waste and vent pipe, NPS 5 and over,

.1 bell clamps and rodding at each joint

.2 bell clamp and rodding at each tee branch

Part 3 Execution

3.1 COORDINATION WITH CONCRETE WORK

.1 Supply and deliver inserts to site in ample time to be built into work.

.2 Set and correctly locate inserts for pipes and equipment hangers. Secure inserts firmly to formwork before concrete is poured.

3.2 HANGER SPACING

.1 Support piping and conduit directly from or on structural building elements. Do not support pipe or conduit directly from other services.

.2 Adjust hanger spacing noted below to suit specific pipe manufacturer's recommendations (specifically related to plastic pipe).

.3 Spacing and middle attachment (rod) diameter as specified in paragraphs below or as in table below, whichever is more stringent.

.1 Plumbing piping: most stringent requirements of the Plumbing Code or authority having jurisdiction.

.2 Fire protection: to applicable fire code; toggle hangers are unacceptable.

.3 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

.4 Within 300 mm [12"] of each horizontal elbow, tee, joints, etc.

.4 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]

3.3 HANGER INSTALLATION

.1 Adjust hangers to equalize hanger loads, to support piping true to line and grade, and to minimize loads transferred through connections to equipment and outlets

.2 Offset hanger so that rod is vertical in operating position.

.3 Install hanger to provide minimum 12 mm [½"] clear space between finished covering and adjacent work.

.4 Support vertical piping at every other floor.

.5 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.6 Where practical, support riser piping independently of connected horizontal piping.

.7 Install plastic inserts between steel studs and piping.

.8 For beam clamps, extend hanger rod tight to underside of beam with top bolt and washer.

3.4 ACOUSTICALLY SENSITVE AREAS

.1 Use spring hangers and spring isolators for all piping, ducts and equipment exiting the basement mechanical room to minimize vibration transfer.

.2 Hangers in the ceiling space of acoustically sensitive areas shall be resilient type such as Mason WHR. Refer to acoustical report for vibration isolation requirements for this type of areas.

3.5 INSERTS

.1 Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

.2 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying piping over 100 mm (4”) or ducts over 1500 mm (60”) wide.

.3 Where concrete slabs form finished ceiling, finish inserts, flush with slab surface.

.4 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square plate and nut above slab, in concealed locations.

.5 Provide a test mock up for review.

.6 Provide inserts for above chillers, pumps and sump pumps to permit equipment servicing. Provide an eyebolt.

.7 Inserts shall be installed in accordance with manufacturer’s recommendations and in no case closer than 2.1 m (7 ft.) apart.

.8 Install anchors per manufacturer instructions.

.9 The contractor shall arrange an anchor manufacturer’s representative to provide onsite installation training for all of their anchorage products. The Seismic Engineer shall receive documented confirmation that all of the contractor’s personnel who install anchors are trained prior to the commencement of installing anchors.

.10 Anchor capacity is dependent upon spacing between adjacent anchors and proximity of anchors to edge of concrete. Install anchors in accordance with spacing and edge clearances indicated on the drawings.

.11 Existing reinforcement bars in the concrete structure may conflict with specific anchor locations. Unless noted on the drawings that the bars can be cut, the contractor shall review existing structural drawings and shall undertake to locate the position of the reinforcing bars at the locations of the concrete anchors by GPR, X-RAY, or other means.

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 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 British Columbia Building Code, with respect to seismic snubbers, or provide equivalent requirements where integral seismic restraint is provided in isolators / bolting.

.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 APPLICABLE CODES AND STANDARDS

.1 This project is deemed a be post-disaster design.

.2 Comply with the latest edition of the following:

.1 British Columbia Building Code and local by-laws

.2 SMACNA - “Seismic Restraint Manual Guidelines for Mechanical Systems”

.3 NFPA 13 - Installation of Sprinkler Systems

.4 ASHRAE Handbook – HVAC Applications

.5 VISCMA (The Vibration Isolation and Seismic Control Manufacturers Association)

1.4 SCOPE

.1 Isolate motor driven mechanical equipment.

.2 Provide restraints for equipment mounted on vibration isolation to limit movement during start-up and normal operation.

.3 Isolator and base type designations shall comply with the appropriate chapter of current ASHRAE Applications Handbook, as a minimum.

.4 Information shown here is to establish minimum standards. Vibration isolation equipment shall be selected to minimize noise levels in the building.

1.5 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.

.2 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 restraint device, results of tests consistent with OSHPD procedures and approvals shall be submitted and certified by a B.C. registered professional structural engineer.

.3 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.

.4 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 consultant for the project.

.5 Submit samples of materials required to complete the work of this section for inspection and review when requested.

.6 Submit product data sheets for isolation components.

.7 Show fabrication details, location and size of anchor bolts and concrete requirements for inertia bases.

.8 Provide vibration isolation equipment by one manufacturer.

.9 Submit samples of materials required to complete the work of this section for inspection and review when requested.

1.6 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.

.2 Provide seismic restraint for all equipment including all seismic restraint related hardware (bolts and anchors) from point of attachment to equipment through to and including attachment to structure. The required anchors shall be indicated on the shop drawings and shall be clearly identified for the correct location and so as to be readily identified after installation. Provide clear instructions for their installation. Refer to Section 23 05 49, Seismic Restraints.

.3 Place isolators under equipment so that the minimum distance between adjacent corner isolators is at least equal to the height of the centre of gravity of the equipment. Include height of centre of gravity on shop drawings. Otherwise, design for increased forces on the supports, and submit design calculations with shop drawings for approval. In particular, provide chiller isolation meeting this requirement.

.4 Ensure isolation systems have a vertical natural frequency no higher than one third of the lowest forcing frequency, unless otherwise specified. Use dynamic stiffness correction factors for elastomers and do not exceed 60 durometer.

.5 Isolators and restraining devices, which are factory supplied with equipment, shall meet the requirements of this section. Isolation supplier to check with pump supplier for number and location of isolators and if there is a requirement for structural or inertia bases.

.6 Provide concrete inertia bases or structural steel bases, where specified or required by equipment manufacturers, located between vibrating equipment and the vibration isolation elements, unless the equipment manufacturer certifies direct attachment capabilities. Coordinate with Division 3 for the provision of concrete work.

.7 Coordinate with Division 3 for the provision of housekeeping pads where specified or shown on the drawings. Provide at least 300 mm [12"] clearance between drilled inserts and edge of housekeeping pads. Housekeeping pads to be tied to structure with reinforcement to meet Code seismic requirements.

.8 For isolated equipment, design anchors, bolts, isolators and bases to meet Code requirements. For larger isolators, where the Code requirement cannot be met by the isolator housing, provide Type 6 seismic snubbers or Type 6P where post-disaster requirement is specified.

.9 Use ductile materials in all vibration and seismic restraint equipment.

.10 Follow structural consultant's instructions for drilled inserts re: installation of anchors.

.11 Coordinate with Section 23 33 00 "Duct Connectors – Vibration Isolation" for all ductwork connections to fans or plenums.

.12 Provide flexible connectors between equipment and piping where required by manufacturers to protect equipment from stress and reduce vibration in the piping system. Meet connector manufacturer's installation specifications as well as equipment manufacturer's requirements.

.13 Coordinate with Electrical Division 26 for the provision of a minimum 180° hanging loop of flexible conduit for all electrical connections to isolated equipment.

.14 Supply all isolators fully assembled and clearly labelled with full instructions for installation by the contractor.

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". Provide neoprene isolators and components using maximum 60 duro "Bridge bearing quality neoprene", as defined by CSA Standard CAN3-S6. Ensure design of isolation and restraint elements allows adequate clearance to avoid binding.

.4 Design springs "iso-stiff" (kx/ky = 1.0 to 1.5) with a working deflection between 0.3 and 0.6 of solid deflection.

.5 Provide hot dipped galvanized housings and neoprene coated springs, or other acceptable weather protection, for all isolation equipment located out of doors or in areas where moisture may cause corrosion.

2.2 ISOLATORS - TYPE 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 Isolation of vibration for small pumps.

.3 Standard of Acceptance: Mason BR, maximum 50 durometer, Kinetics FDS

2.3 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 Reciprocating air or refrigeration compressors, pumps, packaged air-handling and air-conditioning equipment, centrifugal and axial fans, and internal combustion engines.

.3 Standard of Acceptance: Mason SSLFH, Kinetics RDS

2.4 ISOLATORS - TYPE 6P, “POST DISASTER” SEISMIC SNUBBERS.

.1 Seismic stop c/w 18mm [3/4"] neoprene bushing, 50 durometer maximum, and 3mm [1/8"] air gap with removable sleeve for accurate installation. Snubber is to be designed to act omni-directionally and keep acceleration to the equipment during a seismic event, below the fragility level of the equipment (Equipment to function after an earthquake).

.2 Standard of Acceptance: Mason Z-1011.

2.5 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.

2.6 CONCRETE INERTIA BASES

.1 Concrete inertia bases to be a minimum of 1.5 times the weight of the isolated equipment. Generally base thickness shall be 1/12 of the longest dimension of the base, but not less than 150 mm [6"]. Include with base a steel channel concrete form with required steel reinforcement (as determined necessary by suppliers' registered professional engineer). Provide additional steel as required by sleeves or inserts to receive equipment anchor bolts.

.2 Use height saving brackets in all mounting locations to maintain a 35 mm [1-1/2"] clearance below the base.

.3 Bases to be furnished with built-in motor slide rails. Motor location as specified/scheduled.

.4 Standard of Acceptance: Mason type K.

2.7 STEEL BASES

.1 Construct structural steel bases sufficiently rigid to keep deflection and misalignment within acceptable limits as determined by the equipment manufacturer.

.2 Use height saving brackets in all mounting locations to provide a base clearance of 35 mm [1-1/2"].

.3 Bases to be furnished with built-in motor slide rails. Motor location as specified/scheduled.

.4 Steel bases supplied as integral part of equipment to be supplied meeting the above requirements.

Standard of Acceptance: Mason type WF.

Part 3 Execution

3.1 INSTALLATION

.1 Execute the work in accordance with the specifications and 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 Type 3 mounts, which do not meet the seismic requirement, provide Type 6 seismic snubbers.

.7 Use the lowest RPM scheduled for two-speed equipment in determining isolator deflection.

.8 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.

.9 Protect neoprene isolator components from overheating or use type 8 mounts.

.10 Be responsible for ensuring that flexible duct connections (see Section 23 33 00) are installed with a minimum of 40 mm [1-1/2"] metal-to-metal gap. Use flanges to ensure that flexible connectors are clear of the airstream.

.11 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.

.12 Provide stabilizing springs limiting movement at flexible connections to 25% of fabric width under steady state conditions and 40% at start up.

.13 Where the weight of equipment may change significantly due to draining or similar as in cooling towers or chillers, provide limit stops to limit isolator extension.

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 Consultant stating that the complete vibration isolation installation is installed in accordance with his drawings and instructions and operates to his satisfaction.

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 POST DISASTER DESIGN

.1 This project is deemed a be post-disaster design.

.2 Although the project is located in a low seismic zone the assumed Seismic Hazard Level for the project is SHL C.

.3 All equipment, piping, suspended ceiling elements (diffusers, grilles etc.) shall be provided with seismic supports.

1.3 REGULATORY REQUIREMENTS

.1 Restraints shall meet the requirements of the

.1 British Columbia Building Code;

.2 City of Nelson by-laws and regulations and

.3 Interior Health requirements and guidelines.

.2 Comply with the latest edition of the following:

.1 SMACNA - “Seismic Restraint Manual Guidelines for Mechanical Systems”

.2 NFPA 13 - “Installation of Sprinkler Systems”

.3 ASHRAE - “HVAC Applications, Seismic and Wind Restraint Design”

.4 Applicable Codes and Standards.

.5 VISCMA (The Vibration Isolation and Seismic Control Manufacturers Association)

.6 Manufacturers Standardization Society of Valve and Fittings Industry (MSS): MSS SP-127 Bracing for Piping Systems Seismic - Wind - Dynamic Design, Selection, Application.

1.4 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 Provide for the provision of 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 equipment, ductwork and piping as indicated below.

.1 The seismic engineer shall aid the contractor as necessary during the course of restraint of equipment, ductwork and piping.

.2 The seismic engineer shall certify that the installation fully meets the stipulated Post Disaster requirements.

.3 The seismic engineer shall inspect the completed seismic installation and shall submit a statutory declaration to the consultant stating that the complete seismic installation is installed in accordance with his drawings and instructions and it complies with the regulatory requirements. Prior to substantial performance, the seismic engineer shall provide letters of assurance for all mechanical, plumbing and fire protection systems.

1.5 SCOPE

.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 design, selection and provision of materials, installation instructions, installation and inspection of seismic restraint of mechanical piping, ductwork, fire protection and equipment.

.3 Provide all seismic restraint related hardware, (including bolts and anchors) from point of attachment to equipment through to and including attachment to structure.

.4 When equipment is mounted on concrete housekeeping pads, and / or concrete curbs the anchor bolts shall extend through the pad into the structure.

.5 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.

.6 Seismic restraints may only be omitted where permitted by SMACNA.

.7 The requirements under this Section are in addition to the requirements for equipment, piping and duct supports and vibration isolation specified in other Sections.

.8 Where specifications of materials of this Section differ from those in other Sections, this Section governs, including but not limited to vibration isolation devices.

.9 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 SPECIAL REQUIREMENTS FOR SUPPORTS

.1 In some locations in the project there may be large pipes that are required to be suspended from the slab above. The Contractor shall install the anchors and supports in an approved manner to ensure the entire installation (seismic, gravity and lateral forces) will be compliant with the BC Building Code.

.2 Cast-In-Place Anchors:

.1 Anchors, Bolts, Nuts, and Washers: Bolts and studs, nuts, and washers shall conform to ASTM A307, Grade A, and ASTM A449, ASTM A563, and ASTM F436, as applicable. Hot-dip galvanized bolts and studs including associated nuts and washers in accordance with ASTM A153.

.3 Drilled-In Anchors:

.1 Installer Qualifications

.1 Drilled-in anchors shall be installed by a Contractor with at least five years of experience performing similar installations.

.2 Installer Training:

.1 Conduct a thorough training with the manufacturer or the manufacturer's representative for the Installer on the project. Training shall consist of a review of the complete installation process for drilled-in anchors, to include but not limited to:

.1 hole drilling procedure

.2 hole preparation & cleaning technique

.3 adhesive injection technique & dispenser training / maintenance

.4 rebar dowel preparation and installation

.5 proof loading/torqueing

.4 Field Quality Control:

.1 Testing: 25% of each type and size of drilled-in anchor shall be proof loaded by an independent testing laboratory. Adhesive anchors and capsule anchors shall not be torque tested unless otherwise directed by the Engineer. If any of the tested anchors fail to achieve the specified torque or proof load all anchors shall be tested, unless otherwise instructed by the Engineer.

.2 Tension testing should be performed in accordance with ASTM E488.

.3 Torque shall be applied with a calibrated torque wrench.

.4 Proof loads shall be applied with a calibrated hydraulic ram. Displacement of adhesive and capsule anchors at proof load shall not exceed D/10, where D is the nominal anchor diameter.

1.7 SYSTEMS

.1 Seismically restrain the following equipment and systems:

.1 Piping:

.1 piping located inside of mechanical equipment and service rooms, NPS 1¼ and larger,

.2 all other piping NPS 2½ and larger.

.2 All ductwork and piping:

.1 ductwork (plenum) with cross sectional area 0.55 m2 (6 ft2) and greater,

.3 Equipment:

.1 vibration isolated equipment,

.2 rigidly or gravity supported equipment.

1.8 DESIGN CRITERIA

.1 Restraint systems as indicated in SMACNA "Seismic Restraint Manual Guidelines for Mechanical Systems", Seismic Hazard Level **SHL C.** If lesser restraint than recommended by SMACNA, for SHL C, is proposed, provide shop drawings of details certified by a B.C. registered structural consultant.

.2 Design seismic restraint systems to conform to the British Columbia Building Code for the project location:

.1 Nelson, British Columbia

.2 Importance Factor: Post Disaster

.3 Site Soil Classification D

.3 For all pipework and duct systems, the vertical uplift force is restrained by the systems as defined in the SMACNA standard.

1.9 SHOP DRAWINGS

.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 Submit shop drawings in accordance with Division 1.

.3 Submit test certificates for each seismic restraint device, identifying maximum tested load capacities.

.4 Submit calculations for each piece of restrained equipment, piping, ductwork and conduit, including seismic forces, restraint selection, and selection data.

.5 Provide a calculation analysis summary (spreadsheet is acceptable) for each piece of equipment, including the following information:

.1 Equipment ID

.2 Floor level
.3 Horizontal seismic force factor
.4 Equipment weight
.5 Horizontal seismic force
.6 Vertical uplift seismic force (where applicable)
.7 Equipment centre of gravity in three directions
.8 Design condition (worst case) overturning moment
.9 Number of restraint fastenings
.10 Pull-out tension per fastener
.11 Horizontal shear per fastener
.12 Pull-out tension load rating per fastener
.13 Horizontal shear rating per fastener.

.6 Include worst case combination of tension and shear loads at each snubber and restraint location.

.7 Include anchor bolt diameters, embedment depth, full welding details including type and length for field welds, and required housekeeping base dimensions.

.8 Calculations to be sealed by a Professional Engineer licensed in the province of British Columbia.

.9 Proposed inserts or connections to structure to follow directions of project structural consultant.

1.10 QUALITY ASSURANCE

.1 Pre-Construction meeting:

.1 Request and arrange a meeting with the Consultant to review seismic restraint approach, prior to any restraint installation. Obtain approval from the Consultant before commencing work.

.2 Testing and Review

.1 Install the first three lateral and three longitudinal braces for each of: each fire protection systems; one (1) building service piping system; and one (1) ductwork system.

.2 request and arrange for a review of the installation by the Consultant. Obtain approval of the installation before commencing remainder of the work.

.3 Provide services of the manufacturer's technical representative to conduct site inspections of the Work in progress, and to conduct a final inspection of the work. Provide a copy of the final inspection report to the Consultant for review.

.4 Request and arrange for a construction review by the Consultant of the completed seismic restraint installation, before any ceilings are installed.

Part 2 Products

2.1 SEISMIC SNUBBER RESTRAINTS

.1 Single-Axis Limit Stop Snubber Assemblies:

.1 steel construction, attached to equipment structure and equipment, maximum of 6 mm¼" seismic movement.

.2 designed to restrict movement in one axis.

.3 minimum 6 mm¼" thick resilient neoprene pads to prevent metal-to-metal impact.

.4 minimum four (4) snubbers for each piece of equipment.

.2 Multi-Axis Limit Stop Snubber Assemblies:

.1 interlocking steel construction, attached to equipment structure and equipment, maximum of 6 mm¼" seismic movement.

.2 designed to restrict movement in two (2) or three (3) axis.

.3 minimum 6 mm¼" thick resilient neoprene pads to prevent metal-to-metal impact.

.4 minimum two (2) snubbers for each piece of equipment.

2.2 SEISMIC VIBRATION ISOLATORS

.1 All Direction Neoprene Isolator:

.1 molded, oil resistant neoprene compound, with encapsulated cast-in-place top steel load plate, and steel base plate with anchor holes designed for seismic loads in all directions with no metal-to-metal contact.

.2 Restrained Spring Isolator – Constant Load:

.1 colour coded seismic-controlled spring isolator, single or multiple spring coils, with minimum 6 mm¼" neoprene pad.

.2 removable coil spring element without having to disturb supported equipment.

.3 lateral stiffness greater than 1.2 times rated vertical stiffness.

.4 minimum 50% overload capacity

.5 non-welded spring elements: epoxy coated, with a minimum 1000 hour rating when tested in accordance with ASTM B-117.

.6 steel housing design to limit lateral and vertical movement of the supported equipment.

.7 neoprene snubber, to limit maximum equipment movement in any direction to 6 mm¼".

.8 adaptor base suitable sized for larger anchors, when required to suit anchorage capacity.

.3 Restrained Spring Isolator – Variable Load:

.1 colour coded seismic-controlled spring isolator, single or multiple spring coils, with minimum 6 mm¼" neoprene pad.

.2 removable coil spring element without having to disturb supported equipment.

.3 lateral stiffness greater than 1.2 times rated vertical stiffness.

.4 minimum 50% overload capacity

.5 non-welded spring elements: epoxy coated, with a minimum 1000 hour rating when tested in accordance with ASTM B-117.

.6 steel housing design to limit lateral and vertical movement of the supported equipment.

.7 top load plate with adjustable and leveling bolts.

.8 adjustable vertical restraints

.9 isolation washers

.10 bottom load plate with internal non-skid isolation pads and anchor holes

.11 hot dipped galvanized for outdoor installations.

.12 neoprene snubber, to limit maximum equipment movement in any direction to 6 mm¼".

.13 adaptor base suitable sized for larger anchors, when required to suit anchorage capacity.

2.3 PIPING AND DUCTWORK RESTRAINT

.1 Cable Restraints for Suspended Piping and Ductwork:

- .1 manufactured system consisting of cable, building attachment, and vertical rod reinforcement assembly,
- .2 field-built assemblies are not acceptable,
- .3 steel wire strand cables:
  - .1 galvanized steel aircraft cable
  - .2 sized for seismic load with a safety factor of 2,
  - .3 arranged for restraint in both longitudinal and transverse directions.
  - .4 Rope connections: overlap wire “U” clips, or, tool-less wedge insert lock connectors.
  - .5 Connector strength rating equal to 90% of cable breaking strength rating.
- .4 Building and equipment attachment brackets: designed to permit free cable movement in all directions up to a 45 degree misalignment:
  - .1 protective thimbles at sharp corners to protect against cable wear,
  - .2 Selected to exceed the cable working design load by 50%,
  - .3 Single sided “C” beam clamps are not acceptable.
- .5 Vertical Suspension Rods:
  - .1 braced to avoid potential for buckling due to vertical up-lift forces,
  - .2 structural steel angle or formed channel brace selected to prevent support rod buckling,
  - .3 brace attached to support rod with a series of adjustable clips, without the use of hand-tools.

.2 steel angles or channels:

- .1 sized for seismic load with a safety factor of 2,
- .2 arranged for restraint in both longitudinal and transverse directions.

.3 Rigidly Mounted Equipment Restraint

- .1 Undercut or Heavy-Duty Sleeve type, for post concrete-cure installation:
  - .1 carbon steel bolt, nut and sleeve,
  - .2 selected for concurrent shear and tension loads with a safety factor not less than 2.0 x estimated load.

Part 3 Execution

3.1 GENERAL

.1 Design seismic restraints to;

- .1 keep equipment in place during and after seismic events in accordance with local building code,
- .2 resist vertical loading simultaneously with transverse or longitudinal seismic loading .

.2 It is the responsibility of the contractor to ascertain that an appropriate size device be selected for each individual piece of equipment.

.3 Give special consideration to design for adjacent connections, insulation treatment, thermal movement, vibration isolation, and relation to building seismic joints.

.4 Building structure attachments;

- .1 concrete construction:

.1 cast in place anchor
.2 drill-in wedge anchor

.2 steel construction:
.1 double sided beam clamp, loaded perpendicular to beam, or
.2 specifically designed welded or bolted connection.

.3 single sided “C” type beam clamps for support rods for piping, ductwork, conduit, bus duct, cable trays or other equipment are unacceptable as seismic restraint anchor points.

.4 Brace installation;
.1 install cable restraints snug,
.2 install solid braces only in rigidly supported situations,
.3 brace hanger rods forming a part of seismic restraint to accept resulting compressive loads,
.4 transverse and longitudinal braces to be no more than 45° above or below centerline of pipe, duct, or tray.

.5 Equipment:
.1 equipment secured rigidly to wall, floor, or housekeeping pad to have resilient neoprene bushings and washers between equipment and anchor bolts.

3.2 SELECTION OF BRACING DETAILS

.1 Select application type;
.1 single hanger or
.2 trapeze support.

.2 Determine required force level, based on weight of equipment and specified factors.

.3 With required force level, develop transverse and longitudinal brace spacing for single or trapeze hanger in accordance with;
.1 break length into separate straight runs, which are considered to be single straight section between any bends except where bend is at an offset of less than 610mm (2 ft),
.2 brace each straight run in transverse direction at both ends. Check required spacing for transverse bracing and compare it to the length of straight run. If length of straight run is greater than allowable distance for transverse bracing add transverse braces until spacing does not exceed allowable transverse brace distance,
.3 each straight run must have at least one longitudinal brace. Add longitudinal braces so that the spacing does not exceed allowable longitudinal brace spacing. Transverse brace may act as longitudinal brace for an adjacent run when it is located within 610mm (2 ft) of adjacent straight run,
.4 where several short runs occur one after other, each straight run requires longitudinal brace when adjacent short runs exceed offset length of 610mm (2 ft). When adjacent short runs do not exceed maximum offset length the longitudinal braces can act as transverse braces as long as allowable transverse brace spacing is not exceeded. Multiple offsets can be treated as single run when the total offset is less than maximum offset length,
.5 when flexible connection or swing joint is used, such as at pipe drop to mechanical equipment, pipe may cantilever at length equal to or less than half allowable transverse brace spacing. When pipe drop cantilever is greater than half allowable transverse brace spacing, support to floor is required.

.4 Select brace anchorage detail.

.5 Calculate hanger rod load and select rod attachment to structure to suit.

.6 Check if rod stiffeners are required to prevent hanger rod from buckling under compressive load.

3.3 INSTALLATION

.1 Install seismic restraint devices in accordance with manufacturer's instructions.

.2 Install snubber devices only after equipment is installed and operating, to ensure no metal-to-metal contact.

.3 Seismic restraint manufacturer to provide training to the installation contractor on installation methods.

.4 Anchors on piping systems used for thermal expansion may be used as both a lateral and longitudinal restraint where they are designed for concurrent thermal and seismic loadings.

.5 Pipe and duct penetrations through floors are acceptable as lateral restraints, provided sleeves and fire stopping materials are installed correctly.

.6 Racked piping systems may have the rack braced (laterally, longitudinally, or combination thereof), provided each pipe supported by the rack is restrained to the rack.

.7 Each lateral or longitudinal brace must be secured to the building structure, and not any other building service.

.8 Pipe and duct penetrations through masonry and poured concrete wall partitions are acceptable as a lateral restraint, provided sleeves and fire stopping materials are installed correctly.

.1 Drywall partitions, including demountable partitions, are not to be used for lateral restraint.

3.4 EQUIPMENT RESTRAINTS

.1 Floor Mounted Vibration Isolated Equipment

.1 Select basic vibration isolator as per Section 23 05 48.

.2 Select seismic restraint for each piece of equipment either:

.1 integrated seismic vibration restraint, or

.2 vibration isolator as per 23 05 48 combined with seismic snubbers.

.3 Do not mix type of restraint on the same piece of equipment.

.2 Suspended Vibration Isolated Equipment

.1 Provide restraint in accordance with the SMACNA guideline and manufacturers' instructions.

.2 Do not mix cable restraints and rigid bar restraints on the same piping or duct system, except:

.1 On piping or ductwork which is suspended on vibration isolators, use cable type SCR restraints and provide a small amount of slack in the cable to prevent vibration short-circuiting.

.3 Select basic vibration isolator as per Section 23 05 48.

.4 Provide cable restraints in longitudinal and lateral directions.

.5 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.

.6 Provide hanger rod reinforcement.

.7 Do not use ductwork or piping restraints to restrain equipment.

.8 Orient restraint wires on ceiling hung equipment at approximately 90 degrees to each other (in plan), and tie back to the ceiling slab at an angle not exceeding 45 degrees to the slab.

.9 On piping systems, provide transverse slack cable restraints at a maximum spacing of 12 m [40 ft] and longitudinal restraints at 24 m [80 ft] maximum spacing, or as limited by anchor/slack cable performance. For pipes greater than NPS10, reduce transverse restraint spacings to 6.0 m [20 ft]. Small pipes may be rigidly tied to big pipes for restraint, but not the reverse.

.10 Transverse bracing for one pipe section may also act as longitudinal bracing for the pipe connected perpendicular to it, provided the bracing is installed within 600 mm [24”] of the elbow or T, and if the connected pipe is the same or smaller in size. Do not use branch lines to restrain main lines.

.11 Provide flexibility in piping joints or sleeves where pipes pass through building seismic or expansion joints.

.12 At vertical pipe risers, wherever possible, support the weight of the riser at a point or points above the centre of gravity of the riser. Provide lateral guides at the top and bottom of the riser, and at intermediate points not to exceed the transverse spacings discussed above for horizontal pipes, with guide clearance not exceeding 3 mm [1/8”].

.13 Vary adjacent spacing of restraints on a piping run by 10% to 30% to avoid coincident resonances.

.14 Install restraints at least 50 mm [2"] clear of all other equipment and services.

.15 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"].

.16 Provide transverse and axial restraints as close as practical to a vertical bend.

.17 At steel trusses, connect to top chords and follow truss manufacturer's instructions.

.3 Rigidly Floor Mounted Equipment

.1 Anchor all floor mounted equipment with anchor bolts, minimum four bolts for rectangular equipment bases, and three bolts for circular equipment bases.

.2 For round equipment, such as expansion tanks with floor-support ring without mounting flanges, use snubbers or custom seismic snubbers.

.3 Provide resilient neoprene bushings and washers between equipment and anchor bolt.

.4 Surface wall-mounted Equipment and Panels

.1 Select bolts for concurrent shear dead-weight without deduction for uplift load, and tension restraint load.

.2 In block-wall;

.1 up to three bolts, each bolt rated for 2.0 times estimated restraint load, or

.2 for four bolts or more, each bolt is rated for 1.0 times estimated concurrent load.

.3 In dry-wall;

.1 minimum of four self-tapping screws drilled into the studs, with each screw rated for 1.0 times estimated restraint load.

.5 Recessed wall-mounted Equipment and Panels

.1 Same as for surface mounted equipment, except fasten through top bottom and sides of panels to adjacent block wall or wall studs.

3.5 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.

3.6 AIR VALVES

.1 Provide seismic restraints in accordance with details in SMACNA Guidelines or alternatively slack cables may be used.

3.7 ISOLATED PIPING AND EQUIPMENT

.1 For post disaster installations, provide vertical rod stiffeners when rod length is greater than 50 rod diameters.

3.8 MANUFACTURER'S SERVICES

.1 Review design drawings and specifications, and shop drawings.

.2 Provide design and selection of seismic restraints, and preparation of shop and installation drawings.

.3 Provide training of contractor personnel for the installation of seismic restraints.

.4 Conduct site inspections of the Work in progress, and to conduct a final inspection of the work. Provide a copy of the final inspection report to the Consultant for review, including photographs of representative installations of each type of restraint used in the 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.

1.2 APPLICABLE CODES AND STANDARDS

.1 Mechanical systems identification, including piping, ducts and equipment, shall be in accordance with:

- .1 CSA B-149.1
- .2 CAN/CGSB 24.3
- .3 ANSI/ASME A13.1
- .4 CSA Z-7396.1

1.3 SHOP DRAWINGS

.1 Submit list of nameplates, with proposed wording, prior to engraving.

.2 Identification Schedules

- .1 Submit schedules of the following for review, prior to framing:
  - .1 Pipe Identification Colours.
  - .2 Valves.
  - .3 Ceiling Access Identification Colours.
  - .4 Duct Access Identification Colours.

Part 2 Products

2.1 GENERAL

.1 Manufactured identification systems:

- .1 laminated vinyl or polyester,
- .2 resistant to chemical, ultraviolet,
- .3 operating temperature: -25C (-12F) to 121C (250F)

2.2 MANUFACTURER'S NAMEPLATES

.1 Each piece of manufactured equipment shall have a metal nameplate, with raised or recessed letters. Mechanically fasten plate to equipment.

.2 Manufacturer's nameplates shall indicate manufacturer's name, equipment model, size, serial number and electrical characteristics and pertinent information for any other services connections.

.3 Include ULC, (Underwriters' Laboratories Canada) or CSA, (Canadian Standards Association) registration logos and those of other agencies, as required by the respective agencies.

.4 Nameplates shall be located so that they are easily read. Do not insulate or paint over nameplates.

2.3 EQUIPMENT IDENTIFICATION NAMEPLATES

.1 Identification plates are in addition to manufacturers plates.

.2 Identification plates:

- .1 provided for equipment identified with number designations in schedules and equipment selection sheets.

.2 marked with equipment ID, service and power source using wording and numbering used in contract documents, e.g. supply fan SF-1, cooling coil CC-1, pump P-1

.3 Apply nameplates securely in conspicuous places, on cool surfaces.

.4 Identify systems, and areas or zones of building being serviced.

.3 Fabrication:

.1 laminated plastic,

.2 black lettering on white background for “Normal” power equipment

.3 white lettering on red background for “Emergency” power equipment

.4 minimum size 90 x 40 x 2.5 mm (3 x 1½ x 1/8 in),

.5 engraved with 10 mm (7/16 in) high lettering.

.6 use 25 mm [1"] high lettering for major equipment.

2.4 PIPING IDENTIFICATION

.1 Piping Identification

.1 Each piping system shall be colour coded for identification and labelled with the system identification code letters, including temperature and pressure, if applicable, and directional flow arrows in accordance with the Pipe Identification Colour Schedule. See diagram for sizes of lettering and bands.

.2 Flexible coil-wrap manufactured markers:

.1 plastic coated markers with integral printing, or plastic cover with field applied self-adhesive markers,

.2 applicable WHIMS pictogram for identification of material hazard.

.3 Self-adhesive manufactured pipe markers, flow arrows and colour bands:

.1 Identification colour bands for primary and secondary colours to indicate the type and degree of hazard

.2 Standard of Acceptance: Brady vinyl cloth tape bands or Brady vinyl tape bands, with adhesive compatible with the surface temperature.

.4 Colour band tape with flow direction arrows,

.1 waterproof and heat resistant plastic marker tags for pipes and tubing 20mm (¾ in) nominal and smaller.

.2 applicable WHIMS pictogram for identification of material hazard.

.5 Stenciled pipe markers:

.1 stenciled letters and numbers: 12 mm (½ in) high lettering on pipes NPS 2 and smaller, and 25mm (1 in) high for pipes NPS 2 ½ and larger, showing pipe service, pipe size and arrows showing direction of flow.

.2 colour bands: 50mm (2 in) wide, using primary and secondary colours conforming to Pipe and Valve Identification Table. Paint to conform to CGSB 1-GP-60M.

.3 direction arrows:

.1 150mm (6 in) long by 50mm (2 in) wide for piping 75mm (3 in) nominal or larger outside diameter including insulation,

.2 100mm (4 in) long by 20mm (¾ in) wide for smaller diameters.

.3 applicable WHIMS pictogram for identification of material hazard

2.5 VALVE IDENTIFICATION

.1 Provide every valve job with a numbered tag showing valve type and size, attached to valve stem or wheel handle with nonferrous chain or S-hook.

.1 Valve identification is not required at the following valves:

.1 Fixture stops,

.2 within sight of equipment or apparatus they control provided there is no branch piping between valve and equipment served.

.2 Tags may be of brass, aluminum, metalphoto, lamicoid or fiberglass, stamped or engraved, of 25 mm [1"] minimum diameter.

.3 Identification information:

.1 indicating service, sequential valve number by service or specific equipment ID for control valves, location identifier, purpose of valve, valve type and size.

.2 valve type designation:

.1 B (ball valve), GT (gate valve), GL (globe valve), CBV (circuit balancing valve), BF (butterfly valve) etc.

.3 valve size:

.1 for valve size, use NPS designation.

.4 Prepare flow diagrams for each system showing pumps, heat transfer equipment, schematic piping and tagged valves.

.5 Provide a tag schedule for each system, designating number, service, function, size, and location of each tagged item and normal operating position of each valve.

.6 Submit two copies of valve tag schedules, encased in clear plastic, bound in vinyl covered, hardbacked 210mm x 297mm (8½ in x 11 in) three ring binders.

.7 All fuel oil valves shall be identified in conformance with CPPI 1990, “Using the CPPI color-symbol to mark equipment and vehicles for product identification”.

2.6 DUCTWORK IDENTIFICATION

.1 Paint stencilled letters 25mm (1 in) high showing;

.1 duct service,

.2 fan number, and

.3 arrows showing direction of flow,

2.7 VALVE IDENTIFICATION

.1 Brass valve tags or plastic lamacoid:

.1 brass with stamped numbers and letters filled with black enamel,

.2 plastic lamacoid with black lettering on a white background,

.3 brass or stainless steel chain or S-hook

Part 3 Execution

3.1 PIPING IDENTIFICATION - GENERAL

.1 Install markers on cleaned and prepared surfaces free of dirt and oil.

.2 Provide manufactured tape markers:

.1 self-adhesive type:

.1 indoor uninsulated piping,

.2 indoor insulated piping with PVC or smooth metal jackets,

.3 Provide stencil markers:

.1 Paint stenciled letters and numbers identification marks showing pipe service, pipe size and showing direction of flow.

.2 Paint flow direction arrows adjacent to each identification mark.

.3 Paint colour bands adjacent to each identification mark.

.4 Locations:

.1 Identify piping (pipe markers and direction arrows) at the following locations:

.1 Adjacent to major valves and where valves are in series at no more than 2 m [6'-6"] intervals.

.2 At least once in each room and at 15 m [50 ft.] maximum spacing in open areas. Exception: gas piping to be identified at 2 m [6'-6"] intervals in ceiling plenums.

.3 maximum every 15 m (50 ft) along length of pipe, except for medical gas, natural gas and fuel oil,

.4 Adjacent to all major changes in direction.

.5 At point of entry and leaving each pipe chase and/or confined space and piping accessible at each access opening.

.6 At the beginning and end points of each run; and, at each piece of equipment in each run.

.7 within 1 m (3 ft) of each side of barriers, floors and walls,

.8 within 1 m (3 ft) of and behind access doors ,

.9 within 1 m (3 ft) of piping termination point..

.5 Provide schedules in each major mechanical room and at least one schedule will be required on each floor having a minor mechanical room. Frame schedules under glass in matching frames and hang where directed.

.1 Include one copy of schedules in each operating and maintenance manual.

3.2 VALVE IDENTIFICATION

.1 Provide valves with a numbered tag showing valve type and size, attached to valve stem or wheel handle with nonferrous chain or S-hook.

.2 Valves to be tagged include:

.1 Valves on <u>all</u> 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 Drain valves and hose bibbs on systems containing glycol.

.5 Control valves.

.3 Valve identification is not required at the following valves:

.1 Fixture stops,

.2 within sight of equipment or apparatus they control provided there is no branch piping between valve and equipment served.

.3 control valve stations, steam trap stations, fixture stops, system drain valves **other** than glycol.

.4 Prepare flow diagrams for each system showing pumps, heat transfer equipment, schematic piping and tagged valves.

.5 Provide a tag schedule for each system, designating number, service, function, size, and location of each tagged item and normal operating position of each valve.

.6 Schedule the valve numbers using a sequential numbering system indicating location, service and normal position (open or closed). Numbers shall be prefixed by the letter "P" or the letter "H" indicating that the valve is on plumbing or heating service.

.7 Submit two copies of valve tag schedules, encased in clear plastic, bound in vinyl covered, hardbacked 210mm x 297mm (8½ in x 11 in) three ring binders.

.8 All fuel oil valves shall be identified in conformance with CPPI 1990, “Using the CPPI color-symbol to mark equipment and vehicles for product identification”.

3.3 DUCTWORK IDENTIFICATION

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

.2 Stencil on all plenum doors, downstream from air filter bank. "Do not open when fan operating".

.3 Identify all ductwork in mechanical equipment rooms to denote system and/or zone served and an air flow direction arrow.

.4 Identify automatic control dampers concealed in ductwork. Identify the "open" and "closed" position of the operator arm on the outside of the duct or duct insulation.

.5 Identify all hazardous exhaust ducts, e.g. fume hood, radioactive exhaust at not greater than 3 metre [10 ft.] and at least once in each partitioned space. Radioisotope exhaust ducts shall be marked with a radiation-warning symbol. See detail MD 01 005 in Section 23 99 50.

.6 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.

3.4 CEILING ACCESS IDENTIFICATION

.1 Secure 6 mm [1/4"] self-adhesive coloured dots, (Brady Quik Dots or Avery Data Dots), to the ceiling, to identify the location of access to equipment concealed above the ceiling according to the following schedule:

	Colour
Concealed equipment and cleaning access	Yellow
Control equipment, including control valves, dampers and sensors	Black
Heating water, Glycol water, DCW, DHW, DWHR isolation valves	Green
Pipe mounted equipment, other than sprinkler equipment	Green

.2 When T-bar ceilings are installed adhere coloured dots to T-bar framing, adjacent to panel to be removed.

3.5 DUCT ACCESS IDENTIFICATION

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

	Colour	**Letters**
Cleaning and service access	black.	C.A
Controls including sensors	black	C
Dampers, (backdraft, balance and control)	black	D

3.6 EQUIPMENT 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 21, 22, 23.

.3 Refer also to the Controls Section.

3.7 IDENTIFICATION SCHEDULES

.1 Submit schedules of the following for review, prior to framing:

.1 Pipe Identification Colours.

.2 Valves.

.3 Ceiling Access Identification Colours.

.4 Duct Access Identification Colours.

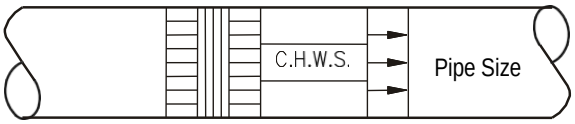
.2 Schedules will be required in each major mechanical room and at least one schedule will be required on each floor having a minor mechanical room. Frame schedules under glass in matching frames and hang where directed.

.1 Include one copy of schedules in each operating and maintenance manual.

3.8 PIPE IDENTIFICATION COLOUR SCHEDULE

Service	Identification Lettering	Primary Colour	Secondary Colour
Domestic H.W. Recirc.	D.H.W.R.	yellow	black
Domestic H.W. Supply	D.H.W.S.	Yellow DOMESTIC HOT WATER	black
Exhaust Piping	-	yellow	black
Glycol Heating Return	GLR - do not drain	yellow	black
Glycol Heating Supply	GLS - do not drain	yellow	black
Hot Water Return	H.W.R.	yellow	black
Hot Water Supply	H.W.S.	yellow	black
Safety Valve Blowdown	-	yellow	black
Sprinkler lines	S.P.R.	red	white
Steam (Humidification)	kPa [psig]	yellow	black

3.9 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: 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 background
  .4 white letters and arrows on 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 Refer to Sections 01 91 13 – Commissioning General Requirements and 23 08 00 – Commissioning of Mechanical for additional responsibilities.

1.2 CODES AND STANDARDS

.1 Procedures shall be in accordance with AABC'S National Standards for Field Measurement and Instrumentation and ASHRAE Standards.

1.3 CONTRACTOR QUALIFICATIONS

.1 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.

.1 The senior site technologist must have a minimum of five years testing and balancing experience of similar projects.

.2 Provide a list of a minimum of ten comparable projects successfully completed by all key members of the balancing team.

1.4 TESTS

.1 Give at least written 48 hour notice of date for tests or longer if possible (due to travel time required to get to site).

.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 Consultant. Arrange for the Owner’s representative to be present.

.4 Bear costs including retesting and making good.

.5 Refer to Piping Sections for specific test requirements.

.6 Refer to Ducting Sections for specific test requirements.

.7 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures.

1.5 TESTING AND BALANCING

.1 General

.1 Employ an approved independent testing and balancing agency to test and balance the following systems.

.1 Heating hot water system;

.2 Antifreeze (glycol) pre-heat system;

.3 Supply air system;

.4 Pharmacy Hazardous Exhaust air system;

.5 Pressure differential monitoring / systems for the compounding Pharmacy systems

.2 The Agency shall be responsible to the Contractor but report jointly to the Consultant and the Contractor. Report in writing to the Consultant any lack of cooperation and any discrepancies or items not installed in accordance with the contract documents.

.3 The balancing agency shall agree to perform spot checks, where requested, in the presence of the Consultant's designated representative.

.4 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 adjust 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.

.5 Consult with the Consultant to clarify the design intent where necessary or in case there are any problems foreseen as the balancing processes.

.6 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.

.7 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. Please note that the Pharmacy clean and ante rooms need to be balanced within the required differential pressures indicated in the NAPRA model standards.

.8 This agency shall remove and re-install ceiling tile to provide access to ductwork and piping. The balancing agency will make good any damage or soiling caused by his forces.

.9 Instrument calibration: At the Consultants 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 Consultant 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 Consultant, 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 99 60 should be used for this purpose. Reports to be signed by the senior member of the balancing team.

.15 Employ the testing and balancing agency to test all fire dampers as follows:

.1 Test all fire dampers (including combination smoke/fire dampers). The test shall be made by releasing the fusible link and witnessing closure of the damper. All fire dampers shall be left in the open position.

.2 A set of prints shall be marked up to show that each damper has checked for closure, accessibility and installation or provide schematic mechanical drawing showing all fire damper locations, label all fire dampers on drawing. The prints shall be certified correct by the agency and submitted to the consultant with completed test certificates.

.16 Prior to demolition, in renovated areas, measure and record supply, return and exhaust airflow into existing areas that are not included in the renovations. After renovations are completed, rebalance existing branches to the conditions as found in the pre-construction measurements. Provide written report indicating all areas that have been pre-measured including Pitot tube traverse sheets.

.17 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.

.18 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 objectionable sounds levels.

.19 Make air quantity measurements in ducts by "Pitot Tube" traverse of entire cross-sectional area of duct. Provide a Pitot tube traverse test sheet for each major duct branch.

.20 Measure air quantities at each air terminal.

.21 Maintain the design relationship between the supply and exhaust air system quantities.

.22 Check to ensure that supply and return air quantities provide reasonable building pressurization. Test building pressurization levels in variable volume systems throughout full range of fan delivery rates, under both heating and cooling conditions. Exit doors and elevator shafts should be checked for air flow so that exterior conditions do not cause excessive or abnormal pressure conditions. Document abnormal building leakage conditions noted.

.23 Adjust the air terminals to obtain the optimum air distribution pattern. The total airflow through each air valve/mixing box should be adjusted and reported by the balancing agency for maximum and minimum flow conditions.

.24 Controllers on air valves/mixing boxes are to be checked by the controls contractor and the commissioning agent and they shall also verify that room thermostats / sensors are cycling valves/mixing boxes properly.

.25 Air systems shall be balanced with clean filters in place, at a total of 105% to 110% of specified total airflow rates.

.26 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.

.27 Balance the rooms to ensure that the air flow into or out of the rooms is in the correct direction. Balance to maintain the required pressures. Report to the Consultant where the desired pressure differential cannot be achieved within 10% of the design values for further direction. This may indicate a problem with how well the rooms are sealed or excessive leakage that needs to be dealt with.

.28 The Balancing Agency shall include for return visits for readjustment of systems after the owner has moved in.

.29 Include in the air balance report:

.1 Date of test, Name and address of building and balancing technician's name.

.2 Range of outdoor air temperature during the balancing period.

.3 System schematics indicating damper positions, design and measured air quantities at each inlet and outlet. Show room numbers and floors.

.4 If installation permits, record both air terminals and fan discharge traverse air volumes to establish system leakage.

.5 Main branch duct traverses. Maximum and minimum outdoor air quantities.

.6 Static pressure across each component in an air handling system at full flow.

.7 Face velocities across major components such as filter or coils.

.8 Static pressure across each fan.

.9 System static pressures at selected points throughout a VAV supply duct system and in main branch ducts in low velocity systems.

.10 Fan and motor speed.

.11 Motor size, starting time, amps and voltage.

.12 Coil air entering and leaving temperatures (D.B. and W.B.).

.13 Maximum and minimum zone supply air temperatures under prevailing conditions at time of test.

.14 Provide fan performance curve for each new air handling system.

.15 Air pressure map (i.e. positive, negative, neutral) and directional airflow for all spaces.

.2 Liquid Systems - Balancing

.1 Set balance valves and balance fittings to provide required or design flow rates for each system component.

.2 Use installed flow measuring devices to determine flow rates for system balance. Where flow measuring devices are not installed, base flow balance on the air and liquid temperature difference across terminal heating/cooling elements and coils, acknowledging the different design temperature drops/rises used in the design of the systems.

.3 Effect system balance with automatic control valves fully open to heat transfer elements.

.4 Trim pump impellors to match pump performance to system characteristics rather than artificially increasing system pressure drops to match pump characteristics. Additional costs incurred in trimming the impellors will be considered as an extra.

.5 Check air vents to ensure that they are correctly installed and are operating properly. The mechanical contractor shall ensure that all air is removed from within the piping system and that there is flow throughout all piping systems before the balancing is started.

.6 Include in the liquid balance report:

.1 Date of test, Name and address of building and balancing technician's name.

.2 Range of outdoor air temperature during the balancing procedure.

.3 Heating Coils: Tag, service & location. Specified and actual capacity, flow, liquid pressure drop, liquid entering and leaving temperatures, air-side entering and leaving temperatures.

.4 Flow measuring devices: Flow rates.

.5 Terminal heating elements: Entering and leaving liquid temperatures.

.6 System schematics: Specified and actual flow rates.

1.6 TYPE II B2 BIOSAFETY CABINENTS - BALANCING

.1 Certifying and balancing of all exhaust Biosafety Cabinets (BSC) systems shall be carried out as follows:

.1 Check room condition in front of the BSC using an anemometer and a smoke source to verify that the velocity of cross drafts does not exceed 20% of the specified average face velocity. Any cross drafts that exceed these values shall be eliminated before proceeding with the BCS tests.

.2 Determine specified average face velocity (required by NAPRA / Manufacturer) by averaging the velocity of at least nine readings taken at the BCS face. Readings shall be taken at the centres of a grid made up of three sections of equal area across the top one third, three across the centre and three across the bottom third of the fume hood face. Use of a thermal anemometer or equivalent is recommended for this test. Adjust exhaust fan as required to achieve specified average face velocities within minus 0% and plus10%.

.3 Smoke tests shall be conducted at BSC face openings. These tests are to be used as an evaluation of spillage or backdraft conditions at all levels and positions across face opening. Small smoke gun is recommended for these tests.

.4 Upon completion of these tests, a report analysis shall be prepared which will list the following final conditions:

.1 Exhaust fan operating characteristics including speed, static pressures, motor amperages and total exhaust flow.

.2 Position of hood sash.

.3 Face velocity readings taken at BSC opening.

.4 Results of smoke test spillage tests.

.5 Operating condition of surrounding area air conditioning or supply air 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 RESPONSIBILITIES

.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.

1.3 CODES AND STANDARDS

.1 Material and method of application to comply with or be tested in accordance with the latest applicable versions of the following Standards;

- .1 B.C. Building Code and local by-laws
- .2 B.C. Insulation Contractors Association (BCICA) Standards Manual
- .3 Thermal Insulation Association of Canada (TIAC) National Insulation Standard, excluding section 12
- .4 ASHRAE/IES 90.1 Energy Standard for Buildings except Low-Rise Residential Buildings
- .5 ANSI/NFPA 90A Air Conditioning and Ventilating Systems and Installation.
- .6 ANSI/NFPA 90B Warm Air Heating and Air Conditioning Systems.
- .7 CGSB 51-GP-10M Thermal Insulation, Mineral Fiber, Block or Board, for Ducting.
- .8 CGSB 51-GP-11M Thermal Insulation, Mineral Fiber, Blanket for Piping, Ducting, Machinery and Boilers.
- .9 ASTM C518 Standard Test Method for Steady State Thermal Transmission Properties by Means of Heat Flo Meter Apparatus
- .10 ASTM C533 Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
- .11 ASTM C534 Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
- .12 CAN/CGSB-51.12 Cement, Thermal Insulating and Finishing.
- .13 CAN/CGSB-51.40 Thermal Insulation, Flexible, Elastomeric, Unicellular, Sheet and Pipe Covering.
- .14 CGSB 51.53-95 Polyvinyl Chloride) Jacket Sheeting, for Insulated Pipes Vessels and Round Ducts.

1.4 REGULATORY AND MATERIAL REQUIREMENTS

.1 Flame spread ratings and smoke developed classifications shall be as required by the B.C. Building Code and NFPA 90A. Generally, the flame spread rating throughout the material shall not exceed 25 and the smoke developed classification shall not exceed 50.

.2 Insulation thickness and insulating values shall be in accordance with ASHRAE 90.1.

.3 Duct linings shall be in accordance with CSA Z317.2-2019

.4 Adhesives shall meet the VOC limits of the South Coast Air Quality Management District Rule #1168

.5 All insulation materials are to be formaldehyde free. Note that listed insulations under products section are to be used for reference only, and they do not necessarily comply with formaldehyde free requirement.

.6 MSDS sheets for VOC content shall be submitted with the adhesive and sealant shop drawings for approval.

1.5 MINIMUM STANDARDS

.1 All ductwork shall be insulated to meet or exceed the minimum requirements of the MNECB. In addition, the requirements of ASHRAE 90.1 are also applicable to this project. The more stringent insulation value (between the two codes) will be the level required for this project.

.2 Refer to the following table taken from MNECB Insulation of Ducts for additional information:

Temperature Difference, (1) °C	Min. Thermal Resistance (RSI) for Ducts and Plenums m^2*^oC/W	Min. Thermal Resistance (RSI) for Run-outs, (2) m^2*^oC/W
< 5	0	0
5 to 22	0.58	0.58
>22	0.88	0.58

Notes:

(1) The temperature difference at design conditions between the space within which the duct is located and the design air temperature of the air carried by the duct. Where duct is used for both heating and cooling purposes the larger temperature difference shall be used.

(2) Ducts not exceeding 3 metres in length connecting to terminal grilles or diffusers.

1.6 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.

1.7 DEFINITIONS

.1 "CONCEALED" means insulated mechanical services in chases, furred spaces, shafts and hung ceilings.

.2 "EXPOSED" will mean not concealed. For greater certainty, the following locations are considered exposed:

.1 Services in all mechanical and electrical rooms.

1.8 ASBESTOS

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

Part 2 Products

2.1 DUCT INSULATION - EXTERNAL

.1 External flexible glass fibre insulation with integral vapour barrier.

.1 Minimum density - 12 kg/cu.m. [0.75 lbs/cu. ft.].

.2 Thermal Conductivity at 24 deg.C. - 0.042 W/m/deg.C.

.3 Flame Spread/Smoke Developed rating throughout the material shall not exceed 25/50.

.4 Standard of Acceptance:

.1 Certainteed SoftTouch Duct Wrap 75

2.2 DUCT INSULATION - INTERNAL

.1 Duct Liner – Flexible (fiber free foam)

.1 Internal, flexible, elastomeric, non-particulating, fiber free, formaldehyde free, low VOC, acoustical insulation with antimicrobial coating

.2 Minimum Noise Reduction Criteria (NRC): 0.6 as per ASTM C423 ‘Type A mounting’.

.3 Thermal Conductivity at 24 deg.C. - 0.036 W/m/deg.C.

.4 Flame Spread/Smoke Developed rating throughout the material shall not exceed 25/50.

.5 Standard of Acceptance:

.1 Armacell AP/Coilflex,

2.3 ACCESSORIES

.1 Lagging Adhesive (Canvas Jackets): Childers’ CP-50A, Epolux’s Cadalag 336, Foster’s 30-36.

.2 Vapor Seal Adhesive (Fibrous Glass Insulation): Childers’ CP-82, Epolux’s Cadoprene 400, Foster’s 85-75 or 85-20.

.3 Vapor Barrier Mastic/Joint Sealer (Fibrous Glass Insulation): Childers’ CP-30, Epolux’s Cadalar 670, Foster’s 95-44 or 30-35.

.4 Adhesive (Flexible Elastomeric Foam): Armstrong’s 520, Childers’ CP-80, Epolux’s Cadoprene 488, Foster’s 82-40.

.5 Adhesive (Reinforcing Membrane): Childers’ Chil-Spray WB CP-56.

.6 Mastic (Reinforcing Membrane): Childers’ AK-CRYL CP-9.

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 unless there is a chance for condensation to occur).

	Thickness	
Service	**Mm**	**[ins]**
All cooling and heating supply ducts; - where the temperature difference between the space within which the duct is located and the design air temperature in the duct, is less than or equal to 22.2°C [40°F]	40	[1.5]
All cooling and heating supply ducts; - where the temperature difference between the space within which the duct is located and the design air temperature in the duct, is greater than 22.2°C [40°F].	50	[2]
Outdoor air ductwork and plenums (from intake to mixing plenum).	50	[2]

	Thickness	
Service	**Mm**	**[ins]**
Exhaust air ductwork outside the building.	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 Duct Liner – Fiber Free

	Thickness	
Service	**mm**	**[ins]**
All exposed supply ductwork in the mechanical room to the outdoors	50	[2]
All outdoor air plenums. Line sheet metal walls and top. – minimum RSI-1.0566 [R-6]. See Note 1	50	[2]

Note1: ASHRAE 90.1 specifies that R values shall match wall or roof insulation values for outdoor ducts and outdoor air plenums. Provide shop drawings to demonstrate compliance.

Part 3 Execution

3.1 APPLICATION

.1 Apply external insulation to ductwork only after all tests have been made and systems accepted by the Consultant as airtight.

.2 Apply insulation and insulation finish in a workmanlike manner so that the finished product is uniform, smooth in finish, pleasing to the eye and with longitudinal seams concealed from view. Apply ductwork insulation materials, accessories and finishes in accordance with manufacturer's recommendations.

.3 Insulation and vapour barrier shall be continuous through all non-rated separations.

3.2 INSULATION TERMINATION

.1 Terminate insulation short of all control, smoke and fire dampers so as not to interfere with their operation.

3.3 INSULATION FOR COOLING COIL HEADERS AND RETURN BENDS

.1 Pack flexible glass fibre insulation around headers and return bends on all cooling coils in built-up air handling units to control condensation.

3.4 EXTERNAL FLEXIBLE INSULATION WITH VAPOUR BARRIER

.1 Adhere insulation with insulation adhesive applied in 150 mm [6"] wide strips on 300 mm [12"] centres.

.2 On rectangular ductwork and plenums, over 610mm [24"] in width, spotweld pins 6mm [1/4"] longer than the insulation thickness, one per square foot of duct minimum. If pins are installed in the field, a capacitor gun shall be used. Impale the insulation over the pins and hold in place using metal or nylon clips (washers). Alternatively, use an assembly consisting of a welded pin with integral head washer welded in place over the insulation. (Clinched pins not acceptable).

.3 Adhere foil faced vapour barrier tape over all butt joints, raw edges, holding washers and other points of penetration of the vapour barrier jacket on all exposed hot and cold ducts and concealed cold ducts.

3.5 INTERNAL FLEXIBLE DUCT LINER APPLICATION

.1 Foam materials, if used as internal insulation, shall only be used in locations where spinning/oscillating cleaning systems will not be used (e.g., terminal units, air intakes, supply plenums (up to AHU), or exhaust plenums.) Such materials shall

.1 be made of **fibre-free**, closed cell foam that is specifically designed for internal lining of air ducts in a Healthcare Environment;

.2 have smooth, cleanable surfaces; and

.3 comply with applicable requirements regarding foam materials.

.2 Spinning or oscillating elements in duct cleaning equipment can damage exposed duct linings. Glass or mineral fibre acoustic insulation, if used as interior duct lining, shall be

.1 isolated from the air stream by a moisture-proof protective film; and

.2 protected from physical damage by a resilient covering (e.g., perforated metal).

.3 Adhere insulation with insulation adhesive applied to the whole of the metal surface, with the coating side of insulation exposed to the airstream.

.4 Ducts 610 mm [24"] in width and less require no further adhesion.

.5 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.

.6 Seal all transverse joints, raw edges, and other points of penetration of the coating with reinforcing membrane and insulation coating/sealer.

.7 Seal all longitudinal joints with insulation coating sealer.

.8 No raw edges of internal insulation material shall be exposed to the moving airstream.

.9 Duct sizes noted on the drawings is dimension inside the insulation. Metal duct sizes shall be increased to allow for the internal acoustic insulation thickness.

.10 Adhere alpha temp cloth over the internal surface of all glass fibre acoustic insulation. Overlap all edges and seal all joints with insulation adhesive/coating/sealer.

3.6 DUCTWORK INSULATION FINISHES

.1 "Concealed" ductwork insulation, in horizontal and vertical service spaces, will require no further finish.

.2 "Exposed" ductwork insulation, in unfinished floor spaces will have no further finish.

.3 "Exposed" ductwork insulation "inside" finished floor spaces, fan rooms, [boiler room], [chiller room], [valve rooms] and [generator room] shall be finished with two coats of white, foil-finishing, insulation coating.

.4 "Exposed" insulated ductwork outside and in the sub-basement plant rooms shall be recovered all around with an aluminum jacketing system. Exterior application shall be a vapour sealed installation. Over the insulation, moisture barrier and then apply 0.53 mm [22 ga] thick stucco embossed aluminum. The moisture barrier shall be continuous. The longitudinal seams of the jacketing shall be located to shed water. Attach with holding straps at 150 mm [6"] on centres. Provide a complete aluminum jacket system using all of the parts, accessories and installation procedures of the manufacturer. Seal all outdoor jacketing watertight with an exterior grade flexible waterproof caulking.

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 RESPONSIBILITIES

.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 enough 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 B.C. Building Code and NFPA 90A. Generally, the flame spread rating and smoke developed classification shall not exceed 25/50.

.2 Insulation thickness and insulating values shall be in accordance with NRC Model National Energy Code of Canada for Buildings (MNECB) and ASHRAE90.1

1.4 APPLICABLE CODES AND STANDARDS

.1 Material and method of application to comply with or be tested in accordance with the latest version of the following Standards;

- .1 B.C. Building Code and local by-laws
- .2 B.C. Insulation Contractors Association (BCICA) Standards Manual
- .3 Thermal Insulation Association of Canada (TIAC) National Insulation Standard, excluding section 12
- .4 ASHRAE/IES 90.1 Energy Standard for Buildings except Low-Rise Residential Buildings
- .5 ANSI/NFPA 90A Air Conditioning and Ventilating Systems and Installation.
- .6 ANSI/NFPA 90B Warm Air Heating and Air Conditioning Systems.
- .7 CGSB 51-GP-10M Thermal Insulation, Mineral Fiber, Block or Board, for Ducting.
- .8 CGSB 51-GP-11M Thermal Insulation, Mineral Fiber, Blanket for Piping, Ducting, Machinery and Boilers.
- .9 ASTM C533 Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
- .10 ASTM C534 Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
- .11 ASTM C552 Standard Specification for Cellular Glass Thermal Insulation
- .12 ASTM C553 Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
- .13 ASTM C612 Standard Specification for Mineral Fiber Block and Board Thermal Insulation
- .14 ASTM C1126 (Gr.1) Standard Specification for Faced and Unfaced Rigid Cellular Phenolic Thermal Insulation

.15 CGSB 51-GP-52MA Vapour Barrier, Jacket and Facing Material for Pipe, Duct, and Equipment Thermal Insulation.

.16 CAN/CGSB-51.2 Thermal Insulation, Calcium Silicate, for Piping, Machinery and Boilers.

.17 CAN/CGSB-51.12 Cement, Thermal Insulating and Finishing.

.18 CAN/CGSB-51.40 Thermal Insulation, Flexible, Elastomeric, Unicellular, Sheet and Pipe Covering.

.19 CGSB 51.53-95 Polyvinyl Chloride) Jacket Sheeting, for Insulated Pipes Vessels and Round Ducts.

1.5 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.

1.6 DEFINITIONS

.1 "CONCEALED" insulated mechanical services in trenches, chases, furred spaces, shafts and hung ceilings (services in tunnels are not considered to be concealed.)

.2 "EXPOSED" will mean not concealed.

1.7 ASBESTOS

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

Part 2 Products

2.1 GENERAL

.1 Flame spread and smoke density of all products shall not exceed 25/50 per ASTM E84 with or without integral jacket.

2.2 PREFORMED PIPE COVERING

.1 Mineral Fibre - Low and Medium Temperature:

.1 With integral vapour barrier jacket and longitudinal lap.

.2 Thermal conductivity at 24^{o}C - 0.033 W/m/deg.C.

.3 Standard of Acceptance:

.1 Manson Alley K, Owens Corning SSL-11, Knauf 850 ASJ/SSL, Johns Manville Micro-Lok AP-T Plus, Owens Corning 1200 ASJ/SSL.

.2 Perlite Insulation - High Temperature:

.1 Without integral jacket.

.2 Thermal Conductivity at 90øC - 0.071W/m/deg.C.

.3 Standard of Acceptance:

.1 Knauf Temperlite 1200.

.3 Mineral Fibre - High Temperature:

.1 With integral vapour barrier jacket and longitudinal lap.

.2 Thermal Conductivity at 93^{o}C - 0.040 W/m/deg.C.

.3 Standard of Acceptance:

.1 Manson Alley Kapt, Johns Manville Micro-Lok AP-T Plus, Owens Corning 1200 ASJ/SSL, Roxul ASJ/SL.

.4 Flexible Foamed Elastomeric:

.1 Thermal Conductivity at 24°C - 0.040 W/m/deg.C.

.2 Standard of Acceptance:

.1 AP Armaflex, Rubatex R-180-FS.

.5 Flexible Closed Cell:

.1 Thermal Conductivity at 24°C - 0.036 W/m/deg.C.

.2 Standard of Acceptance:

.1 Bondtex Polyethylene, Therma-Cel.

.6 Phenolic closed cell – rigid:

.1 With integral vapour barrier jacket and longitudinal lap.

.2 Thermal conductivity @ 24°C - 0.019 W/m/deg.C.

.3 Standard of Acceptance:

.1 Kingspan Koolphenk

2.3 ACCESSORIES

.1 Insulation Fastenings:

.1 1.6 mm [16 ga.] galvanized wire or 1.6 mm thick copper wire as commercially available.

.2 Jacket Fastenings:

.1 Thermocanvas and All Service:

.1 Staples (flare type), compatible jacket finishing tape, contact adhesives recommended by the jacket manufacturer.

.2 Metal Jackets:

.1 Sheet metal screws, pop rivets, bands.

.3 PVC Jacket and Fitting Covers:

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

.3 Adhesives:

.1 Flexible elastomeric and flexible closed cell insulation adhesive:

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

.2 Vapour barrier jacket adhesive:

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

.3 Fabric adhesive, to insulation pipe covering:

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

.4 Coatings:

.1 Vapour barrier coating on reinforcing membrane or on insulating cement:

.1 Bakelite 120-09, Childers CP-50, Epolux Cadalag 336, Foster 30-36.

.2 Childers CP-30 (refrigeration suction lines only).

.2 Flexible elastomeric and flexible closed cell insulation finish coating:

.1 Armstrong, Bakelite 120-13, Rubatex, Zipcoat.

.5 Finish Jackets:

.1 Thermocanvas Jacket:

.1 Fattal's Thermocanvas, Robson Flamex FR Canvas or Tai-Can Canvas.

.2 All Service Jacket (with 0.03 mm [0.0019”] minimum thick foil:

.1 Fattal's Fat-Lock ASJ, Fiberglass ASJ, Knauf ASJ, Kingspan ASJ, Manson APT, Johns Manville AP-T Plus, Owens Corning ASJ, Roxul ASJ.

.3 PVC Finishing Jacket (minimum 0.50 mm [0.02”] thick:

.1 Proto PVC, Speedline PVC, Zeston PVC.

.4 Aluminum Jacket:

.1 0.51 mm [22 ga.] thick corrugated or smooth aluminum jacketing with longitudinal slip joints and 50 mm [2"] end laps with factory applied protective liner on interior surface.

.1 Childers, Alco Thermoclad 1 or other as commercially available.

.6 Reinforcing Membrane:

.1 Glass reinforcing membrane as commercially available.

.7 Insulating Cement:

.1 Fibrex Superkote, Partek No. 1, Ryder Thermokote MW high temperature.

.8 Finishing Cement:

.1 Ryder Thermokote 1 FW.

.9 Flexible Insulation:

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

.10 Preformed Fitting Covers:

.1 Aluminum Fitting Covers:

.1 0.51 mm [22 ga.] thick, die shaped components with factory applied protective liner on interior surface.

.1 Childers Ell-Jacs, Perma-Ells or Shield-Ells or other as commercially available.

.2 PVC Fitting Covers:

.1 0.50 mm [0.020"] thick premoulded one piece covers.

.1 Certainteed Snapform, Childers, Proto PVC, Speedline PVC, Zeston PVC, Fattal PVC.

.11 Preformed Insulation fittings:

.1 Shur-Fit, Moulded Acoustic Products or from insulation fabricators.

2.4 SCOPE OF INSULATION

.1 Heating Pipe, Fittings and Valves:

.1 Insulate the following systems, unless otherwise noted:

.1 Hot water heating supply and return piping;

.2 Steam Humidification piping;

.3 Glycol (Antifreeze) heating supply and return piping and

.4 Any addition piping not listed but required by ASHRAE 90.1 and the BC Building code.

.2 DO NOT insulate the following, unless otherwise noted:

.1 Relief piping.

.2 Drain lines.

.3 Insulate the following valves and fittings if the pipe is insulated:

.1 Elbows, tees, reducers.

.2 Valve bodies on valves and check valves, over NPS 2-1/2".

.3 Flanges.

.4 Strainers.

.4 The following hot pipe fittings that operate at 60° C [140° F] shall be coated with Thermalite –SG as per manufacturer's specifications to prevent skin burns:

.1 Valves, NPS 2-1/2" and smaller.

.2 Valve bonnets.

.3 Unions.

.4 Drip legs.

.5 Steam pressure reducing valves.

.6 Steam traps.

.7 Flexible connections.

.8 Expansion joints.

.9 Check valve covers.

.2 Plumbing pipes, fire suppression pipes, fittings, valves:

.1 Insulate the following systems, unless otherwise noted:

.1 Domestic cold water system including meter body and including traps on handicapped lavatories (where exposed).

.2 Domestic hot water supply and recirculation piping.

.3 Underside of drain bodies, rainwater leaders, storm drainage piping and fittings for the entire system.

.4 All drains, lines, stacks,* fire standpipes and sprinkler mains in unheated areas (insulation shall cover heat tracing cables).

.5 Water valves, flanges, PRV's, strainers, check valves.

.6 Interior irrigation / hose bibb supply piping.

.2 DO NOT insulate the following, unless otherwise noted:

.1 Piping used exclusively for fire protection (unless in unheated spaces).

.2 Soil stacks, vents, etc.,

.3 All special service piping, e.g. gases, compressed air, etc.

.4 Unions.

.5 Flexible connections or expansion joints (unless noted on the drawings).

.6 Check valve covers.

.7 Strainer leg and basket covers.

.8 Flexible fixture connections.

Part 3 Execution

3.1 PIPE INSULATION THICKNESS TABLE - MM [INS]

	NOMINAL PIPE SIZE (NPS)					
Service	**Design Operating Temperature**	**Runouts 2 and less (note 1)**	**1 and less**	**$1^1/_4$ to 2**	**$2^1/_2$ to 4**	**5 and larger**
Chilled Water	5°C [40°F]	25 [1]	25 [1]	25 [1]	25 [1]	25 [1]

Note 1: Runouts to individual terminal units not to exceed 3.7 m [12 ft] in length.

Note 2: All piping forming part of the HVAC system or plumbing domestic hot water or domestic hot water recirculation piping, and located outside the building envelope (including piping located within unheated areas of the building such as underground parking levels) shall be insulated for the level specified in the Table for steam piping at pressures 334 kPa [121 psig] and greater.

3.2 CONNECTIONS TO EXISTING PIPING

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

3.3 APPLICATION

.1 Apply insulation to piping only after all tests have been made and systems accepted by Consultant 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.

3.4 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.

3.5 VERTICAL RISERS

.1 On vertical pipe over 75 mm [3"] provide insulation supports welded or bolted to pipe, directly above lowest pipe fitting. Thereafter, locate on 4.5 m [15 ft.] centres.

3.6 HOT APPLICATION 26C [80F] TO 200C [400F]

.1 Piping:

.1 Install medium temperature pipe insulation with integral jacket to pipe and hold in place by stapling the flap, with spreading staples at 75 mm [3"] centres. Pipe insulation with integral self-sealing jacket will not require additional fastening.

.2 Install strips of vapour barrier jacket over butt joints and secure with spreading staples.

.2 Fittings:

.1 Insulate fittings, to thickness of adjacent pipe insulation, with sections of the pipe insulation mitred to fit tightly, or with preformed insulation fittings (Shur-Fit) or from insulation fabricator.

.3 Valves, Strainers:

.1 Insulate valve bodies and strainers with fitted pipe insulation, or mitred blocks all to thickness of adjacent pipe insulation or insulate with preformed insulation fittings (Shur-Fit) or from insulation fabricator. Drains, blowoff plugs and caps shall be left uncovered.

.4 Flanges and Victaulic Fittings:

.1 Insulate flanges with oversized pipe insulation or mitred blocks to the thickness of the adjacent pipe insulation. Insulation to overlap adjoining insulation at least 75 mm [3"].

3.7 COLD APPLICATION 10C [50F] AND LESS

.1 Piping:

.1 Install low/medium temperature pipe insulation with integral vapour barrier jacket to pipe and hold in place by securing the jacket flap. Seal all flaps with vapour barrier adhesive. Pipe insulation with integral self-sealing vapour barrier jackets will not require additional fastening.

.2 Install strips of vapour barrier jacket over butt joints with vapour barrier adhesive. Over wrap butt strips by 50 percent for insulation O.D. 300 mm [12”] and above apply strips on 250 mm [10”] centres for additional securement.

.2 Fittings:

.1 Insulate fittings to thickness of adjacent pipe insulation with sections of the pipe insulation mitred to fit tightly, or preformed insulation fittings (Shur-Fit), then apply reinforcing membrane embedded barrier coating and apply finish vapour barrier coating.

.2 Alternatively insulate fittings with tightly placed flexible insulation and apply premoulded 25/50 rated PVC fitting covers. Apply vapour-barrier adhesive and tape on all joints and overlaps.

.3 Valves, Strainers:

.1 Insulate valve bodies, bonnets and strainers with fitted pipe insulation, or mitred blocks all to thickness of adjacent pipe insulation, then apply reinforcing membrane embedded in barrier coating. Alternately, insulate with preformed insulation fittings (Shur-Fit) covered with reinforcing membrane, stapled in place and covered with a barrier coating. Drains, blow-off plugs and caps shall be left uncovered.

.4 Unions, Flange and Victaulic Fittings:

.1 Insulate cold unions and flanges with oversized pipe insulation or mitred blocks to the thickness of the adjacent pipe covering, then apply reinforcing membrane embedded in barrier coating and final coating of vapour barrier mastic.

3.8 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.

3.9 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:

.5 PVC Jacket 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.

.6 Canvas Finish:

.1 Over a factory applied integral all-service type jacket on the pipe insulation, apply canvas jacket.

.2 Over insulated fittings apply PVC fitting covers and canvas jacket.

.3 Over insulated valve bodies, valve bonnets, strainers and flanges apply purchased PVC covers or field fabricate from PVC sheeting secured with solvent bonding cement and apply canvas jacket.

.4 Finish fabric with one (1) coat of fabric coating.

.7 Aluminum Finish:

.1 Use in areas subject to traffic or mechanical damage, and all insulation **outdoors**.

.8 "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.

3.10 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.

3.11 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, Apply fire stop compound to prevent transmission of sound and/or passage of fire/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.

1.2 QUALITY ASSURANCE

.1 The commissioning shall be executed in accordance with the intent of:

- .1 ASHRAE Standard 202 - The Commissioning Process for Buildings and Systems.
- .2 ASHRAE/NIBS Guideline 0 - The Commissioning Process
- .3 ASHRAE Guideline 1.1 - HVAC&R Technical Requirements For The Commissioning Process
- .4 ASHRAE Guideline 1.3 - Building Operations and Maintenance Training for The HVAC&R Commissioning Process
- .5 ASHRAE Guideline 1.4 - Procedures for Preparing Facility Systems Manuals
- .6 CSA Z8001-13 Commissioning of health care facilities

.2 An independent firm specializing in building systems commissioning has been retained by the Owner to act as the project Commissioning Authority (CA). This firm will be responsible to manage and administrate the commissioning process on this project.

.3 The list of commissioned equipment and systems is found in Section 01 91 13 Commissioning – General Requirements. Commissioning requires the participation of contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in the same section.

.4 Contractors shall be familiar with all parts of Section 01 91 13 Commissioning – General Requirements, 01 91 15 Commissioning – Training, and the Commissioning Plan issued by the CA and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

1.3 RESPONSIBILITIES

.1 Be responsible for the performance and commissioning of all systems and equipment supplied under the Sections of Division 21, 22, 23 and 25.

.2 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 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

.4 Due to the phased nature of the construction it will be necessary to commission, test, balance and demonstrate each Phase of the work prior to commencing the next Phase of work so that the hospital can relocate their departments and create working space for subsequent Phases of work to proceed.

.5 Please refer to the Architectural Drawings and Specifications for a detailed description of the phases. Please not that some phases (like the Sterile Compounding portion of the work) have critical deadlines that must be met to achieve accreditation and continue operations.

1.4 COMMISSIONING AND DEMONSTRATION

.1 Provide a designated representative to report to the Commissioning Authority, and coordinate the commissioning process specified under this division and those items of other Divisions which interact with work of this Division as outlined herein, including the complete life safety and fire protection system.

.2 The cooperation of all trades is essential for an efficient and planned process. A team comprising the following is recommended:

.1 General Contractor,

.2 Mechanical Contractor's Supervisor,

.3 Mechanical Consultant,

.4 Control Contractor (Twin Rivers) Div. 25

.5 Building Owner's representative;

.6 Division 21, 22 and Trades: especially Controls Contractor & Balancing Agency and Division 26 Electrical.

.3 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.

.4 Each phase is applicable to each major and/or separate system making up the work in Division 21, 22, 23 and 25 plus Division 26 interface as applicable.

.5 Regular meetings shall be held during the commissioning process. Minutes of the meetings shall be issued to all contractors involved, the Consultant and the Owners representative.

.6 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 Consultant and Owner 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 Consultant. 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 Troubleshooting: Where problems become apparent during the commissioning process, work at the identification and resolution of these problems. The basic functions in trouble shooting are:

.1 What - Identification and definition of the problem.

.2 Why - Determination and evaluation of the causes.

.3 When - Determine the time available to resolve the problem.

.4 Involve the Consultant in the review of the problem and proposed resolution.

.5 Co-ordinate remedial action with the appropriate parties.

.6 Evaluate the effectiveness of the remedial action.

.5 Laboratory Tests: If the field tests indicate that equipment supplied to the project does not meet specifications, Pharmacy certification of the potentially deficient equipment may be requested by Interior Health. 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.

.7 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 99 60).

.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 Confirmation of Room Tightness

.1 Refer to Division 1 for additional information

.2 Rooms to be Tested

.1 Pharmacy

.1 Compounding Rooms

.2 Ante Room

.3 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, 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 mixing boxes and 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.M.S. (Building Management System).

.14 Set up and test all alarm protective devices.

.15 Calibration and adjustment of the smoke venting and pressurization systems.

.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 Consultant and Owner's representatives.

.3 PHASE 3 Verification of System Performance

.1 Please note that each new and renovated department are sequentially stages and must be coordinated throughout the whole project, For example the new Hazardous and Non-Hazardous Compounding suites will need to be up close to commissioned prior to moving the existing Biosafety cabinet from the existing space to the new compounding room. There will be a short time frame where the department can operate without the BSC. This will need to be carefully planned and coordinated.

.2 Verification of system performance by the Consultant 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 and smoke 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 mixing boxes and variable volume air valves to thermostats and volume adjustment controls.

.5 Operation of all smoke dampers and all smoke pressurization and removal provisions.

.6 Operability of randomly selected fire dampers.

.7 Noise level from typical mixing boxes and variable volume air valves under extreme operating conditions.

.8 Operation of all equipment and systems, under each mode of operation including:

.1 B.M.S. control features.

.2 Pharmacy Controls

.3 D.X. Heat Pump condensing and evaporating systems.

.4 Air Handling Unit

.5 Hazardous Exhaust Fan

.6 Coils (Pre-Heat, Heating and Re-Heat Coils)

.7 Humidifiers

.8 Biosafety Cabinets – Type II B2

.9 Laminar Airflow Workstations

.3 At the completion of Phase 3, the Contractor shall submit the following to the Consultant:

.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 Fire Commissioner's approval of oil fuel installations.

.4 Record drawings as specified, update to include changes resulting from commissioning.

.5 A statement confirming completion of B.M.S. acceptance test, Division 25 Controls.

.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 Owner upon completion.

.3 Systems operation in the fire mode (pressurization and smoke removal) shall be demonstrated to the Authorities having jurisdiction. Obtain a written statement/certificate of approval.

.4 For additional demonstration and instruction to Operating staff requirements refer to the following clauses and to Division 25 Controls.

.5 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 Operation and maintenance requirements of all air and water systems and equipment under each mode of operation including:

.1 Air Handling Unit Operation including Catastrophic Event Management and failure operation modes.

.2 Automatic controls

.3 Hot water/glycol heating system.

.4 Ambient temperature loops and ground source loops.

.5 Plumbing Systems.

.6 Remote AHU Steam Humidification

.7 Hazardous Exhaust Fan

.8 Re-Heat coils, Pre-heat Coil, Heating coil (associated with AHU)

.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 Owner that the demonstration and instructions have been given satisfactorily.

.6 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 Consultant and Owner which documents any problems that have arisen and correction action required.

.7 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 Consultant and Owner which documents any problems that have arisen, and correction action required.

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 piping.

1.2 REFERENCE STANDARDS

.1 Do all piping system work in accordance with ASME/ANSI B31.9 code and CSA B51.

1.3 REGULATORY REQUIREMENTS

.1 All components, products and fabrication techniques shall be provided in compliance with the Regulations and Requirements of the Province of British Columbia "Power Engineers Boiler and Pressure Vessel Safety Act and Regulations".

.2 Installation of, and repair or alterations to, pressure piping systems shall be performed only by licensed Contractors and licensed Welders, certified for the work being done in accordance with the Regulations and Requirements of the Province of British Columbia "Power Engineers Boiler and Pressure Vessel Safety Act and Regulations".

.3 All field welding to be in accordance with the procedures of CSA-W117.2 and the current edition of ASME/ANSI B31.1 or B31.9 Code.

.4 All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. (Combining products of multiple manufacturers is not permitted.) Grooving tools shall be of the same manufacturer as the grooved components.

.1 The manufacturer shall be ISO 9001 certified.

.2 All coupling, fitting, and valve (body and component) castings shall be date stamped for quality assurance and traceability.

1.4 SYSTEM PRESSURE RATINGS

.1 Pipe Fittings:

.1 Piping systems 860 kPa [125 psig] or less operating pressure - 860 kPa [125 psig] rating.

.2 Piping systems 870 kPa [126 psig] to 1730 kPa [250 psig] operating pressure - 1730 kPa [250 psig] rating.

.2 Valves:

.1 Suitable for maximum system operating temperature and pressure.

1.5 SHOP DRAWINGS

.1 Submit detailed shop drawings of valves in accordance with Section 23 05 00. Shop drawings shall clearly indicate valve make, model, location, type, size and pressure rating and Provincial CRN number.

.2 Grooved joint couplings and fittings shall be shown on drawings and product submittals and shall be specifically identified with the applicable style or series designation.

Part 2 Products

2.1 GENERAL

.1 All products shall be registered with the regulatory authority in accordance with CSA B51.

2.2 PIPE

.1 Steel Pipe:

.1 12mm [1/2”] to 50mm [2”]: ASTM A795.

.2 65mm [2.5”] to 250mm [10”]: Schedule 40 to ASTM A53 Grade B

.3 300mm [12”] and over: 9.5 mm [0.375"] wall thickness to ASTM A53 Grade B.

.4 for the following systems:

.1 Hot water / glycol heating

.2 Relief valve vents

.2 Copper Pipe: to ASTM B88, Type K, or L hard drawn copper tubing.

.1 Type L hard drawn may be used as an alternative to steel piping for the following systems:

.1 Hot water and glycol heating.

.2 Type K, hard drawn:

.1 Air vent overflow where exposed.

.3 Type K, soft drawn:

.1 Air vent overflow where concealed.

2.3 PIPE JOINTS - STEEL PIPING

.1 50mm [2”] and under: screwed fittings, except where otherwise noted, with teflon tape and rectroseal teflon paste or pipe dope.

.2 65mm [2.5”] and over: welding fittings and flanges to CSA W47.1.

.3 Flanges: raised face, steel weld neck, lap or back-welded slip on type. Use flat face for attachment to cast iron valves.

.4 Roll grooved mechanical type pipe couplings

.1 Where compliant with CSA B242, may be used on hot water heating up to 110°C [230°F] working temperature, glycol heating, glycol heat recovery, heat pump, and domestic water systems. Use lubricant supplied by manufacturer and coat gasket.

.1 Standard of Acceptance: Victaulic ‘Vic-Lube’.) Gasket grade "EPDM" gasket for temperature range -34°C [-30°F] to 110°C [230°F].

.2 Gaskets shall be molded and produced by the coupling manufacturer.

.3 Lubricate gaskets in accordance with the manufacturer’s recommendations with lubricant supplied by the coupling manufacturer that is suitable for the gasket elastomer and system media.

.2 Couplings shall consist of two ductile iron housing segments, pressure responsive gasket, and zinc electroplated steel bolts and nuts. Multiple segment type couplings are not permitted.

.1 50mm [2”] to 300mm [12”]:

.1 Rigid Type: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9.

.1 50mm [2”] to 150mm [6”]: ‘Installation-Ready’ Victaulic Style 107, for direct stab installation without field disassembly.

.2 Victaulic Style 07 “Zero Flex”

.2 Flexible Type: For use in locations where vibration attenuation and stress relief are required. Three couplings may be used in lieu of a flexible connector. The couplings shall be placed near the source of the vibration. Victaulic Style 77.

.3 Flange Adapter: Flat face, ductile iron housings with elastomer pressure responsive gasket, for direct connection to ANSI Class

125 or 150 flanged components. Victaulic Style 741.

.2 350mm [14”]” to 600mm [24”]: Victaulic AGS series with lead-in chamfer on housing key and wide width FlushSeal® gasket.

.1 Rigid Type: Housing key shall fill the wedge shaped AGS groove and provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9. Victaulic Style W07.

.2 Flexible Type: Housing key shall fit into the wedge shaped AGS groove and allow for linear and angular pipe movement. Victaulic Style W77.

.3 Flange Adapter: Victaulic Style W741.

.5 Flange Bolts and Nuts, carbon steel: to ANSI B18.2.1 and ANSI B18.2.2.

.6 Flange gaskets:

.1 860 kPa [125 psig] system pressure and under: non-asbestos gaskets for mating surfaces.

.2 Over 860 kPa [125 psig] system pressure: stainless steel spiral wound non-asbestos gaskets.

2.4 PIPE FITTINGS - STEEL PIPE

.1 Pipe fittings, screwed, flanged or welded:

.1 Cast iron pipe flanges: Class 125 to ANSI B16.1.

.2 Cast iron screwed fittings: Class 125 to ANSI B16.3.

.3 Steel pipe flanges and flanged fittings: to ANSI B16.5.

.4 Steel butt-welding fittings: to ANSI B16.9a.

.5 Unions, malleable iron ground joint type: Class 150 to ANSI B16.3.

.2 Fittings for roll grooved piping: Ductile iron to ASTM 536; wrought steel to ASTM A234; or where cast or wrought pattern is not available factory fabricated and tested to ASTM A53.

.1 Fittings shall be of the same manufacturer as the adjoining couplings.

2.5 PIPE JOINTS - COPPER PIPE

.1 All sizes, soldered or brazed as specified in “EXECUTION”.

.2 50mm [2”] to 200mm [8”]: Victaulic Style 606 rigid copper couplings with offsetting angle-pattern bolt pads and flush seal gasket grade "EPDM" gasket for temperature range -34°C [-30°F] to 110°C [230°F] may be used on chilled water, domestic water and condenser water systems.

.1 Manufactured to copper-tube dimensions. (Flaring of tube or fitting ends to accommodate IPS sized couplings is not permitted.)

2.6 PIPE FITTINGS - COPPER PIPE

.1 Cast bronze: to ANSI B16.18.

.2 Wrought copper and bronze: to ANSI B16.22.

.3 Roll grooved (non-flared) fittings by Victaulic “Copper Connection” manufactured to copper tube dimensions.

2.7 FLANGES - COPPER PIPE

.1 Brass or bronze: to ANSI B16.15.

.2 Cast iron: to ANSI B16.4.

.3 Victaulic Style 641 Flange Adapter.

2.8 PIPE JOINTS – STAINLESS STEEL PIPE

.1 12mm [1/2”] to 50mm [2”]: plain end, Type 304/304L

.2 65mm [2.5”] and larger: welded.

2.9 PIPE FITTINGS – STAINLESS STEEL PIPE

.1 Precision, cold drawn, austenitic stainless steel.

2.10 VALVES GENERAL

.1 Wherever possible all valves shall be of one manufacturer.

.1 Grooved valves shall be of the same manufacturer as the adjoining couplings.

.2 Provide valves with manufacturer's name and pressure rating clearly marked on outside of body. All valves must be suitable in all respects for service used.

.3 All valves shall have a Provincial CRN number which is current.

.4 Include lock shield handles where shown or noted.

.5 Provide valves located more than 2100 mm [7 ft] from floor in equipment room areas with chain operated sheaves. Extend chains to 1800 mm [6 ft] above floor and hook to clips arranged to clear walking aisles.

.6 Use non-rising stem valves where there is insufficient clearance for stem to rise.

.7 Where butterfly valves are installed to permit removal of equipment, they shall be of the threaded full lug type or grooved if grooved system is used. They may be of the wafer type if an additional pair of flanges (not those installed to contain the valve) are installed.

2.11 GATE VALVES

.1 50mm [2"] and under: screwed:

.1 Bronze body, rising stem, solid wedge disc, union or screwed bonnet.

.2 Standard of Acceptance:

.1 Class 125 [860 kPa] - Crane 1700, Grinnell 3010, Kitz 24, Nibco T-134, Red-White/Toyo 293

.2 50mm [2"] and under: soldered:

.1 Bronze body, rising stem, solid wedge disc, screwed bonnet.

.2 Standard of Acceptance:

Class 200 W.O.G. [1380 kPa] - Crane 1700S, Grinnell 3080SJ, Kitz 44, Nibco S-134, Red-White/Toyo 299.

2.12 GLOBE VALVES

.1 50mm [2"] and under: screwed:

.1 Bronze body, rising stem, renewable composition or bronze disc, union bonnet.

.2 Standard of Acceptance: Class 125 [860 kPa] - Crane 1703, Grinnell 3240, Kitz 03, Nibco T-235-Y, Red-White/Toyo 220

.2 50mm [2"] and under: soldered:

.1 Bronze body, rising stem, renewable composition or bronze disc, screwed bonnet.

.2 Standard of Acceptance: Class 200 W.O.G. [1380 kPa] - Crane 1703S, Grinnell 3240SJ, Kitz 10, Nibco S-211-YW, Red-White/Toyo 212.

2.13 BALL VALVES

.1 50mm [2"] and under: screwed:

.1 Forged brass body, threaded cap, chrome plated ball, PTFE seats, blow out proof stem.

.2 Ball valves for isolation service shall have a large/full port.

.3 Ball valves for balancing service shall have a reduced port and valve handle shall have a memory stop.

.4 Standard of Acceptance: Class 600 W.O.G. [4140 kPa] - Crane F9202, Grinnell 3700, Kitz 58, Nibco T-585-70, Red-White/Toyo 5044A, Victaulic 722.

.2 50mm [2"] and under: soldered:

.1 Forged brass body, threaded cap, chrome plated ball, PTFE seats.

.2 Ball valves for isolation service shall have a large/full port.

.3 Ball valves for balancing service shall have a reduced port and valve handle shall have a memory stop.

.4 Standard of Acceptance: Class 500 W.O.G. [3450 kPa] - Crane F9222, Grinnell 3700SJ, Kitz 59, Nibco S-585-70, Red-White/Toyo 5049A.

2.14 BALANCE FITTINGS AND PLUG VALVES

.1 32mm [1-1/4”] and under:

.1 Bronze body and bronze trim, rising stem, renewable composition disc, globe type with memory stop, Lockshield, male union connection, angle and straight type.

.2 Standard of Acceptance: Class 100 [690 kPa] - Dahl 13000-M series, Toyo 250 or 251.

.2 40mm [1.5”] and over:

.1 Up to 50mm [2"]: screwed

.2 65mm [2.5”] and over: flanged

.3 Cast iron body, non-lubricated eccentric plug with resilient coating EPT or RS 55, suitable for 121°C [250°F] operating temperature, stainless steel bearings, adjustable memory stop, plug type suitable for wrench adjustment.

.4 Standard of Acceptance:

.1 Class 175 W.O.G. [1210 kPa] - DeZurik 400, Keystone Ballcentric.

2.15 AUTOMATIC FLOW LIMITING VALVES

.1 General: Devices shall automatically limit the rated flow quantity between differential pressure ranges of 14 to 310 kPa [2 to 45 psig].

.2 50mm [2"] and under:

.1 Body shall be forged brass ASTM B283 Class 600 W0G, 163°C [325°F].

.2 Return from coil: (downstream side of Temperature Control Valve); Combination assembly including:

.1 Body fitted with ball shut off valve, hard chrome plated, Teflon Ball Seals and Viton O-Rings.

.2 Flow limiting cartridge shall be accessible non-clogging piston type with ± 5% accuracy.

.3 Two P/T Plugs, union for accepting temperature control valve (by controls contractor).

.3 Return from coil: (upstream side of Temperature Control Valve); Combination assembly including:

.1 Full port union with manual air vent and P/T test plug.

.4 Supply to coil; Combination assembly including:

.1 Ball valve, strainer P/T test plug and blow down drain valve.

.3 65mm [2-1/2”] and larger:

.1 Body shall be epoxy coated ductile iron ASTM A536 2758 kPa [400 psig] 177C [350F].

.2 Flow cartridges 304 SS moving parts in brass housing, 14 to 310 kPa (2 to 45 psig) 1.9 to 144 l/s (30 to 2282 USgpm)

.3 P/T Plugs, thermometer well and drain.

.4 Provide a dual hose temperature/pressure meter kit with flow conversion chart and carrying case.

Standard of Acceptance: Delta, Griswold, Belimo

2.16 CIRCUIT BALANCING VALVES

.1 50mm [2"] and under: copper alloy body, screwed, 'Y' pattern globe.

.2 65mm [2-1/2”] and larger: cast iron body, flanged or grooved, 'Y' pattern globe.

.3 Maximum pressure 1715 kPa [250 psig] and maximum temperature 121°C [250°F].

.4 Calibrated balancing valve with memory, positive shut-off, inlet and outlet pressure measuring connections with integral shut-offs and drains.

.5 Calibration charts and adjustment tools to be included.

.6 Provide one (1) differential pressure meter kit suitable for direct readout c/w connection hoses suitable for the system pressure.

.7 Standard of Acceptance:

.1 Victaulic/Tour & Andersson: STAD (to 50mm [2”]) or STAF/STAG (65mm [2-1/2”] and larger), Nexus, Armstrong

2.17 SWING CHECK VALVES

.1 50mm [2"] and under: screwed:

.1 Bronze body, bronze swing disc, screw in cap, regrindable seat.

.2 Standard of Acceptance:

.1 Class 125 [860 kPa] - Crane 1707, Grinnell 3300, Kitz 22, Nibco T-413-B, Red-White/Toyo 236

.2 50mm [2"] and under: soldered:

.1 Bronze body, bronze swing disc, screw in cap, regrindable.

.2 Standard of Acceptance:

.1 Class 200 W.O.G. [1380 kPa] - Crane 1707S, Grinnell 3300SJ, Kitz 23, Nibco S-413-B, Red-White/Toyo 237.

2.18 SILENT CHECK VALVES (SPRING TYPE)

.1 50mm [2"] and under: screwed:

.1 Bronze body, bronze trim, stainless steel spring, (heavy duty spring in vertical down flow application)

.2 Standard of Acceptance:

.1 Class 125 [860 kPa] – Conbraco 61-500, Durabla, Grinnell 3600, Mueller 303AP

2.19 COMBINATION BALANCE/CHECK VALVES

.1 Integrated shut off, non-slam check valve and balance valve.

.2 Suitable for 2065 kPa [300 psig] and 110°C [230°F].

.3 Cast iron body, stainless steel trim, bronze seat and disc.

.4 Connections:

.1 50mm [2"] and under: screwed.

.5 Select for system flow rate, and allowable pressure drop at a velocity not exceeding 1.8 m/s (6 fps).

.6 Standard of Acceptance:

.1 Armstrong Flo Trex, Bell & Gossett Triple Duty, Taco Multi-purpose, Victaulic triple service valves.

2.20 NEEDLE VALVES

.1 Bronze body, screwed, globe type with cadmium plated steel stem.

.2 Standard of Acceptance:

.1 Class 400 [2760 kPa] - Crane 88/89, RP&C 60-100.

.3 Application: Install needle valves where petcocks or manual vents are indicated.

2.21 DRAIN VALVES

.1 Globe type, bronze body with bronze trim and composition disc.

.1 Standard of Acceptance:

.1 Crane 1703, Dahl 2343, Kitz 03, Nibco T-235-Y, Red-White/Toyo 220

.2 Brass ball valve with forged brass cap and chain, 20mm [3/4”] male threaded hose end, lockshield in public areas. Working pressure 1724 kPa [250 psig] to 121°C [250°F].

.1 Standard of Acceptance:

.1 Crane F9202CC, DAHL #50-430 [50.430LS], Kitz 68AC, Red-White / Toyo 5046.

Part 3 Execution

3.1 PIPING

.1 Ream pipe ends. Clean scale and dirt, inside and outside before and after assembly. Remove welding slag or other foreign material from piping.

.2 During construction, protect all openings in piping and equipment, by capping or plugging to prevent entry of dirt.

.3 Screw, or weld, fittings (unless otherwise specified) for all piping systems up to 50mm [2”].

.4 Weld or Victaulic groove (unless otherwise specified) all piping systems 65mm [2.5”] and over.

.5 Ammonia systems - weld all sizes 40mm [1.5”] and larger.

.6 Install piping to conserve headroom and space. Run exposed piping parallel to walls. Group piping wherever practical.

.7 Avoid piping in exterior walls unless otherwise directed. If required, install this piping protected from the outside by the building insulation and vapour barrier.

.8 Maintain a minimum of 25 mm [1"] space between adjacent flanges or pipe insulation, whichever has the larger diameter.

.9 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.

.10 Saddle type branch fittings may be used on mains, if branch line is half size or smaller than main. Hole saw or drill and ream main to maintain full inside diameter of branch line prior to welding saddle.

.1 Victaulic Style 920/920N Mechanical Tee fittings may be used in applicable sizes in lieu of saddle-branch fittings. (Victaulic Style 622 may be used on hard copper tubing.) Use a Victaulic ‘HCT’ series tool for pipe preparation.

.11 Use long radius elbows. Victaulic #10 or W10 standard radius elbows may be used in lieu

of long radius elbows in grooved piping systems in equipment rooms and where space considerations must be made.

.12 Install all thermometer wells and immersion sensor wells specified under the Controls Section. Where wells will restrict flow in small diameter pipes (40mm [1.5”] and smaller) install a section of oversized pipe at least 50mm [2”].

.13 Remake leaking joints using new materials, do not caulk or cement leaking threaded joints.

.14 Use eccentric reducers at pipe size changes, flush on top side, to permit positive venting and drainage.

.15 Do not use thread protection couplings, close nipples, running nipples or street elbows.

.16 Install dielectric type unions or flanges or Victaulic Style 47 Clearflow Dielectric Waterways on "OPEN" type systems, where copper piping connects to steel. eg. domestic hot water tanks.

.17 Avoid locating water and drain piping over electrical equipment. Where this is unavoidable, provide galvanized drip pans under such pipe and weld piping and fittings. Provide drain and piping from drip pans to satisfactory floor drain.

.18 Bull head tees shall not be used for converging flows.

3.2 PIPE GRADING

.1 Grade all piping to provide positive drainage and venting. Slope as follows:

.1 Supply mains and branches - up in the direction of flow, minimum 1:480 [1" in 40 ft].

.2 Return mains and branches - down in the direction of flow, minimum 1:480 [1" in 40 ft].

.3 Reverse return supply and return mains - up in the direction of flow, minimum 1:480 [1" in 40 ft.].

.4 Grade horizontal drainage and vent piping down in direction of flow, 2% minimum.

.5 On closed system, equip low points with 20 mm [3/4”] drain valves. Provide, at high points on lines and on equipment connections, collecting chambers and high capacity float operated air vents.

3.3 SOLDERING AND BRAZING

.1 Pressure fluid systems - with chemical treatment (heating, chilled and condenser water) BRAZE with silver base brazing alloy, 538°C [1000°F] melting point.

.2 Pressure fluid systems - without chemical treatment, (heat recovery, domestic water) SOLDER with 95/5 tin-antimony.

.3 Non-pressure systems, (drains) SOLDER with 50/50 tin lead.

.4 Piping connections to radiant ceiling panels, SOLDER with 95/5 tin-antimony.

3.4 GROOVED JOINT PIPING

.1 Grooved joints shall be installed in accordance with the manufacturer’s latest published installation instructions.

.2 Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.

.3 Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer.

.4 The grooved coupling manufacturer’s factory trained representative shall provide on-site training for contractor’s field personnel in the use of grooving tools and installation of grooved joint products.

.1 The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).)

3.5 CONNECTIONS TO EQUIPMENT AND TO EXISTING PIPING

.1 Install unions, grooved couplings, or flanges at connections to all equipment and specialty components and at all connecting points to existing systems which, for reasons of separation for testing, will require to be blank flanged or capped.

.2 Install removable sections of pipe or 300 mm [12"] spool pieces on the suction side of end suction pumps and where required for ease of maintenance.

.3 Connect to equipment in accordance with manufacturer's instruction unless otherwise noted.

.4 Arrange piping connections to allow ease of access and for removal of equipment.

.5 Align and independently support piping connections adjacent to equipment to prevent piping stresses being transferred.

.6 Do not reduce equipment connection sizes by bushing.

.7 Branch connections to existing steel piping may be made using double strap service saddles - Smith Blair #313 or Dresser #91.

.8 Connections to existing copper piping systems may be made using Victaulic Series 606 or mechanical type couplings (flair or union types) provided they are compatible with the existing system's operating and test pressures and temperatures.

.9 Where shut down of a service is not possible, a hot-tap process shall be used for the tie-in connection of the services. The hot-tap welding in-place requires special equipment and the services of a journeyman welder with applicable experience.

.10 When connecting to an existing antifreeze system, the antifreeze solution shall be drained into temporary storage tanks. Do not drain into sanitary / storm system.

3.6 DRAIN CONNECTIONS

.1 Pipe the discharge from all liquid relief valves, liquid safety valves, high capacity air vents, steam drip pan elbows, equipment blowdowns, water columns, overflows and piping system drains to the nearest building drain. Install a brass, bronze or copper receiving funnel on the drain where shown.

.2 Drains from drain pans shall be DWV copper ASTM B306 32 mm [1-1/4"] minimum size.

.3 Drain and vent piping shall be of the same material as the piping system to which it is connected, except where otherwise specified.

.4 Where item being drained is under pressure, provide a deep seal trap.

3.7 EXPANSION OF PIPING

.1 Install all piping systems with due regard and provision for expansion avoiding strain or damage to equipment and building. Pay particular attention to piping running horizontal across building expansion joints and provide adequate expansion and contraction for all such piping.

.2 Only major expansion configuration and fittings have been shown on the drawings. Provide all required additional compensators, loops and swing connections.

.3 Provide anchors, where shown. Anchors shall be fabricated from mild steel plate and structural steel angle and channel sections, in accordance with ANSI B.31.

.4 Expansion loops shall be of all welded construction with long radius elbows.

.5 Install expansion loops, cold sprung 50% of the calculated expansion.

.6 Install at least three [3] elbows in all branch connections. Where space does not permit 3

elbows, install braided flexible pipe connectors in accordance with manufacturers recommendations. Three [3] elbow branch connections shall have sufficient developed length to ensure that excessive stresses are not generated in the piping and in no case less than 900 mm [36"].

.7 For water systems, use adequate numbers of Victaulic Style 77 flexible couplings in header piping to accommodate thermal growth and contraction, and for the elimination of expansion loops. (In accordance with Victaulic instructions and as approved by the engineer.) Where expansion loops are required, use Victaulic Style 77 couplings on the loops.

3.8 VALVES

.1 Install valves with stems upright or angled 45 degrees above horizontal unless approved otherwise.

.2 Install control valves with their stems upright unless approved otherwise and with adequate clearance for removal of actuators.

.3 Use gate valves or (ball valves for 50mm [2”] and under) to shut off branch takeoffs and to isolate equipment.

.4 Butterfly valves may be used as an alternative to gate valves on chilled water, condenser water, hot water heating, heat pump and glycol heat recovery systems.

.5 Use globe valves to control flow in circuits; except, where balancing cocks are specifically specified.

.6 Use plug type globe valves in control valve bypass connections.

.7 Use plug cocks for balance valves in water return branch mains and branch connections to return mains and for shut off and balancing on glycol circuits.

.8 Install balance fittings or valves in the return piping connections to each terminal heating and cooling unit - eg. radiators, unit heaters, fan coil units, heating and cooling coils.

.9 Install radiator valves in the supply connections to each convection heating element.

.10 Provide isolation valves in all systems such that floor by floor for horizontal systems, all risers in a vertical system and zone areas on a large horizontal system can be isolated.

.11 Provide valves upstream of all meters, gauges, automatic air vents, etc. for isolation purposes.

.12 Use swing or spring loaded check valves, in horizontal and vertical upflow pipes and on the discharge of pumps. Spring loaded water check valves shall be located 8 pipe diameters downstream of pumps or elbows.

.13 Use silent check valves where specifically shown in vertical pipes with downward flow.

3.9 DRAIN VALVES

.1 Install drain valves at each low point in the piping system and at specific drain locations shown on the drawings.

.2 Install 20mm [3/4”] drain valves at all downfed terminal heating and/or cooling units.

.3 Install 40mm [1.5”] or 20mm [3/4”] on line sizes less than 40mm [1.5”] drain valves at all low points in the piping systems to facilitate draining.

.4 Install a hose end adaptor on the discharge side of each drain valve, or pipe to drain where indicated.

.5 Use a 40mm [1.5”] hose and connect it to the discharge side of the drain valves, to flush the piping system during the pipe cleaning process.

.6 Install brass caps with restraining chains, on hose end adaptors, in public areas.

3.10 PIPING TESTS

.1 Notify the Consultant and the Inspection Authority having jurisdiction, 48 hours in

advance of intended test dates.

.2 Before testing piping, isolate all equipment, which cannot withstand the test pressure.

.3 Do not insulate, backfill or conceal until tests have been completed and approved by the inspection authorities.

.4 Examine all systems under test for leaks.

.5 Joints shall remain dry during the test. A general sweating around a weld shall be reason for rejection.

.6 Remake all leaking connections and joints.

.7 Tests shall be limited to new piping only.

.8 New connections to existing piping shall be warranted.

.9 Initial Hydrostatic test:

.1 150% of working pressure, but not less than 860 kPa [125 psig] for 1 working day.

.10 Final Hydrostatic test:

.1 150% of working pressure, after piping connections to all equipment are complete, maintain until all parts of piping systems have been inspected.

3.11 FLUSHING AND CLEANING

.1 Flushing and cleaning shall commence only after all piping tests have been completed.

.2 Install temporary bypass connections around all heat pump units before commencing chemical cleaning.

.3 Chemically clean the following piping systems as recommended by an approved professional chemical cleaning and treatment agency who shall supervise the work:

.1 Heating hot water system(s).

.2 Glycol heating system(s).

.4 Flush out all traces of chemicals with clean water after chemical cleaning is complete.

.5 Install final connections to heat pump units after flushing is complete.

.6 Remove, clean and reinstall all strainer baskets.

.7 Submit a report signed by a principal of the Agency, which certifies that the cleaning has been satisfactorily completed.

3.12 CHEMICAL TREATMENT

.1 Chemically treat water systems in accordance with Section 23 25 00.

3.13 TESTING AND BALANCING

.1 Balance all piping systems in accordance with the requirements of Section 23 05 93.

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 REFERENCE STANDARDS

.1 The provision of all specialty components shall be in accordance with ANSI/ASME B31 Codes for Building Services Piping.

1.3 REGULATORY REQUIREMENTS

.1 All water specialty components shall be provided in compliance with the Regulations and Requirements of the Province of British Columbia "Power Engineers Boiler and Pressure Vessel Safety Act and Regulations".

1.4 SYSTEM PRESSURE RATINGS

.1 Piping systems 860 kPa [125 psig] or less operating pressure - 860 kPa [125 psig] rating.

Part 2 Products

2.1 AIR VENTS AUTOMATIC - HIGH CAPACITY TYPE

.1 Non-Serviceable Type

- .1 Casing and internal parts suitable for system operating pressure and temperature.
- .2 All metal construction with outlet threaded to accept vent tubing connection.
- .3 Automatic float type.
- .4 Shrader type venting valve.
- .5 Standard of Acceptance:
  - .1 345 kPa [50 psig] maximum operating pressure -Armstrong 11-AV, Dole 75, Maid-O-Mist 7, Taco 423, Watson McDaniel AE1800.
  - .2 517 kPa [75 psig] maximum operating pressure -Armstrong 11-AV, Dole 75, Maid-O-Mist 7, Taco 426, Watson McDaniel AE1800.

2.2 AIR VENTS MANUAL - HIGH CAPACITY

.1 Globe Type

- .1 Bronze body, union bonnet, screwed, 450 brinell hardened stainless steel trim and plug type disc.

.2 Standard of Acceptance:

- .1 Class 125 [860 kPa] - Crane 14-1/2 LP, Jenkins 2032, Kitz 17S, Red-White/Toyo 214

2.3 AIR VENTS MANUAL - RADIATOR TYPE

.1 Needle Type

- .1 Bronze or steel body, screwed, needle valve.
- .2 Manual key operator.
- .3 860 kPa [125 psig] maximum operating pressure and 121°C [250°F] maximum operating temperature.
- .4 Standard of Acceptance:
  - .1 Maid-O-Mist 816.

.2 Hydroscopic Type

.1 Bronze or steel body, screwed, hydroscopic discs.

.2 Manual screwdriver or key operator.

.3 Standard of Acceptance:

.1 345 kPa [50 psig] maximum operating pressure - Dunham Bush V19B, Maid-O-Mist 72, Taco 417.

.2 517 kPa [75 psig] maximum operating pressure -Maid-O-Mist 72, Taco 417.

2.4 FLEXIBLE HOSE ASSEMBLIES

.1 Scope: For connecting to air valve reheat coils, fan coil units etc.

.2 EPDM rubber inner core, stainless steel exterior braid, steel crimp ferrules and brass or bichromate steel threaded ends.

.3 End connections are male solid NPT one end and male swivel NPT on the other end.

.4 Suitable for hot water applications up to 110 ° C [230° F].

Standard of Acceptance: Unisource Manufacturing Inc. H-P Flex.

2.5 STRAINERS

.1 NPS 2 and under: bronze body, screwed connections.

.2 NPS 2-1/2 and over: cast iron body, flanged connections.

.3 NPS 2 and over: Y or T type strainer with grooved ends with ductile iron body (to NPS 12) or factory-fabricated steel body (NPS 14 to 24).

.4 Suitable for maximum system operating pressure.

.5 Basket Screen:

.1 Stainless steel perforated screen.

.2 35 holes/cm^2, 1.2 mm dia. perforations, 36% open area.

.3 21 holes/cm^2, 1.6 mm dia. perforations, 41% open area.

.4 5 holes/cm^2, 3.2 mm dia. perforations, 40% open area.

.5 2.5 holes/ cm^2, 5.2 mm dia. perforations, 57% open area.

.6 Standard of Acceptance:

.1 Victaulic Series 732 (Y-type) or W730 (T-type) for all grooved end strainers; or Spirax/Sarco (flanged), Muleller 315M or 758, Kitz 15 or 80, Red-White/Toyo 380 0r 318A.

Part 3 Execution

3.1 AIR VENTS - AUTOMATIC - HIGH CAPACITY TYPE

.1 Install automatic high capacity air vents at each high point in the new piping systems

.2 Install on tees and not on horizontal pipe runs or elbows.

.3 Install a 12 mm [1/2"] minimum isolating gate valve ahead of each air vent, unless the air vent has an integral shut-off valve.

.4 Fit all vents on top of an air-collecting chamber.

.5 Pipe all air vent discharge connections, (except for glycol) separately, to the nearest building drain, using 6 mm [1/4"] hard drawn copper tube. Label ends with permanent labels.

.6 Pipe all air vent discharge connections, (except for glycol) separately, to a water-tight solder jointed, 1.2 mm [16 ga.] copper drain pan, using 6 mm [1/4"] hard drawn copper tube where exposed and soft copper where concealed. Label ends with permanent labels.

.7 Pipe all air vent discharge connections from the glycol circuit, separately back to the glycol mixing tank, using 6 mm [1/4"] hard drawn copper tube.

3.2 AIR VENTS MANUAL RADIATOR TYPE

.1 Install manual/automatic low capacity air vents on the return side of each water heating terminal element installed above the connection mains piping.

.2 Fit air vent on top of an air collecting chamber of 20mm [3/4”] pipe, 150 mm [6"] high.

.3 Arrange air vents so that screwdriver slots or key openings are easily accessible.

.4 Drill access holes through radiation enclosures, where necessary.

.5 Do not use this style of air vent for glycol systems.

3.3 COMBINATION BALANCE/CHECK VALVES

.1 Install combination stop/balance/check valves and valve assemblies on the discharge of centrifugal pumps where shown on the drawings and/or where scheduled.

.2 Install in accordance with the manufacturer's recommendations.

.3 Minimum 5 pipe diameters from pump connections.

3.4 FLEXIBLE PIPE CONNECTORS

.1 Install convoluted and arched pipe connectors, for misalignment connections, where shown on the drawings.

.2 Install in accordance with manufacturer's recommendations.

.3 Three Victaulic Style 77 couplings may be used in lieu of a flexible connector for vibration attenuation and stress relief. The couplings shall be placed in close proximity to the source of the vibration.

3.5 FLOW CONTROL VALVES - AUTOMATIC

.1 Install automatic flow control valves where shown on the drawings in accordance with the manufacturer's instructions.

.2 Hand over temperature/pressure meter kit and calibration charts to the Owner's representative, at substantial performance and obtain receipt.

3.6 CIRCUIT BALANCING VALVES

.1 Install flow measuring balancing valves where shown on the drawings in accordance with the manufacturer's instructions.

.2 Hand over differential pressure meter kit and calibration charts to the Owner's representative, at substantial performance and obtain receipt.

3.7 STRAINERS

.1 Install pipe line strainers where shown on the drawings.

.2 Provide isolation valves on either side of the strainer to permit cleaning without draining the system.

.3 Blowdown connections:

.1 Strainers, 50mm [2”] and under - hot services: nipple and cap.

.2 Strainers, 65mm [2.5”] and over - hot services: nipple, globe valve and nipple.

.3 Strainers, all sizes - cold services: plug.

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.

.7 Ductwork used on this project shall be clean and free from scale, corrosion and deposits. All ductwork shall be degreased and wiped clean of all oil and other surface films with appropriate solvents prior to installation.

.8 All ductwork shall be delivered clean to the site and maintained in clean condition. Dirty ductwork shall be removed from site.

.9 Where welded ductwork is indicated, the welding shall be continuous with Everdur welding. Tack welding is unacceptable except as specifically noted. Paint damaged areas with zinc coating after welding.

.10 Provide seismic restraints for ductwork in accordance with SMACNA "Guidelines for seismic restraints of mechanical systems and plumbing piping systems".

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 LINING OF HVAC ELEMENTS

.1 Per CSA Z317.2: Section 6.9.5.2 “Foam materials, if used as internal insulation, shall only be used in locations where spinning/oscillating cleaning systems will not be used (e.g., terminal units, air intakes, supply plenums (up to AHU), or exhaust plenums.) Such materials shall

.1 Be made of fibre-free, closed cell foam that is specifically designed for internal lining of air ducts;

.2 Have smooth, cleanable surfaces; and

.3 Comply with applicable requirements regarding foam materials.”

2.3 DUCTWORK AND PLENUM PRESSURES

.1 Provide ductwork and plenums fabricated from galvanized steel for the static pressure categories listed below.

.1 1000 Pa [4" W.G.] static pressure.

.1 All supply air ductwork downstream from supply air handling units discharge, to the upstream side of mixing boxes/air valves.

.2 All exhaust ductwork downstream from exhaust air valves to the return/exhaust fans and downstream from the exhaust fans to the air handling units and/or outdoor relief.

.3 All outdoor intake plenums in mechanical room(s).

.2 500 Pa [2" W.G.] static pressure

.1 All supply ductwork downstream from air valves to terminal air outlets.

.2 All supply ductwork and plenums on systems without air valves.

.3 All exhaust ductwork and plenums, except where otherwise specified

.4 All outdoor air ductwork and plenums, except as otherwise specified.

2.4 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. Adjustable elbows are not permitted.

2.5 DUCTWORK - 750 PA [3"] AND GREATER STATIC PRESSURE

.1 Provide galvanized iron ductwork for system operating pressure over 500 Pa [2" W.G.]. 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 1-6 through 1-13 and Figs. 1-2 through 1-18 of the SMACNA Duct Standards.

.3 Nomasco "Ductmate System", Exanno "Nexus System" or "Lockformer TDC, TDF system", may be used for rectangular duct joints.

.4 Construct rectangular duct fittings in accordance with Section II including Figs. 2-1 through 2-11 of the SMACNA Duct Standards.

.5 Construct round ductwork in accordance with Section III including Table 3-2 and Figs. 3-1 and 3-2 of the SMACNA Duct Standards.

.6 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 duct. Flat oval duct to be used for positive pressure application only.

.7 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 1.5 times duct diameter. Construct 90 deg. elbows of not less than 5 tapered sections. All seams and joints in round or oval duct fittings and elbows shall be spot welded lap seams at not more than 50mm [2"] spacing and all inside seams sealed with approved duct sealant. If the zinc coating is burned off the steel during welding, the joints shall be painted to prevent corrosion. Sheet metal gauges of fittings and elbows shall be not less than the thickness of that specified for longitudinal seam straight duct but suitably thick for welding methods used.

2.6 PLENUMS - 500 PA [2"] STATIC PRESSURE

.1 Provide galvanized steel low pressure plenums suitable for 500 Pa [2" W.G.] positive or negative pressure, for central plant ventilating and air conditioning equipment.

.2 Construct plenums in accordance with Section VI including Figs. 6-1 through 6-3 of the SMACNA Duct Standards.

.3 Where the building structure does not form the bottom surface of a walk-in plenum, fabricate plenum floor panels of 1.78 mm (14 ga.] galvanized steel, with angle iron reinforcing such as to limit deflection of the floor panels to a maximum of 6.4 mm [1/4"] under a concentrated load of 115 kg [250 lbs] at mid span.

.4 Where plenum floors are internally lined, install a 1.47 mm [16 ga.] thick galvanized steel panel on top of the insulation.

.5 Apply silicone sealant CGE Silpruf 2000 series or Dow Corning 781/732 between plenum base angles and concrete or curbs before bolting together.

.6 Reinforce all openings in plenum walls with 40 mm x 40 mm x 4.8 mm [1-1/2" x 1-1/2" x 3/16"] angle iron, secured to the main vertical and horizontal reinforcing angles.

.7 Construct access door and casing around door as per SMACNA, casing access doors, Fig. 6-12. Section C-C with angle iron frame sized to suit plenum wall. Doors constructed of 16-gauge metal.

.8 Arrange access doors so that they open against the airflow and static pressure.

.9 Weld all joints on condensate drain pans. Construct the pans from 1.45 mm [16 ga.] thick stainless-steel type #302 or #304. Install a minimum of 32 mm [1-1/4"] piping connection, complete with water seal at least 100 mm [4"] deep, from the pan drain connection to the nearest building drain. Install drain connections so that they shall completely drain the pans.

.10 Seal piping penetrations through plenum walls, with gland seals as detailed in Fig. 6-10 of the SMACNA Duct Standards.

.11 Bulkheads mounting air filters and air coils shall be airtight to prevent air bypass around filters and/or coils.

2.7 DUCTWORK AND PLENUM SEALERS

.1 Provide duct sealing compounds for use in fabrication of all ductwork and plenum joints.

.2 All ductwork shall be sealed to SMACNA Seal Classification A.

.3 For further details refer to Section 23 33 00, Duct Accessories.

2.8 STAINELESS STEEL DUCTWORK - GENERAL

.1 All exhaust ductwork in this project is to be stainless steel unless otherwise noted.

.2 CSA Z317.2 Section 6.13 requires stainless steel ductwork with sealed seems for the following locations:

.1 Exhaust “ducts conveying corrosive fumes and vapours or other hazardous substances (including fume hoods and biological safety cabinet exhaust systems); and”

.2 Exhaust “ducts where condensation is likely to occur.”

.3 “Ducts shall be sloped to provide drainage where condensation is expected. The exhaust duct and the sheet metal transition to the connection of the fan and to the connection of the hood or cabinets shall be pressure tested to meet SMACNA Class A leakage criteria.”

.4 “Note: Special requirements might be necessary for duct drain lines.”

.5 Refer below for additional information:

2.9 DUCTWORK - STAINLESS STEEL - RECTANGULAR

.1 The following ductwork shall be fabricated from stainless steel with sealed seems:

.1 Sterile Pharmacy Hazardous Exhaust ducts serving the Sterile Hazardous Compound suite and

.2 Where indicated on the drawings.

.2 Low-pressure stainless-steel ductwork shall be suitable for system operating pressures 500 Pa [2" W.G.] or less.

.3 Material: 1.14 mm [18 ga.], 316L stainless steel, with No. 2B finish where concealed and No. 4 finish where exposed. (Exposed areas shall include finished occupied areas of the building but not mechanical rooms).

.4 Do not cross break duct panels. Grade to drain as indicated.

.5 Weld all longitudinal seams and lateral joints and finish all exposed seams and lateral joints by grinding smooth and buffing to finish of the sheet. Do not penetrate stainless steel with screws, bolts or rivets.

.6 Provide gasketted companion flange connections where necessary to connect to equipment. Flanged connections shall be made up by slipping a formed 1.8 mm [14 ga.] thick matching stainless-steel welded angle frame over the end of the duct, leaving space for continuously welding the frame to the duct on the inside.

.7 Provide escutcheon trim bands around all duct ceiling penetrations.

.8 Provide gasketted cleanouts (not smaller than 450 mm x 300 mm [18" x 12"], with formed 1.8 mm [14 ga.] thick matching stainless steel welded angle reinforcing frames, in the

side of the ductwork at not more than 6 m [20 ft.] intervals, changes in direction and base of risers. Cleanouts shall be fastened with wing nuts at 150 mm [6"] centres. Cleanouts openings shall terminate not less than 40 mm [1-1/2"] from the bottom of the duct.

.9 Gaskets shall be 3 mm [1/8"] thick teflon or an approved alternate.

.10 Support exposed ductwork with 50 mm x 1.8 mm [2" x 14 ga.] matching stainless steel (No. 4 finish) U-strap hangers on 2.4 m [8 ft.] centres.

2.10 DUCTWORK - STAINLESS STEEL - ROUND

.1 The following ductwork shall be fabricated from stainless steel with sealed seems:

.1 Sterile Pharmacy Hazardous Exhaust ducts serving the Sterile Hazardous Compound suite and

.2 Where indicated on the drawings.

.2 Material:

.1 1.14 mm [18 ga.], 316L stainless steel with No. 2B finish where concealed and No. 4 finish where exposed to the room or exposed outdoors.

.3 Fabrication:

.1 BSC exhaust ducts shall be constructed to SMACNA Seal Class A Standards as a minimum.

.2 All joints on duct and fittings shall be butt seams continuously MIG. welded. Lap type joints are not acceptable. All welded joints in exposed locations must be ground and polished.

.3 Provide gasketted companion flanged joints and any required transitions for fume hood duct connections.

.4 Provide escutcheon trim bands around all duct ceiling penetrations.

.4 Elbows:

.1 Round duct elbows shall be made of mitred, welded matching stainless steel or stamped elbows of the same material. Welded elbow thickness shall be 1.14 mm [18 ga.]. 90 deg. elbows shall have a minimum of five sections. Centreline radius shall be 1.5 times duct diameter.

.5 Support:

.1 Support exposed ductwork with 50 mm x 1.8 mm [2" x 14 ga.] stainless steel (No. 4 finish), U-strap hangers at 2.4 m [8 ft.] centres.

.2 Support concealed ductwork with 50 mm x 1.8 mm [2" x 14 ga.] galvanized steel, U-strap hangers, at 2.4 m [8 ft.] centres.

2.11 DUCTWORK – OUTDOORS

.1 The internally or externally insulated supply, return and exhaust ducts (down stream of heat recovery coils) including silencers, located outdoors on the roof, shall be constructed watertight.

.2 Internal insulation shall be fiber free per CSA Z317.2

.3 All joints shall be caulked with a water impervious sealant. TDC clips should be continuous on the top and sides of the ducts.

.4 The top of the finished product (waterproof membrane) should be pitched to avoid pooling of water.

.5 After pressure testing, the exterior of the ducts and the duct silencers shall be wrapped with a waterproof membrane. The details of this membrane need to be researched but could be as follows:

.1 Membrane consisting of a SBS rubberized asphalt compound, integrally laminated to a reinforced aluminum foil, providing a waterproof membrane.

.2 Standard of Acceptance: Bakor Foilskin

2.12 PLENUM INSULATION COVERING

.1 Sheet Metal

.1 Provide 0.76 mm [22 ga] galvanized sheet metal covering on acoustically lined plenum walls for a distance of 1.2 m [4 ft] downstream from cooling coils.

.2 Perforated Metal

.1 Provide 0.76mm [22ga] thick perforated galvanized sheet metal covering on all acoustically lined plenum walls (except immediately adjacent to down stream side of cooling coils).

2.13 AIR DISTRIBUTION PLATES

.1 Provide perforated air distribution plates at the discharge of supply fans.

.2 Modify and reposition plates as necessary to balance airflow through downstream filters and coils to plus or minus 15%.

2.14 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.

2.15 WIRE MESH SCREENS

.1 Provide wire mesh screens in all air intake openings where noted on the drawings.

.2 Screens shall be constructed from aluminum wire 1.3 mm diameter [16 ga].

.3 Screen mesh shall be 12.7 mm [1/2"].

.4 Mount screens in 0.66 mm thick [20 ga] folded aluminum frames.

2.16 COUNTER FLASHINGS

.1 Counter flashings - galvanized sheet steel of 0.8 mm [22 gauge] minimum thickness.

.2 Counter flashings are attached to mechanical equipment and lap the base flashings on the roof curbs.

.3 All joints in counter flashings shall be flattened and solder double seam. Storm collars shall be adjustable to draw tight to pipe with bolts. Caulk around the top edge. Storm collars shall be used above all roof jacks.

.4 Vertical flange section of roof jacks shall be screwed to face of curb.

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. Adjustment shall be accessible outside the duct with lockable quadrant operator or through the grille or register with key-operated worm gear mechanism.

.10 Cross-break or bead all metal duct panels unless otherwise noted.

.11 Do not cross-break duct panels on 750 Pa [3"] and greater static pressure systems.

.12 Do not cross-break bottom duct panels when ductwork is handling moisture.

.13 Roof mounted ducts shall have standing seams and shall be sealed weather tight.

.14 Grade all ductwork handling moisture, a minimum of 1:120 [1" in 10 ft] back to the source or at low points in the ductwork, provide a 150 mm [6"] deep drain sump and 32 mm [1-1/4"] dia. drain connection with deep seal trap and pipe to drain.

.15 Construct ductwork handling moisture with three-sided bottom sections and a separate top panel. Install the three-sided bottom sections and internally seal the transverse joints with CGE Silicone Sealant "Silpruf". Then install the top panels and seal the top panel seams and joints.

.16 Provide floor drains in outside air and humidifier sections with deep seal traps.

.17 Provide moisture collection sections inside all louvres for outside air and exhaust air.

.18 Support ductwork using galvanized steel straps, cadmium plated threaded rods, flat bar or angle hangers. Attachments to the structure shall be compatible with the structure and selected for the load of the ductwork. Install ductwork hangers in accordance with Section IV including Tables 4-1 through 4-3 and Figs. 4-1 through 4-9 of the SMACNA Duct Standards.

.19 Support duct risers at their base and at each floor and at not greater than 3.7 m [12 ft] intervals.

.20 Prior to the fabrication of ductwork, co-ordinate and field measure all ductwork to ensure a complete installation respecting all other services. Provide all necessary fittings, offsets, and alternate construction methods to facilitate the installation.

.21 Arrange ductwork and plenums so that duct and plenum mounted equipment can be easily removed.

.22 Arrange access doors so that they open against the airflow and static pressure.

.23 Provide necessary baffling in manufactured or built-up mixed air plenums to ensure good mixed air temperature with variations of not more than ± minus 5°C [23°F] under all operating conditions.

.24 Ducts passing through non-rated fire separations, sound insulated walls and through non-rated walls and floors shall be tightly fitted and sealed on both sides of the separation with silicon sealant to prevent passage of smoke and/or transmission of sound. (U.L.C. approved fire stop sealant is not a requirement). Where ducts are insulated provide a 0.61 mm [24 ga] thick galvanized steel band tightly fitted around insulation and then caulk to band.

.25 During construction, protect openings in ductwork, from dust infiltration, by covering with polyethylene, and protect floor outlet duct openings with metal caps.

.26 Where ductwork is required to pass through open web steel joists, coordinate with the joist fabricator before fabricating ductwork.

.27 Where ducts penetrate roofs, install sleeves and roof curb c/w flashing and counterflashing. Pack sleeves in roof with fibreglass insulation.

.28 Provide drip pans under piping and shields for protection of electrical panels and equipment.

.29 Unless noted otherwise, line all builder's shafts and air plenums used as ducts and plenums with sheet metal.

3.2 DUCT PENETRATIONS IN PRESSURE SENSITIVE ROOMS

.1 All ducts passing through walls, floor and ceiling slabs of rooms that are required to be maintained at negative or positive pressure, shall be tightly fitted and sealed on both sides of the separation with smoke seal caulking sealant to prevent the transmission of air.

.2 These rooms include:

.1 Compounding Pharmacy Areas:

.1 Hazardous Compounding Room

.2 Hazardous Anteroom

.3 Hazardous Storage Room

.4 Non-Hazardous Compounding room

.5 Non-Hazardous Anteroom

.3 Refer to drawings for additional information

3.3 DUCTWORK LEAKAGE TEST

.1 Leakage test all 750 Pa [3"] and greater static pressure supply ductwork installed under this contract, as recommended in the SMACNA H.V.A.C. Air Duct Leakage Test Manual, 1985 Standards, to a static pressure 500 Pa [2" W.G.] in excess of the specified ductwork design static pressure.

.2 Use equipment capable of demonstrating leakage.

.3 Test the first 30 m [100 ft] of installed ductwork in the presence of the Consultant.

.4 Test a 30m [100ft] section of 500 Pa [2"] static pressure ductwork, where complete systems over 30m [100 ft] long are installed under this contract to a static pressure of 500 Pa [2" W.G.].

.5 The total allowable leakage for the entire system shall be not greater than five [5] percent of the total system capacity.

.6 Submit test reports for all ducts tested.

3.4 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 Owner. 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 Oil film on sheet metal shall be removed before shipment to Work Site. Ducts shall be inspected to confirm that no oil film is present.

.3 Oil film on sheet metal shall be removed before shipment to Work Site. Ducts shall be inspected to confirm that no oil film is present.

.4 Close all dampers immediately following installation thus checking the operation and retarding movement of contaminants through the system.

.5 Seal all openings at the end of each day and at such other time as site conditions dictate.

.6 Floor openings to be capped with sheet metal or floor grilles plus 0.15 mm [6 mils] thick poly sheet.

.7 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 All ductwork shall be handled and installed in accordance with the advanced level specified in SMACNA's Duct Cleanliness for New Construction Guidelines

.2 Supply and return ducts shall be cleaned in accordance with NADCA General Specifications for the Cleaning of Commercial Heating, Ventilation and Air Conditioning Systems. Verification of HVAC system cleanliness shall be in accordance with the latest NADCA ACR Standard.

.1 If visual inspection (Method 1 in NADCA ACR) is inconclusive, surface comparison testing (Method 2 in NADCA ACR) should be used.

.2 If surface comparison testing is inconclusive, vacuum testing (Method 3 in NADCA ACR) should be used.

.3 On completion of the duct and plenum installation and prior to the installation of air terminals and prior to balancing of the air systems, but not until the areas are substantially clean (floors have been swept and vacuumed) and all "dirty" construction has been completed, employ an approved Cleaning Agency to vacuum clean the following:

.1 All air handling units.

.2 All plenums.

.3 All supply air ducts.

.4 All exhaust air ducts.

.4 All components within each system shall be thoroughly cleaned and shall include but not be limited to the following: coils, fans and motors, silencers, air terminals and mixing boxes / air valves.

.5 When connecting to existing supply ductwork, clean existing supply ducts upstream from connection back to the filters. Clean existing supply ductwork downstream from new connections to outlets.

.6 Cleaning shall generally be by high capacity power vacuum. High-pressure compressed air, wire brushing and/or non-toxic solvent cleaning shall be used where dirt or scale cannot be removed otherwise. Coils shall be de-scaled.

.7 The Cleaning Contractor shall be responsible for removing and replacing filter media. This contractor will remove the temporary filters and replace with new after cleaning the systems.

.8 The Cleaning Contractor shall mark balancing damper positions before cleaning and return them to their original position when cleaning is completed unless the system is still to be balanced.

.9 Reinstall any grilles, registers and diffusers, which may have been removed for cleaning purposes.

.10 In accordance with CSA Standard Z317.2, all new air handling systems shall be cleaned and disinfected prior to occupancy.

.11 After the duct systems have been cleaned they should be resealed if they are not being used.

.12 The Cleaning Agency shall perform a full inspection of the duct interior. Utilizing a fibre optic borescope with dedicated light source, inspect interior ductwork surfaces, and ductwork accessories including terminal units, mixing boxes / air valves, ductwork liners, duct-mounted coils, filters, dampers, humidifiers and all other appurtenances within the ductwork system.

.13 Spot checks will be made by the Consultant during the cleaning process to verify that the required standard is being met. When substantial performance is claimed, final spot checks will be made to verify that the ducts are clean. Make available for the use of the Consultant a fibre optic borescope with dedicated light source. If any ducts are found to be unclean, then they shall be recleaned.

.14 Ducts serving very clean areas served with 85% NBS or HEPA filters shall be reviewed by the Consultant utilizing the equivalent of a white glove wipe technique.

.15 Submit a report from the cleaning agency that certifies all specified air systems have been cleaned (complete Mechanical Form MF 171).

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 QUALITY ASSURANCE

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

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.

2.2 BALANCING DAMPERS

.1 Construction in accordance with SMACNA Duct Standards - Figs. 2-14 and 2-15.

.2 Minimum Requirements:

- .1 Rectangular ducts:
  - .1 Up to 300 mm [12"] deep - single blade (butterfly type).
  - .2 330 mm [13"] to 400 mm [16"] deep - two opposed blades, mechanically interlocked with pivots at quarter points.
  - .3 430 mm [17"] deep and over - multiple opposed blades, mechanically interlocked with blades not greater than 200 mm [8"] deep and pivots equally spaced.
- .2 Round Ducts:
  - .1 Single blade (butterfly type).
- .3 Material:
  - .1 Minimum 1.47 mm [16 ga] thick galvanized steel blade on all butterfly dampers.
  - .2 Minimum 1.47 mm [16 ga] thick galvanized steel blades on multi-blade dampers with rigidly constructed galvanized steel frame (no frame required on single blade dampers).
  - .3 Minimum 1.14 mm [18 ga] thick stainless-steel blades for fume exhaust ducts.

.4 Bearings:

.1 End bearings on all low-pressure single blade dampers above 300 mm [12"] dia.

.2 Bearings on multiple blade dampers shall be bronze oilite type.

.5 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 Drawing designation: D (CR).

.2 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.

.3 Concealed damper regulator to be connected to balancing damper by means of flexible Bowden cable and to be installed flush with ceiling.

.4 Coverplate to be held in place with 2 screws and to be easily removed for damper adjustment.

.5 Refer to Mechanical Details.

.6 Standard of Acceptance:

.1 Young Regulator Co. Model No. 270-301.

.2 Provide all necessary hardware including Young Regulator balance damper model 5020-CC, Bowden cable and Young Regulator Model 030-12 wrench.

2.3 DUCT AND PLENUM ACCESS

.1 Locations: Refer to Part 3 (Execution).

.2 Dimensions:

.1 Doors:

.1 500 mm [20"] wide x 1370 mm [54"] high.

.2 Head of door 1780 mm [70"] above floor.

.2 Panels:

.1 380 mm x 500 mm [15"x20"].

.2 Where the far corners of the duct are closer than 500 mm [20"] and the equipment within the duct is closer than 300 mm [12"] the size may be reduced to 400 mm x 300 mm [16"x12"] or 450 mm x 250 mm [18"x10"] elliptical.

.3 Where space will not permit the above dimensions to be attained, they should be matched as closely as possible and where necessary additional access be provided.

.3 Products:

.1 Doors - construct in accordance with SMACNA Duct Standards Fig. 6-12 except for latch type. 40 mm [1-1/2"] thick insulation.

.2 Panels - Nailor Hart, Ventlok, 25 mm [1"] thick insulation.

.3 Gaskets - neoprene or foam rubber.

.4 Hardware:

.1 Panels up to 400 mm x 300 mm [16 "x 12"] - 2 sash locks.

.2 Panels - 380 mm x 500 mm [15 "x 20"] - 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 - THERMAL BREAKS

.1 Provide flexible duct connections to provide thermal breaks in all sheet metal ducts and plenums passing through or terminating at the exterior of the building. Install inside the building.

.2 Minimum Requirements:

.1 Pre-assembled 75 mm [3"] long thermal barrier with 75 mm [3"] long, 0.61 mm [24 ga] galvanized steel duct connectors on each side of the thermal break.

.2 Thermal break - heavy fiber glass fabric with elastomer coating.

.3 Standard of Acceptance: Duro Dyne "Durolon", Ventfabrics "Ventlon".

2.5 DUCT CONNECTORS - VIBRATION ISOLATION

.1 Provide flexible duct connections to provide vibration isolation at all duct and plenum connections to fan and air handling units. See Figure 2-19 SMACNA Duct Standards.

.2 Minimum Requirements:

.1 Pre-assembled 75 mm [3"] minimum long flexible connection with 75 mm [3"] long 0.62 mm [24 ga] galvanized steel duct connectors on each side of the flexible connection. Flexible connector - fiber glass fabric with elastomer coating.

.3 Centrifugal fans with 900 mm [36"] diameter and larger fan wheels, use 150 mm [6"] long flexible connection.

.4 Do not install connectors on perchloric acid fume exhaust systems.

.5 Standard of Acceptance: Duro Dyne "Durolon", Dynair "Hypalon", Ventfabrics "Ventlon".

2.6 DUCTWORK - FLEXIBLE - PLAIN

.1 Provide factory fabricated plain, flexible air ductwork for the following applications:

.1 Connections to air terminals.

.2 Connections to downstream side of mixing boxes / air valves.

.3 Connections to round fire dampers (up to 300 mm [12"] diameter).

.2 Minimum Requirements:

.1 Non-corrosive spiral wire reinforcing with flexible vinyl coated fiberglass cloth membrane.

.2 Suitable for up to 2500 Pa [10" w.g.] positive static pressure and 250 Pa [1" w.g.] negative static pressure.

.3 U.L. or U.L.C. labelled, Class 1, duct connector.

.4 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

.3 Standard of Acceptance: Flexmaster FAB4, Thermaflex SLP10,

2.7 DUCTWORK - FLEXIBLE - INSULATED

.1 Provide factory fabricated insulated flexible ductwork for the following applications:

.1 Connections to downstream side of variable volume and constant volume mixing

boxes, where indicated.

.2 Connections to air terminals where indicated.

.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.

2.8 DUCTWORK AND PLENUM SEALERS

.1 Provide duct sealing compounds for use in fabrication of all ductwork and plenum joints.

.2 All ductwork shall be sealed to SMACNA Seal Classification A.

.3 Standard of Acceptance:

.1 Foster 32-14, Hardcast Versa Grip, Hardcast Foil Grip 1402, Robson's Duct Seal-WB, United Duct Sealer, Trans Continental Multi-Purpose.

.4 Where accessible, apply sealer to inside of joints on ducts and plenums under positive pressure - e.g. on the discharge side of fans.

.5 Apply sealer to outside of joints on ducts and plenums under negative pressure - e.g. on the suction side of fans.

2.9 FLOW MEASURING DEVICES – AIR (PROBE TYPE)

.1 Airflow Probe (Duct or Fan Inlet)

.1 Minimum Requirements:

.1 Aluminum construction.

.2 Multiple traverse probes.

.3 Traverse probe to contain multiple total and static pressure sensors located along exterior surface of probe and internally connected to their respective averaging manifolds.

.4 Threaded end support rod and mounting plate with gasket and signal fittings.

.5 Fan inlet probes (two per inlet) shall have dual end support swivel brackets suitable for mounting in the fan inlet bell.

.6 Capable of producing an output signal linear and scaled to air volume (4-20 mADC, 0-10 VDC, 0-5VDC).

.7 Capable of local digital display of continuous indication of air volume.

.2 Standard of Acceptance:

.1 Air Monitor VOLU-probe/7200AZ (Duct).

.2 Air Monitor VOLU-probe/7200AZ (Fan Inlet).

2.10 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.

Part 3 Execution

3.1 BALANCING DAMPERS

.1 Provide balancing dampers at points on low pressure supply, return and exhaust systems where branches are taken from larger duct as required for proper air balancing.

.2 Provide balancing dampers at each run out to a grille or diffuser.

.3 Identify the airflow direction and blade rotation and open and closed position.

.4 On all round ductwork larger than 300 mm [12"] diameter and on externally insulated rectangular ductwork, provide sheet metal bridge to raise quadrant type operators above the insulation thickness (coordinate with Section 23 07 13). Provide an open end bearing where bridges are used. Bridges on uninsulated round ducts shall be at least 25 mm [1"] high.

.5 Where quadrant type operators are used, the lever shall be arranged parallel with the damper blade.

3.2 BACKDRAFT DAMPERS

.1 Install backdraft dampers on all exhaust and relief openings through the building walls and roof on all exhaust fans where control dampers are not called for or indicated.

3.3 CONTROL DAMPERS - AUTOMATIC

.1 Packaged equipment specified to be complete with control dampers, shall include control dampers as normally supplied by the equipment manufacturer unless otherwise noted.

.2 All other automatic control dampers are specified in the Controls Sections.

.3 Under this section be responsible for receipt, handling, storage and installation of control dampers supplied under the Control Sections.

.4 The indicated size of control dampers is the dimension outside the frame. Oversize the ductwork to include the depth of the damper frame if the pressure drop across the damper exceeds 25 Pa [0.1" w.g.].

.5 Control damper frames shall be fitted tightly into ductwork and sealed airtight.

.6 Check that dampers are installed square and true. Ensure that damper end linkages are easily accessible.

.7 Do not install control dampers within the thickness of any wall unless otherwise indicated.

3.4 DUCT AND PLENUM ACCESS

.1 Locations: Provide access doors and panels as follows:

.1 Doors: where shown on the drawings.

.2 Panels:

.1 Every 12 m [40 ft] on all ductwork.

.2 At the base of each duct riser.

.3 Both sides of equipment blocking the duct e.g.

.1 air flow measuring stations

.2 coils

.4 At or to one side of other equipment in duct e.g
- .1 backdraft dampers (counterweight side)
- .2 balance dampers serving multiple outlets/inlets
- .3 bearings (fans/motors)
- .4 control dampers
- .5 control sensors
- .6 heat detectors (upstream from device)

.5 Panels need not be provided where access is available through a door or a register mounted on the side of the duct.

.3 Patches:
- .1 Where required for cleaning and where access panels are not specified, e.g. on both sides of turning vanes.

.4 Flexible duct - on round duct and round fire dampers up to 300 mm [12"] dia.

.2 Seal frames airtight.

.3 Install so as not to interfere with airflow.

.4 Install to provide easiest possible access for service and cleaning.

.5 Do not use sheet metal screws for attaching access panels to ductwork.

.6 Round ducts 330 mm [13"] dia. and larger shall include a short collar for the installation of access panels.

.7 Small rectangular ducts shall be transitioned to a minimum dimension across the duct of 330 mm [13"] for the installation of access panels.

3.5 DUCT CONNECTORS - VIBRATION ISOLATION

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

3.6 DUCTWORK – FLEXIBLE

.1 Installed lengths shall be limited to 6 times duct diameter but not longer than 1200 mm [4 ft].

.2 Connect to ductwork and diffusers with stainless steel worm drive clamps or Panduit adjustable clamps or Thermaflex duct strap applied over two wraps of duct tape. Use stainless steel clamps on connections to fire dampers.

.3 Minimum centreline radius of flexible ductwork bends shall be 1.5 times the duct diameter, alternatively, sheet metal elbows may be used at branch takeoffs and boot/diffuser connections.

.4 Support with 25 mm x 0.76 mm [1" x 22 ga] galvanized steel straps at a maximum of 600mm [24"]. Straps shall completely encircle duct.

.5 Support clear of ceiling assembly, light fixtures and hot surfaces.

3.7 FLOW MEASURING DEVICES - AIR

.1 Install in accordance with manufacturers recommendations. The minimum distances from air turbulence - producing fittings, transitions etc. shall be maintained.

.2 When specified mount air volume gauges at a convenient height for easy visual inspection and install interconnecting piping.

END OF SECTION

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 Adhesives and sealants shall meet the VOC limits of the South Coast Air Quality Management District Rule #1168. MSDS sheets for VOC content shall be submitted with the adhesive and sealant shop drawings for approval.

1.2 SUBMITTALS

.1 Submit shop drawings detailing all attenuator data specified in the schedule. The data submitted shall apply to this project application.

.2 Provide engineering certification of sound attenuator performance (insertion loss, pressure drop and regenerated noise under stated operation conditions) certified by a Professional Engineer and supported by test results, if required by the Consultant.

.3 Submit laboratory acoustic and aerodynamic performance obtained according to ASTM E477-06a and so certified when submitted for approval. The laboratory must be currently NVLAP accredited for the ASTM E477-06a test standard. A copy of the accreditation certificate must be included with the submittals. Data from non-NVLAP accredited test facilities will not be accepted. Shop drawings submitted without proper certifications will be rejected.

.1 Submitted silencer pressure drops shall not exceed those listed in the silencer schedule. Silencer pressure drop measurements shall be made in accordance with the ASTM E-477-06a test standard. Tests shall be conducted and reported on the identical units for which acoustical data is presented.

.2 The manufacturer shall supply certified dynamic insertion loss and self-noise power level data for each scheduled silencer. The data shall match the project's air distribution system requirement for forward or reverse flow, and total system airflow. All ASTM E-477-06a tests to obtain this data shall be conducted in the same facility and shall utilize the same silencer.

.3 Silencer dynamic insertion loss shall not be less than that listed in the silencer schedule.

.4 Silencer generated noise shall not be greater than that listed in the silencer schedule

.4 The silencer manufacturer shall test the silencer(s) as indicated in the silencer schedule. The Engineer shall be notified of the test date at least two weeks in advance and the test may be witnessed by the Engineer. Test shall show compliance with the project criteria and is subject to engineer approval. Test facilities and test reports shall be open to inspection upon request from the Engineer.

1.3 QUALITY ASSURANCE

.1 Silencers shall comply with CSA Z317.2 (Packless, Fiber Free etc.)

.2 Product of a manufacturer who regularly engages in production of such units and who issues complete catalogue data on such products.

.3 Comply with NFPA-90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA-90B, "Installation of Warm Air Heating and Air Conditioning Systems."

.4 Silencer performance must have been substantiated by laboratory testing in a duct-to-reverberant room test facility according to ASTM-E477-06a.The test facility must provide for airflow in both directions through the test silencer. The test set-up, procedure and facility shall eliminate all effects due to flanking, directivity, end reflection, standing waves

and reverberation room absorption. The aero-acoustic laboratory must be currently NVLAP accredited for the ASTM-E477-06a test standard.

.5 Silencer manufacturer shall provide a written test report by a third-party organization showing silencer assemblies have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM-E84, NFPA-255 or UL-723.

Part 2 Products

2.1 GENERAL

.1 Refer to separate equipment lists for details and for performance. Silencers shall comply with CSA Z317.2.

.2 Standard of Acceptance: IAC Acoustics

.3 Minimum Requirements:

.1 Fabricate attenuators to SMACNA Standards, air-tight at twice the operating pressure, with sufficient strength to withstand normal handling, transportation installation and operational stresses and consistent with the ductwork in which the attenuator will be installed. Split spot welds or sagging insulation will result in rejection of a sound attenuator.

.2 Provide galvanized, lockformed casing constructed to SMACNA standards

.3 Attenuators shall be inorganic, noncombustible, impart no odours to the air, and shall not erode due to airflow over the internal surfaces.

.4 Silencer inlet and outlet connection dimensions must be equal to the duct sizes shown on the drawings. Duct transitions at silencers are not permitted unless shown on the contract drawings.

.5 Units shall be modular unit sizes to fit ducts and air handling units without using transitions or large blank-off sections

.6 Units shall be available in any cross-sectional dimensions to “fit-the-duct”

.7 Paint attenuator inside and out with an anti-rust prime coat paint.

.8 Provide label on attenuators with manufacturer's name and flow direction.

.9 Measure sound attenuator performance, both aerodynamic and acoustical, by an approved laboratory. Supply details of testing methods used, if requested. Provide engineering certification of sound attenuator performance (insertion loss, pressure drop, and regenerated noise under stated operation conditions), if requested.

.10 Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

.11 Fire-Performance Characteristics: Silencer assemblies, including acoustic media fill, Vibar™ film liner, sealants, and acoustical spacer, shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM-E84, NFPA 255 or UL 723.

.12 All casing seams and joints shall be lock-formed and sealed or stitch welded and sealed except as noted in Section G below, to provide leakage-resistant construction. Airtight construction shall be achieved by use of a duct-sealing compound supplied and installed by the contractor at the jobsite.

.13 All casing seams and joints shall be lock-formed and sealed or stitch welded and sealed except as noted in Section G below, to provide leakage-resistant construction. Airtight construction shall be achieved by use of a duct-sealing compound supplied and installed by the contractor at the jobsite.

.14 Rectangular Silencers including models **RD**: Outer casing shall be ASTM-A653/A653M, G90 galvanized sheet steel, 22 gauge.

2.2 SOUND ATTENUATORS (PACKLESS)

.1 Submit certification with shop drawings that silencers can be used in typical fume hood corrosive applications, including systems exhausting radioactive isotopes.

.2 Fabricate attenuators to SMACNA standards, air-tight at twice the operating pressure, with sufficient strength to withstand normal handling, transportation installation and operational stresses. Non-continuous or rough welds will result in rejection of a sound attenuator.

.3 The sound attenuators shall be 316 stainless steel with no cavities or insulation, which may trap or retain particles from the fume exhaust gases.

Part 3 Execution

3.1 SOUND ATTENUATORS

.1 Inspect attenuators arriving on site to ensure that they meet the specified requirements. Report any deficiencies to the manufacturer and to the Consultant.

.2 Install attenuators in accordance with manufacturer's instructions including minimum upstream and downstream straight length requirements

.3 Provide access panels in front of and behind silencers.

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 QUALITY ASSURANCE

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

.2 Fans shall conform to AMCA bulletins regarding testing and construction. Airfoil fans shall bear the AMCA certified rating seal for airflow and sound.

1.3 SUBMITTALS

.1 Fan shop drawings shall include sound rating data and fan curves showing operating point plotted on curves.

.2 Fan shop drawings shall include motor efficiencies. Refer to Section 23 05 13 for minimum motor efficiencies.

1.4 GENERAL

.1 Fan motors shall be UL listed and CSA certified.

.2 Full Voltage Start Applications:

.1 All motors shall be in accordance with NEMA standards, and CSA C390-93, or the latest version as is applicable. Motors also shall comply with the applicable portions of the Canadian Electrical Code.

.3 Variable Frequency Drive and soft start applications:

.1 All motors shall be in accordance with NEMA standards (MG-1) Part 31, and inverter duty class, or the latest version insofar as it is applicable. Motors also shall comply with the applicable portions of the Canadian Electrical Code.

.2 Motors connected to VFD(s) shall be wound using inverter spike resistant magnet wire capable of 1600V.

.4 The noise level of each motor shall comply with NEMA standards, less than 80 dBA at 1 meter.

.5 Motors powered by variable speed drive controllers shall be EEMAC class B with Type F "inverter duty" insulation, shall have a 1.15 service factor on sine wave power, 1.0 service factor on PWM power and meet NEMA Code MG-1.

.6 All motors 10 hp and larger that are controlled by a VFD are to use dielectric grease bearings and a shaft grounding kit with a system of brass or stainless steel brushings to prevent premature failure.

Part 2 Products

2.1 GENERAL

.1 Provide fans selected for maximum efficiency and generating noise levels on site not exceeding the level calculated from the ASHRAE Guides. If fans are not specified at maximum efficiency, advise mechanical consultant before tendering and submit alternate price for maximum efficiency fans. If approval to supply noisier fans is not obtained prior to tendering, provide equipment meeting ASHRAE levels on site without loss in efficiency.

.2 Submit fan sound power levels with shop drawings measured to applicable AMCA standards, or other data acceptable to the engineer. Provide test data, if requested.

Indicate on shop drawings the test configuration, including ductwork, and any end reflection corrections applied to the data and / or if such corrections have been omitted.

.3 Fans: statically and dynamically balanced, constructed in conformity with AMCA-99. Dynamically balance fans to 1.5-mm/s vibration amplitude, maximum measured on bearing housings. Provide fan shafts with critical speed at least 1.5-times operational speed.

.4 Fans shall conform to AMCA bulletins regarding testing and construction. Airfoil fans shall bear the AMCA certified rating seal for airflow and sound.

.5 Ratings: based on tests performed in accordance with AMCA 210, and ASHRAE 51. Units shall bear AMCA certified rating seal.

.6 Refer to Section 23 05 13 for high efficiency motor requirements.

.7 All motors shall be TEFC unless noted otherwise.

.8 All motors shall be provided with premium efficiency classification.

.9 Where fans are used for smoke exhaust, the motor, bearings, operators, etc. shall be capable of three (3) hours of operation at 250°C [482°F].

.10 Refer to drawings for motor position, rotation and discharge arrangements.

.11 For motors less than 10 H.P. provide standard adjustable pitch drive sheaves having +/- 10% range. Use mid-position of range for specified RPM.

.12 For motors 10 H.P. and larger, provide fixed pitch drive sheaves with split tapered bushing and keyway. Provide final drive sheaves of size to suit final balancing.

.13 Match drive and driven sheaves.

.14 V-belts shall conform to the American Belt Manufacturers standards. Multiple belts shall be matched sets.

.15 Minimum drive rating shall be 150% of nameplate rating of motor

.16 Not less than a 2-belt configuration is required for each drive for motors 3/4 H.P. and larger.

.17 Provide belt guard with tachometer ports for all belt drive fans.

.18 Where fans are used for smoke exhaust, the motor, bearings, operators, etc. shall be capable of three (3) hours of operation at 250°C [482°F].

.19 Bearings shall have a minimum L-10 life of 100,000 hours based on the maximum safe speed of the fan class.

.20 Fans shall be treated to suit the airstream in which they are used.

.21 Provide secure attachment points for seismic restraints. Mounting brackets shall be suitable for seismic loading.

2.2 MOTORS AND VARIABLE SPEED DRIVES

.1 Provide motors and variable frequency drive / motor assemblies generating noise levels which are imperceptible in the occupied space, and outside building, relative to fan noise. Provide acoustical data confirming required performance prior to tendering. If approval is not obtained prior to tendering, provide equipment meeting specified imperceptible requirement without loss in efficiency.

2.3 AXIAL FANS - CONSTANT VOLUME

.1 Minimum Requirements:

.1 Steel tubular casing, long type, with flanged ends and stationary guide vanes where scheduled.

.2 Mounting feet.

.3 Aluminum airfoil blade impeller with adjustable pitch angle.

.4 Rotating parts factory statically and dynamically balanced.

.5 Totally enclosed motor, direct drive.

.6 Casing with externally mounted junction box.

.7 Galvanized or prime and factory enamel coating over all interior of casing, including steel accessories. Galvanized or prime coating over all exterior parts of casing and steel components.

.8 Provide extended lubricators for fan bearings 19 mm [3/4"] diameter and larger.

.2 Accessories:

.1 Inlet bell and screen where scheduled or when not directly connected to ductwork on inlet side.

.2 Inlet and outlet cones where scheduled and/or shown on drawings.

.3 Matching flanges.

.4 Fans to be supplied adjusted for duty scheduled.

.5 The acoustic centre pod in the discharge cone shall be constructed from 23% open area perforated galvanized steel packed with inorganic fiber under compression. Dimensions of pod as follows: length of pod to match length of discharge cone (with extension, if applicable, to reach the downstream side of the fan motor), diameter to match diameter of fan motor.

2.4 CENTRIFUGAL FANS - GENERAL

.1 Minimum Requirements:

.1 Welded steel fan wheel with airfoil blades, unless otherwise specified.

.2 Bearings: Heavy-duty pillow-block grease lubricated ball or roller self-aligning type.

.3 Gasketted scroll access panel, secured with quick release fasteners.

.4 20 mm [3/4"] scroll drain and brass plug.

.5 Enamel painted steel fan wheels and inside scrolls.

.6 Prime coat painted outside scroll including supports and steel accessories.

.7 Rust preventative coating on fan shafts.

.8 Drip proof motor.

.9 On single inlet fans provide extended lubricators on inlet side bearings.

.2 Accessories:

.1 Belt drives.

.2 Belt guards c/w tachometer holes.

.3 Coupling guards.

.4 Fan inlet safety screens.

.5 Steel frame base and motor slide rails (refer to Section 23 05 48).

2.5 AIR PRESSURE GAUGES

.1 Application:

.1 Across all new supply fans:

.2 Minimum Requirements:

.1 Ranges:

.1 Supply fans: 0-1500 Pa [0-6" w.g.].

.2 Return/exhaust fans: 0-500 Pa [0-2" w.g.].

.3 Standard of Acceptance:

.1 Dwyer Series 2000.

Part 3 Execution

3.1 FANS

.1 Install fans as indicated, complete with vibration isolators and seismic restraints as specified in Sections 23 05 48 and 23 05 49.

.2 Install fans with flexible connections on inlet ductwork and on discharge ductwork. Ensure metal bands of connectors are parallel with minimum 25 mm [1"] flex between ductwork and fan during running.

.3 Install connectors such that connectors are clear of the air stream. Provide flange extensions as necessary. Ensure accurate alignment of duct to fan.

.4 Provide safety screens where fan inlet or outlet is exposed.

.5 Provide belt guards on belt driven fans.

.6 Provide and install sheaves and belts required for final air balance.

.7 Assist the Balancing Agency in altering blade pitch angles as required for final air balance. Provide access to fan wheel for blade adjustment.

.8 Mount floor mounted fans on 100 mm [4"] thick concrete housekeeping bases (bases under Division 3).

.9 Mount roof mounted fans on curbs 200 mm [8"] minimum above roof.

3.2 MIXED FLOW INDUCED DILUTION EXHAUST FANS

.1 Install fans on roof curb with 25mm thick gasket (provided by fan manufacturer) sized for 3mm deflection under weight of the fans. Fan base to be securely fastened to curb by means of stainless steel bolts. Provide hemi-grommets (Mason HG) under hold-down bolts. Use lock nuts and ensure bolt can be turned by hand after lock nut secured.

3.3 AIR PRESSURE GAUGES

.1 Mount gauges for easy visual inspection.

.2 All piping to be neatly formed in true vertical/horizontal lines free from kinks.

.3 Seal all penetrations of plenums or ducts.

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 QUALITY ASSURANCE

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

1.3 APPLICABLE CODES AND STANDARDS

.1 ARI Standard 410 Forced-Circulation Air-Cooling and Air-Heating Coils

.2 ARI Standard 880 Standard for Air Terminals

.3 ARI Standard 885 Standard for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.

.4 ASHRAE Standard 180 Methods of Testing for Rating Ducted Air Terminal Units

1.4 SYSTEM PRESSURE RATINGS

.1 All hydronic accessories, valves and fittings in EC and MH building suitable for a maximum working pressure of 1033 kPa [150 psig].

Part 2 Products

2.1 GENERAL

.1 Manufacturers, other than those listed in the acceptable manufacturers list, wishing to bid shall make a detailed submission responding to each point outlined in the specification in the exact same form. A listing of valve for valve taken from the drawings, shall be included showing the design selection and the alternate proposed with airflow capacities and minimum static pressure requirement**.**

.2 Selection of units to meet air quantities shown to be based on;

.1 maximum Inlet Air Pressure; 750 Pa [3 in wg],

.2 minimum Inlet Air Pressure; 75 Pa [0.3 in wg],

.3 maximum room NC sound pressure level (2 x 10-4 microbar reference) at maximum inlet pressure to be less than 40 at discharge and 42 radiated for box with attenuator mounted exposed (without ceiling).

2.2 TERMINAL UNIT /AIR VALVE IDENTIFICATION

.1 The manufacturer shall number the units in accordance with numbers shown on the drawings. Secure 50 mm [2"] high, Gothic style self-adhesive, black stick on-letters, (Letrasign or Brady Quick-Align) on one side and on the bottom of all air valves.

2.3 CONTROLLERS

.1 Direct Digital Controllers (DDC) including actuators to be supplied by BMS Equipment Controllers, and factory mounted by Terminal Box Manufacturer. Costs associated with receiving, storage, installation, box control system connections and calibration to be included by Terminal Box Manufacturer.

.2 Coordinate the installation of the BMS supplied equipment with the BMS supplier to ensure that it is installed and operates fully in accordance with the manufacturers recommendations.

.3 Air flow sensor to be provided by Terminal Box Manufacturer.

.4 Commission and factor test/ calibrate each box before leaving the factory.

2.4 AIRFLOW CONTROL DEVICES – VENTURI VALVES

.1 Refer to specification section 25 09 35 for additional information.

.2 The airflow control device shall be a Vantage by Phoenix Controls Accel II pressure independent venturi valve or approved equivalent.

Part 3 Execution

3.1 BOX INSTALLATION

.1 Install in accordance with manufacturers recommendations.

.2 Support terminal boxes from building structure with angles, hangers and supplementary steel before installation of piping and connecting ductwork. Support air terminal units independently of ductwork.

.3 Provide seismic restraints in accordance with details in SMACNA Guidelines or alternatively slack cables may be used.

.4 Arrange for suitable ceiling access to units. Provide access doors or locate near easily removable ceiling components.

.5 Seal openings in box and attenuator for control, and power wiring.

.6 Provide flexible connections for heating coil piping and electrical connection.

.7 Provide isolation valves, control valve and balancing valves on piping connections.

3.2 DUCTWORK CONNECTIONS

.1 Connect inlet ductwork with rectangular duct of same size as terminal box inlet

.2 Support outlet ductwork independent from box.

.3 Provide access door in ductwork downstream of terminal box.

.4 Install units with a minimum of four duct diameters of straight inlet duct, same size as the inlet, upstream of the inlet.

.5 Where inlet flow deflections and/or turbulence alter factory calibration by more than 10%, installer shall field adjust the air volume calibration settings to compensate.

3.3 ELECTRICAL CONNECTIONS

.1 Electrical Division 26 will provide 120 Volt, single phase power supply with a junction box for each group of terminal boxes with maximum of 12 terminal box controls fed from one junction box.

3.4 LEAKAGE TESTING

.1 Terminal boxes and attenuators to be included in ductwork leakage testing.

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 QUALITY ASSURANCE

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

Part 2 Products

2.1 GENERAL

.1 For details and performance, refer to separate equipment lists.

2.2 AIR TERMINALS

.1 Grilles, registers and diffusers shall be product of one manufacturer.

.2 Refer to drawings for sizes and air quantities.

.3 Base air outlet application as follows:

Room Type/Usage	NC (max)
Pharmacy Compounding Rooms	30-35

.4 All air terminals must be checked for compatibility with ceiling types. Refer to Architectural reflected ceiling plans.

.5 Air Terminal in Clean Rooms (Sterile HD and Non-HD Compounding rooms, HD Storage room, HD and Non-HD Ante Rooms and Pharmacy IV Prep Areas) shall be fully gasketed to help prevent air movement between the room and wall or ceiling spaces.

.6 Ceiling tee-bar modules are in soft conversion metric, Imperial measurements unless where specifically noted otherwise. Refer to Architectural drawings for additional information.

.7 The manufacturer (other than the design listed) shall match performance data and indicate a specific comparison for each item, with the shop drawing submission.

.8 All ceiling mounted air terminals shall be provided with means for attachment of two seismic security wires at opposite corners of each air terminal.

.9 Provide concealed baffles, where necessary, to direct air away from walls, columns or other obstructions within the radius of air terminal operation.

.10 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.

2.3 AIR TERMINALS - HEPA FILTER UNITS

.1 Provide Laminar Flow Diffusers with High Efficiency Filter

.1 Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

.2 Provide 18 month manufacturer warranty from date of shipment for laminar flow diffusers.

.3 Basis of Design: Price Industries, Inc., Laminar flow diffuser with high efficiency filter: Model LFDCSS

.2 The laminar flow diffusers shall be non-aspirating, unidirectional type, providing a filtered air at controlled low velocity with minimal entrainment of room air to satisfy the requirements of ASHRAE Standard 170.

.3 Components:

.1 Plenum material shall be 304 Stainless steel

.2 Face and frame material shall be 304 stainless steel

.3 Plenums shall have an airtight seal preventing contaminants in the interstitial space from being drawn into the diffuser plenum and mixing with conditioned air that is being delivered to the clean space.

.4 A diffuser knife edge shall be integral to the mounting frame, penetrating a silicone or urethane gel seal to prevent leakage between the filter and housing.

.5 Plenum and knife edge shall be factory PAO scanned according to standard IEST-RP-CCO34.3 to ensure a leak free assembly.

.6 A static pressure port accessible from the room side shall be factory supplied to measure pressure drop across the filter, and to sample aerosol concentrations before the filter.

.7 Air shall be admitted to the plenum through an inlet collar and an optional butterfly style volume control damper.

.8 The diffuser plenum shall feature four (4) integral hanger tabs for securing the unit to structural supports above the ceiling.

.9 Mounting frames shall utilize corner alignment brackets.

.10 Four (4) thumb wheel retainers hold the filter in the housing, allowing filter removal and replacement without disturbing the ceiling seal or duct connections.

.11 The 51% free-area perforated distribution plate shall be secured to the face using quarter-turn fasteners with anti-slip, snap-in retainers and stainless steel retainer cables for ease of installation and removal.

.4 Filter type shall be High Efficiency Particulate Air (HEPA) filter shall provide 99.99% efficiency on .30 µm particulate.

.5 Plenum Finish shall be

.1 The paint finish must demonstrate no degradation when tested in accordance with ASTM D1308 (covered and spot immersion) and ASTM D4752 (MEK double rub) paint durability tests.

.2 The paint film thickness shall be a minimum of 2.0 mils.

.3 The finish shall have a hardness of 2H.

.4 The finish shall withstand a minimum salt spray exposure of 1000 hours.

.5 The finish shall have an impact resistance of 80 in-lb.

.6 Stainless steel with mill finish.

.6 Face and frame finish shall be

.1 The paint finish must demonstrate no degradation when tested in accordance with ASTM D1308 (covered and spot immersion) and ASTM D4752 (MEK double rub) paint durability tests.

.2 The paint film thickness shall be a minimum of 2.0 mils.

.3 The finish shall have a hardness of 2H.

.4 The finish shall withstand a minimum salt spray exposure of 1000 hours.

.5 The finish shall have an impact resistance of 80 in-lb.

.6 Stainless steel with #4 brushed finish on all exposed surfaces.

.7 Options:

.1 LED status indicator light shall be either factory supplied or loose shipped for field installation.

.2 The LED indicator light shall be visible from the occupied area to determine the filter loading status or the motor status without opening the diffuser.

.3 The LED light shall turn from green to yellow when the pressure drop across the filter exceeds the specified limit.

.4 The LED kit shall turn from green to red to indicate the motor is not functioning.

.5 The LED kit shall be provided with a switch, factory pre-calibrated for 150% of initial clean filter pressure drop.

.6 The LED kit shall operate on a 24 VAC power supply, provided by others.

.8 External Insulation

.1 The diffuser plenum shall be externally insulated with ½" aluminum foil-backed fiberglass insulation

.2 Insulation shall not contain formaldehyde.

.3 Insulation and adhesive surface burning characteristics shall have a maximum flame/smoke spread of 25/50 when tested in accordance with ASTM E84. Secure insulation with adhesive. Coat edges exposed to airstream with NFPA 90A approved sealant.

.4 Insulation shall meet the requirements of ASTM-84 and UL 723.

.9 Volume Control Damper

.1 The volume control damper shall be Room-side adjustable by turning a screw without removing the diffuser face or filter.

.1 The operator shaft shall be positively sealed against leakage.

.2 The damper finish shall be Stainless steel construction.

.10 Quarter-turn fastener material shall be Stainless steel construction

.11 Inlet Diffusion basket

.1 The diffusion basket shall equalize air distribution over the filter media to improve filter loading and extend filter life.

.12 Aerosol test system:

.1 An aerosol test system shall be provided for injecting aerosol challenge into the diffuser from the room side to allow the filter and housing to be scanned for leaks during commissioning or after filter replacement.

.2 Aerosol concentrations upstream of the filter shall be sampled through the static port.

.13 Verify that conditions are suitable for installation.

.14 Verify that field measurements are as shown on the drawings.

.15 Install in accordance with manufacturer's instructions.

.16 See drawings for the size(s) and locations of laminar flow diffuser inlets.

.17 Support components individually from structure in accordance with SMACNA (SRM).

.18 Do not support components from ductwork.

.19 Connect to ductwork in accordance with Section 203 31 00.

.20 Ensure supply air to the laminar flow diffusers by performing pitot traverse of the main supply duct.

.21 Balance outlets according to manufacturer's recommendations.

.22 Verify that field measurements are as shown on the drawings.

.1 Standard of Acceptance:

.1 E.H.Price – Model LFDCSS

2.4 LOUVRES - MOTORIZED

.1 Standard of Acceptance: Price

.2 Refer to drawings for sizes and air quantities.

.3 Minimum Requirements:

.1 Extruded aluminum: frame depth 100 mm [4"].

.2 Blades limited to 45 deg. to horizontal in open position.

.3 Blades at 127 mm [5"] centres with up-turned rain stops on trailing edges.

.4 Concealed motor operator.

.5 Electric motor to be included (120/1/60).

.6 Finish as scheduled: Baked enamel finish to Architects choice.

.7 Removable 1.3 mm [16 ga] aluminum wire birdscreen with 12 mm [1/2"] mesh.

2.5 LOUVRES - STATIONARY

.1 Standard of Acceptance: Price

.2 Refer to drawings for sizes and air quantities.

.3 Minimum Requirements:

.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.

.5 Birdscreen mounted in 0.66 mm [20 ga] thick aluminum folded frame. Frame to be installed inside louvre.

.6 Mounting as scheduled: flat flange.

.7 Formed metal sill plate, 1.6mm [14 gauge] aluminum, finished to match louvre.

.8 Jamb drainable blade

.9 Continuous blade appearance.

.10 Finish as scheduled: Baked enamel finish to Architects choice

.4 Specific:

.1 Frame 150 mm [6"] deep.

.2 150 mm [6"] deep blades inclined at 35 deg. to the horizontal.

.3 Blades at 90 mm [3-1/2"] on centres.

.4 Blades arranged with up-turned rain stops on trailing edges and drip channel on leading edges.

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 Where air terminals are installed in mechanical grid ceilings, provide at least two 12 ga. galvanized steel wire seismic security bridles per air terminal tied either to the building structure or to ceiling hanger wires. Attach security bridles at opposite corners of each air terminal and in such a manner that the air terminal cannot fall.

.7 Hand over door grilles to the General Contractor for installation.

.8 Diffuser, grille, and register cores in air systems shall be removable for cleaning

3.2 LOUVRES

.1 Provide all necessary flashing and counterflashing for louvres installed in walls.

.2 Caulk louvre and flashing and counterflashing to make installation water tight.

.3 Blank-off panels shall be constructed to SMACNA standards, minimum 20 Ga. Sandwich panel with 25 mm [1”] thick fibreglass insulation.

.4 All blank-off panels shall have a painted flat black enamel finish.

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.

Part 2 Products

2.1 COILS - LIQUID

.1 For details and performance, refer to separate equipment lists.

.2 Standard of Acceptance: Colmac

.3 Ratings: ARI Standard 410 certified.

.4 Fins: Aluminum fins continuous across entire coil width, with full fin collars for maximum fin-tube contact and even spacing. Fins mechanically bonded to tubes. Fins not to exceed 12 in 25 mm [1"].

.5 Tubes: 16 mm [5/8"] O.D. Seamless copper tubes with return bends brazed into tube ends.

.6 Headers: Cast iron, copper or steel pipe.

.7 Casing: Galvanized Steel, formed end supports and top and bottom channels with additional center support on coils over 1067 mm [42"].

.8 Casing (cooling coils): Coil frames shall be 304 SS.

.9 Connections: Drain and vent threaded plug connections.

.10 Testing: Factory air pressure test under water to 1700 kPa [250 psig] and hydraulic tested to 860 kPa [125 psig].

.11 Glycol Coils: Where glycol coils are specified, coils shall be suitable for use with ethylene or propylene glycol at the scheduled percentage by volume.

2.2 COILS - FACE AND BYPASS

.1 For details and performance, refer to separate equipment lists.

.2 Standard of Acceptance: WING VIFB

.3 Ratings: ARI Standard 410 certified.

.4 Finned heating elements: Seamless 16 mm [5/8"] vertical copper tubes with rectangular fins. Each tube individually secured to steam and return headers by a brazed joint with provision for individual tube expansion.

.5 Headers: Steel or copper.

.6 Casing: 1.7 mm [14 ga] thick steel, galvanized and painted with rigid framework.

.7 Dampers: Clam shell dampers shall completely enclose the heating coil passes, isolating them from the air stream. Volume of air passing through coil shall not vary more than +/- 5% regardless of position of internal dampers. Damper actuators to be supplied by the Controls Contractor.

.8 Testing: Factory tested to 1700 kPa [250 psig] steam and hydraulically to 3450 kPa [500 psig].

Part 3 Execution

3.1 INSTALLATION

.1 Refer to manufacturer's installation drawings.

.2 Install according to piping layout. Provide for pipe movement during normal operation.

.3 Provide airtight seal between coil and duct or unit cabinets.

.4 Verify electrical service work with characteristics stamped on unit.

.5 Cooling coil supports shall use Type 304 stainless steel.

.6 All bolts and fastenings shall be stainless steel.

.7 Connect water supply to bottom of supply header and return water connection to top in order to provide self-venting and reverse return arrangement.

.8 Provide coil drain pans under all coils; not just cooling coils. Drain lines for coils other than cooling coils may be capped outside of unit casing.

.9 Ensure coils and fins and flanges are not damaged. Replace loose and damaged fins. Comb out bent fins unless they need to be replaced.

.10 Drain line from drain pans shall be minimum 32 mm [1-1/4”]

.11 Pipe drain lines to floor drain with deep seal trap and trap primer.

.12 Venting:

.1 On up-fed units provide screw driver vent on convectors and standard air vent with cock on continuous wall convectors.

.2 On unit heaters and cabinet unit heaters provide standard air vent with cock unless piping is installed above units and is self-venting into mains.

.3 Pitch heating elements to assist air venting.

.13 Valves:

.1 Install isolating gate valve on supply and lock shield globe valve on return, together with control valve shown or specified in the Controls Section.

.2 In public areas use lock shield type on supply and return for isolation.

.14 Steam Units

.1 Use float and thermostatic traps for steam coils.

.2 Provide vacuum breaker for steam coils.

.3 Provide 6 mm [1/4"] petcock cracked open for continuous air venting on steam face and bypass coils.

.4 Face and bypass coils shall be connected to condensate piping with braided flexible hose.

.5 Demonstrate to the Consultant that all face and bypass dampers fully open and fully enclose the coil sections.

.15 Completion

.1 Clean coils and comb fins on finned elements.

.2 Set dampers and isolating valves open.

.3 Re-finish units damaged during installation.

END OF SECTION

ITEM	ACCEPTABLE PRODUCTS / SUPPLIERS / MANUFACTURERS	SHOP DWG.
ACCESS DOORS	Acudor, Maxam, Milcor, Mifab	X
ACCESS PANELS	Nailor, Ventlok	X
AIR TERMINALS	Price, Nailor, Titus	X
AIR TERMINAL UNITS	Price, Nailor, Titus	X
AIR TERMINAL – VENTURI VALVES	Phoenix, EH Price	X
BACKDRAFT DAMPERS	Airolite 625, Penn CBD-6, Ruskin CBD-4, Nailor	X
COILS	Aerofin, Colmac, Eng. Air, McQuay, Trane, Haakon, Huntair	X
CONTROL DAMPERS	Arrow-Foil PBDAF & OBDAF, Honeywell Moduflow D642 & D643, Johnson Proportion/Aire D-1200 & D-1300, Ruskin CD36, Tamco 1000, Nailor 1010,	X
CONTROLS	Controls Systems are to be Supplied and Installed by the base building Controls contractor (ESC Automation)	X
DUCT CONNECTORS FLEXIBLE	Duro Dyne "Durolon", Ventfabrics - "Ventlon", Dynair Hypalon	X
DUCTWORK - SPIRAL	United Sheet Metal, B.C. Ventilating, Spiro-Lok	X
DUCTWORK FLEXIBLE	Thermaflex, Flexmaster, Wiremold	
FANS		
Centrifugal (Including Plug)	Barry, Chicago, Northern Blower, Trane, Twin City	X
Centrifugal Fume Exhaust –	Loren Cook, Strobic, Twin City	X
FILTERS	AAF, Cambridge, Camfil Farr	X
FILTERS - Fibreglass Free	Viledon, Tridec	X
FILTER GAUGES	Dwyer, Cambridge	X
FIRE / SMOKE DAMPERS	Controlled Air, Ruskin, Nailor	X
INSULATION	Certainteed, Fiberglas, Knauf, Johns-Manville, PPG, Manson	X
INSULATION – FIBRE FREE	Armacell AP/Coilflex, K-flex	X
PIPE CONNECTORS (FLEXIBLE)	**Mason, Victaulic (flexible couplings)**	X
SEISMIC ISOLATORS	Mason, USS Snubbers	X

ITEM	ACCEPTABLE PRODUCTS / SUPPLIERS / MANUFACTURERS	SHOP DWG.
SILENCERS	IAC Acoustics, Korfund, Vibro-Acoustics, Vibron Kinetics, Ruskin, VAW Systems	X
VALVES	Jenkins, Anvil, Crane, Red-White, Toyo, Kitz, Nibco, Apollo	
VARIABLE SPEED DRIVES	ABB, Allen-Bradley, Baldor, Hitachi, Graham, Siemens, Teco-Westinghouse, Toshiba	X
VIBRATION ISOLATORS	Mason, Korfund, VMC, Vibro-Acoustic	X

NOTE:

.1 The design is based upon the equipment listed in the equipment schedules and/or underlined in the H.V.A.C. Equipment Supplier Schedules.

.2 **X** Denotes required submission.

END OF SECTION

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 Sections 01 91 13 – Commissioning General Requirements and 23 08 00 – Commissioning of Mechanical for additional responsibilities of the BAS contractor

1.2 SCOPE OF WORK

.1 The new control system shall be connected to the existing Queen Charlotte Hospital Building Automation System.

.2 This project includes the renovation to the existing compounding pharmacy in order to meet NAPRA model standard requirements for Hazardous and Non-Hazardous Sterile Compounding. Some existing valves

.3 The Controls Contractor shall provide the following:

.1 Standalone Pharmacy Room Pressurization, temperature, and airflow control (see Section 25 09 35 for full requirements) with BACnet connections for status and alarms conditions (Phoenix Control Systems).

.2 Integrated control of the new hazardous exhaust fans to the existing building management system (Delta Controls).

.4 The new controls and systems shall be integrated into the existing system and operator interface shall be through the existing operator's workstations. In addition, the new systems will provide access to Facility & Energy Management Software Use through the Delta Controls enteliWEB system. The intent is to centralize the facilities building management operation and collect real-time data about energy use for the Interior Health Facilities. located in _XXXXXX_

.5 Refer to Section 23 99 60 Mechanical Forms and submit all documentation therein that is applicable to Division 25 Controls and Instrumentation.The control will be coordinated and provided by ESC Automation including the generation of new graphics for all control components.. BMS graphics to be updated to suit new controls system.

1.3 CODES, BYLAWS, STANDARDS AND APPROVALS

.1 Where multiple versions of the same code are published, the most recent version shall be applied, unless noted otherwise by building codes and local by-laws.

1.4 GENERAL

.1 The control system is to be fully microprocessor based.

.2 The controls system is to be complete with all necessary control components and connections to achieve the specified functions and to permit the H.V.A.C. systems to perform properly in the manner described and as hereinafter specified.

.3 The controls contractor shall furnish all materials, including all central computer hardware and software, operator input/output peripherals, standalone DDC panels, automation sensors and controls and wiring.

.4 The controls contractor shall be responsible for the design, installation, supervision and labour services, calibration, all software programming, and checkout necessary for a complete and fully operational Building Automation System and meet the requirements of the NAPRA model standards for Hazardous and Non-Hazardous Sterile compounding.

.5 The control system is to be set up and adjusted to achieve optimum operation of the Pharmacy systems and other H.V.A.C. system. This includes sequencing, timing and readjustment, as required. Modifications to the sequence of operation using points indicated will not be considered as extra to the Contract. These modifications to continue

through the construction period, commissioning period and warranty period as required to achieve optimum operation of the mechanical system.

.6 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.

.7 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..

.8 When preparing shop drawings, review the proposed sequences, suggest improvements and review these with the Consultant.

.9 Work with the other parties involved in commissioning, assess how the programming can be modified to improve function, review this with the Consultant and modify the programming as instructed by the Consultant.

.10 The control system shall be a modular, flexible and fully commissioned Direct Digital Control (DDC) System except that controls not scheduled on the points list may be electric. Items identified in the sequence of operation as being under DDC control but which are not included in the points list shall be included in the DDC system.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Division 1 and Division 25.

.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 One-line diagram from sensor and control points to Field Interface device and/or standalone DDC panel including all components and cables.
- .6 Terminal cabinets, including termination listing.
- .7 Written description indicating sequence of operation. Shop drawings will be rejected if the written description is not included with the submission. Sequences should reference English descriptors and labels for each point described.
- .8 All input/output points which shall include the following information associated with each point.
  - .1 Sensing element type and location.
  - .2 Details of associated field wiring schematics and schedules.
  - .3 Software and programming details.
- .9 Detailed block diagrams of transmission trunk routing and configuration.
- .10 Valve and damper schedules indicating size, configuration, capacity and locations. If size varies greater than 10%, obtain approval of Consultant.
- .11 Copies of all system graphics complete with system specific point labels.

1.6 OPERATING & MAINTENANCE MANUALS

.1 The maintenance manual data is intended to cover the operation and maintenance of all control systems and equipment installed. Forward 3 copies of the Controls and Instrumentation section of the operating and maintenance manuals to the Balancing Agency to ensure the binding and format of material are compatible. Ensure sufficient

time has been given to the Balancing Agency for the compiling of the complete operating and maintenance manuals by the commissioning deadline. One complete manual shall be furnished prior to the time that system or equipment tests are performed.

.2 The manuals shall include the name, address and telephone number of the control subcontractor installing the systems and a list of emergency numbers for service personnel. The manuals shall have a table of contents and be assembled to conform to the table of contents with the tab sheets placed before instructions covering the subject.

.3 Manuals shall be furnished which provide full and complete coverage of the following subjects:

.1 **Operational Requirements:** This document shall describe, in concise English terms, all the functional and operational requirements for the system and its functions that have been established. It shall not require knowledge of digital processor programming or electronic techniques or control system theory.

.2 **System Operation**: Complete guidance and procedures for operation of the system, including required actions at each operator station; operation of computer peripherals; input and output formats and procedures; and emergency, alarm, and failure recovery procedures. Provide step-by-step instructions for system startup, back-up equipment operation, and execution of all system functions and operating modes.

.3 **Functional Description**: Detailed documentation, in language readily understandable to 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 **Software:** Documentation of the theory, design, interface requirements, and functions of all software modules and systems for all digital processors. Include test and verification procedures and detailed descriptions of program requirements and capabilities. Provide all data necessary to permit modification, relocation, or other reprogramming and to permit combination of new and existing software modules to respond to changing system functional requirements without disrupting normal control system operation. Include, as a minimum, for all software modules, fully annotated source code listings, error-free object code files ready for loading via a peripheral device, and complete program cross reference, plus any calling requirements, data exchange requirements, necessary subroutine lists, data file requirements, and other information necessary to ensure proper loading, integration, interfacing, and program execution. All DDC panel software shall be provided individually for each DDC panel while a single section shall reference all DDC panel common parameters and functions.

.5 **Maintenance:** Documentation of all maintenance on all system components including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective units. Include calibration, maintenance, and repair of all sensors and controls, plus diagnosis and repair or replacement of all system hardware.

.6 **Test Procedures and Reports:** The test implementation shall be recorded with a description of the test exercise script of events and documented as Test Procedures. A provision for the measurement or observation results, based on

the previously published Test Specification, forms the Test Reports. The procedures record and the results of these exercises shall be conveniently bound and documented together.

.4 Refer to Section 23 05 00 for additional requirements.

1.7 WARRANTY

.1 Refer to General Conditions for additional information.

.2 The system including all hardware and software components shall be warranted for a period of one year following the date of final acceptance per department. Any manufacturing defects arising during this warranty period shall be corrected without cost to the Owner.

.3 All applicable software as detailed in this specification shall be updated by the Controls Contractor free of charge during the warranty period. This will ensure that all system software will be the most up-to-date software available from the Controls Contractor. All future patches to the software shall be made available to the Owner.

.4 Repairs required by a total system failure, or the malfunction of any priority portion of the system shall be considered an emergency repair, and shall be performed within eight (8) hours of the report of the failure.

.5 Repairs of a non-emergency nature shall be promptly repaired on the next normal business day.

.6 Provide written assurance that a local service centre will be maintained with a complete stock of replacement parts, and capable of servicing any and all troubles in the system.

.7 Use of installed equipment during construction shall not shorten or alter the warranty period as specified in the General Conditions.

.8 Take note of and provide any extended warranties specified.

1.8 ELECTRICAL COMPONENTS, WIRING AND CONDUIT

.1 By Division 25 Control Contractor (ESC):

.1 All control system components to make a complete and operable system, except those supplied as part of packaged equipment controls, but including all auto-sequencing devices and electrical interlocks required to accomplish the sequences specified hereafter. Refer to the electrical equipment schedule, the electrical drawings and the electrical specification, which describes the limits of the extent to the work in Division 26 serving mechanical systems. Materials, equipment, connections and power not provided by Division 26 but required for the Control System shall be provided under this section.

.2 All control circuit transformers (120/1/60 or 24/1/60 and as designated).

.3 All control wiring and metallic conduit for mechanical system controls.

.4 Supply, installation and connection of all electric control items including: damper motors, relays, outside sensors, sub-master control circuits, safety devices, electric thermostats, aquastats, flow switches, wiring to terminal strips, proportional controllers, controllers, etc..

.5 All wiring and conduit from power distribution system to any control devices needing power (including B.M.S components)

.6 Be responsible for coordinating with Division 26.

.7 Electrical work installed under Division 25 shall be to the standards specified under Division 26. Refer to Section 26 05 34 for additional information.

.2 By Division 26 Electrical:

.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 Fire alarm signals.

.3 Note Division 25:

.1 All magnetic starters for equipment shall have the following features supplied under this division:

.1 Hand-off-automatic selector or on-off selector or start-stop buttons in cover with hand-automatic bridge if applicable.

.2 120-volt coils;

.3 120-volt control transformer and

.4 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 Refer to electrical specification sections for overall wiring requirements.

.2 Wiring shall match electrical wiring requirements to ensure consistent wiring is provided throughout the project.

.3 Carrier System – Open, exposed areas including mechanical, electrical and equipment rooms:

.1 All wiring shall be run in EMT conduit except the final 900mm of wiring to all operators and to all sensors subject to vibration, which shall be run in flexible metallic conduit.

.2 Provide steel fittings with nylon throats for all conduit connections.

.4 Carrier System – Concealed, accessible areas.

.1 Class II low voltage BMS open cable, neatly bundled, shall be routed parallel to building lines. Cable may follow ductwork routing and may be tied to the side or top of the ducting at duct supports, using suitable cable ties. If cabling does not follow ducting, it shall be fixed to the structure, supported at a minimum of every 5m. Open cable must be properly rated per electrical code.

.5 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

.6 Cable:

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

.7 Note:

.1 Run carrier system parallel to building lines.

.2 Support conduit carrier system one meter on centre 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.

.5 Wiring for B.M.S Life Safety Systems:

.1 Conductors for communications between the front-end CPU and standalone DDC panels and between DDC panels shall be high temperature, 200°C, Teflon FEP insulated and jacketed, shielded twisted cable pairs of minimum 18 gauge provided by the controls contractor for the distances involved. Wiring shall be fully redundant for separate channels of communication to the CPU via a different route (so as to protect the communication links in the event of a fire in a particular area).

1.9 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 :

.1 Automatic control valves.

.2 Temperature sensor wells.

.3 Automatic control dampers.

.4 Pressure tappings.

.5 Static pressure sensors.

.6 Flow switches.

.2 The Controls Subcontractor shall be responsible for arranging, coordinating and supervising the installation of the above devices in a suitable manner and readily accessible location.

1.10 ALARMS - GENERAL

.1 No alarm shall be triggered for a device until the device has been started and is in stable operation. Use software time delays to achieve this effect.

.2 Generate an alarm on the B.M.S. if any equipment is not in the intended operating condition or if any analog input is not within the intended operating range.

1.11 IDENTIFICATION

.1 Identify all controls with symbols relating directly to the control diagram. Use plasticized tags, engraved brass, aluminum, metalphoto or lamicoid labels and secure them to, or adjacent to, the control devices with key chains or cable ties.

.2 All manual switches supplied by this trade, unless they come with standard nameplates, shall be labelled with engraved lamicoid plastic nameplates to clearly indicate the service. Wording on nameplates shall be subject to approval by the Consultant.

.3 Where "day" and "night" thermostats are adjacent to one another they shall be labelled with engraved lamicoid plastic nameplates.

.4 Motor control centre and motor starters should be provided with labels identifying that motors are under remote control.

.5 Mount an input/output layout sheet within each main DDC panel. This sheet shall include the name of the points connected to each controller channel.

.6 Identify all DDC panels and associated devices with symbols relating directly to the control diagram. Provide durable wire labels for each input and output point with the following information:

.1 Point descriptor.

.2 Point type and channel number.

.3 Corresponding DDC panel number.

1.12 SYSTEM COMMISSIONING AND CALIBRATION

.1 Program each standalone DDC panel immediately following installation.

.2 Set up and calibrate all control loops and sensors during the initial start-up of the systems and check, recalibrate and readjust as necessary during the Owner's Demonstration and Instruction period.

.3 Upon completion of the installation, perform all necessary testing and debugging operations satisfactorily.

.4 Perform all modifications and alterations as required to correct any deficiencies noted during these tests.

.5 Check sensor calibration and control system operation during the first heating season and prior to the first cooling season.

.6 Following each visit submit printed graphs of trend logs one week in duration with hourly samples for all analog inputs connected to each DDC panel.

1.13 VERIFICATION OF SYSTEM COMMISSIONING

.1 Preliminary Tests

.1 After installation of each part of the system and completion of mechanical and electrical hook-up, perform tests to confirm correct installation and functioning of equipment.

.2 Notify the Consultant 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 Consultant.

.6 Demonstrate the proper operation of each component.

.7 Correct any deficiencies and re-test in the presence of the Consultant, 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.

.2 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.

.3 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.

.4 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.

.5 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.

1.14 DEMONSTRATION AND INSTRUCTION TO OWNER

.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.

.2 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.

.3 The number of instruction furnished shall be, as specified below, as a minimum.

.4 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.

.5 Training Program: The training program shall be accomplished in two phases.

.1 First phase: this phase shall be for a period of at one day at a time mutually agreeable between the Contractor and Owner. 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 Changes to the existing contol system architecture.

.2 System communications.

.3 Operational changes and new peripheral devices including the pharmacy differential pressure monitoring and control system elements.

.4 Elementary preventative maintenance.

.5 New report generation.

.6 Operator control functions.

.2 Second phase: this phase of training shall be conducted four to eight weeks after system acceptance for a period of one to two days as required. The training shall include as a minimum, but not be limited to:

.1 A review of Phase 1 training, response to any questions etc.

.2 Equipment maintenance - this training shall include:

.1 General equipment layout.

.2 Trouble shooting of all control system components.

.3 Preventative maintenance of all control system components.

.4 Sensors and controls maintenance and calibration.

.3 Programming - this training shall include:

.1 New system architecture.

.2 New application programs.

.3 DDC panel programming.

.4 Software access code review.

1.15 MAINTENANCE SERVICE DURING THE WARRANTY PERIOD

.1 The Contractor shall provide all services, materials and equipment necessary for the maintenance of the entire Control System, for a period concurrent with the warranty period. Any necessary material required for the maintenance work shall be provided by the Contractor.

.2 The Controls Contractor shall provide minor and major inspections, as required, by the manufacturer, and all service for the required maintenance.

.3 Major Inspections: these inspections shall include but not be limited to the following:

.1 Work as detailed hereinafter for minor inspections.

.2 Clean all peripheral equipment, CPU, interface panels, multiplexing panels and microprocessor interior and exterior surfaces.

.3 Provide signal, voltage and system isolation checks of all CPU, interface panels, multiplexing panels and peripherals.

.4 Provide mechanical adjustments

.5 Check and/or calibrate each field input/output device.

.6 Run system software diagnostics as required.

.4 Minor Inspections: Provide inspections as required by KLH facility and Maintenance staff. Regular service calls shall be performed during regular working hours, 8:00 a.m. to 4:30 p.m. Monday through Friday excluding legal holidays.

.5 Emergency Service:

.1 The Owner will initiate service calls when there is indication that the control system is not functioning properly.

.2 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 Owner.

.3 The Contractor shall furnish the Owner 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.

.4 Repairs of a non-emergency nature shall be promptly repaired on the next normal business day.

.6 Records and Logs: records and logs shall be kept of each maintenance task.

.7 System Modifications: recommendations for system modification shall be provided in writing to the Consultant. No system modification, including operating parameters and control settings, shall be made without prior approval.

.8 Software: provide implementation of all software maintenance updates. These shall be accomplished as required and full coordination with control system supervisory personnel shall be maintained.

END OF SECTION

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 REQUIREMENTS

.1 Provide all new required remote sensing points and instrumentation as required for the complete operational capability of the Control System. All sensors shall have the accuracies as stated hereinafter. Hysteresis, relaxation time, span, maximum / minimum limits, etc. shall also be accounted for in all application of sensors and controls.

.2 All instruments of a particular category shall be of the same type and manufacture.

.3 All external trim material shall be completely corrosion resistant with all internal parts assembled in watertight, shockproof, vibration proof, heat resistant assembly.

.4 Use standard conduit box termination with screwdriver connector block unless otherwise specifically stated.

.5 Operating conditions -5°C to 60°C with 10-90% RH (non-condensing) unless otherwise specifically stated or required.

Part 2 Products

2.1 GENERAL

.1 Control Devices provided by the Control Contractor ESC automation..

.2 Generally, all control devices shall be

.1 Compounding Pharmacy Controls to be Phoenix including Venturi Valves, Controllers, Terminal Display Units and Differential Pressure Control Display Panels and associated equipment.

2.2 SOFTWARE

.1 For the new control systems provide connections to the existing BMS. System shall be a web-based application that centralizes building management operation, site engineering and energy analytics. The system shall provide the ability to create personal dashboards for staff.

2.3 AIR VALVE CONTROLLERS

.1 See Specification Section 25 09 35 for additional information

.2 Microprocessor based terminal unit controllers (TUC's) (ASC – ASHRAE's standards for naming unitary controllers) and damper actuators for the air valves will be supplied by the Controls Contractor. The TUC's shall be provided in a pre-assembled control box for mounting on the air valve.

.3 The Air Valve controller shall be a native BACnet® controller with an integrated airflow sensor and damper actuator for VAV applications, available in both configurable and hybrid-programmable versions.

.4 Controller to provide a wide range of VAV configurations including multi-stage reheat with analog, binary or floating control, and series or parallel fan boxes. Controllers to provide, through the BMS tracking of VAV box airflow between supply and return boxes to allow for pressure control between rooms as outlined on the drawings and recommended by CSA Z317.2.

.5 Features

.1 Native BACnet firmware allows easy integration with any BACnet system

.2 Local scheduling, trending, and alarming support

.3 Built-in configurable VAV algorithms for quick setup and commissioning

.4 Optional hybrid-programmable option allows customization for non-standard sequences or repurposing unused I/O

.5 Universal outputs provide flexibility for any combination of analog, binary, or floating output stages

.6 Firmware upgrade and database load / save over the network

.7 Provide communication using BACnet MS/TP on a RS-485 main LAN port.

.8 Provide RS-485 subLAN port for the optional addition of a Delta LINKnet network sensor(s)

.9 RS-485 subLAN supports up to 4 DNS or eZNS LINKnet network sensors

.6 The necessary interface requirements for the multi-point flow sensor shall be provided by the Controls Contractor (confirm exact requirements with the air valve manufacturer).

.7 Controller and actuator shall be field mounted on the air valve by the controls contractor.

.8 The Controls Contractor shall be responsible for ensuring that the controllers and damper actuators are suitable for the units and that the characteristics of the boxes listed in the drawings are met.

.9 Controls shall be arranged for pressure independent, variable volume and constant volume operation.

.10 Resettable to any air volume between zero and maximum rated volume.

.11 The Controls Contractor shall provide all necessary assistance to air valve manufacturer for factory / laboratory testing of air valves. One unit of each size air valve shall be factory tested under varying pressure and flow conditions.

.12 Refer to Section 25 09 20 or 25 for TUC specifications.

.13 Refer to Section 23 36 00 for air valve specifications.

.14 Standard of Acceptance:

.1 Delta Controls eZV-440

2.4 CURRENT SENSING (CR)

.1 Design: Nelsen-Kuljian; Greystone, Veris, RIB (Functional Devices).

.2 Range: 0-120 amps.

.3 Accuracy: +/-1%.

.4 Split core type if required by owner

.5 Interface care:

.1 +/-1% accuracy.

.2 Integral zero and span adjustment.

.3 1-5 VDC or 4-20 mA output for full range input.

2.5 CONTROL DAMPERS

.1 Minimum Requirements:

.1 Provide control dampers configured as follows:

.1 Modulating; opposed blade dampers.

.2 Mixing; parallel blade dampers.

.3 Two position; parallel blade dampers.

.2 Assemblies - rigid and adequately braced with corner gussets.

.3 Galvanized steel or extruded aluminum frames.

.4 Maximum frame dimensions - 1220 mm [48"] wide and 1220 mm [48"] high, unless otherwise indicated. Multiple sections to have stiffening mullions.

.5 Maximum blade width - 200 mm [8"].

.2 Low leakage control dampers:

.1 Minimum performance, based on 610x610 [24"x24"] damper size as tested in an independent testing laboratory:

.1 Maximum 62 Pa [0.25"] static pressure drop at 15.2 M/s [3000 fpm] (damper fully open).

.2 Maximum 55 L/s / sq m [10.75 cfm/sq.ft] leakage at 747 Pa [3" wg] (Damper fully closed).

.3 Maximum blade length of 1219mm [48"] suitable for minimum 100 Pa [4" wg] and 15.2 M/s [3000 fpm] velocity.

.2 Minimum 2.0 mm [14 ga] galvanized steel airfoil type or 2.1mm [12 ga] extruded aluminum airfoil type blades.

.3 Synthetic sleeve type bearings (no metal to metal contact).

.4 Linkage concealed within the damper frame.

.5 Square or hexagonal axles locked into blades.

.6 Synthetic rubber blade seals mechanically locked into the blade edge (adhesive or clip-on type seals not acceptable).

.7 Flexible metal compression type or extruded synthetic rubber jamb seals.

.8 Standard of Acceptance: T A Morrison 1000.

.3 Note:

.1 Control dampers integral to air handling units provided, and factory installed, by the unit supplier (actuators by this Division). All other control by this Division. Control dampers supplied by the unit manufactures shall follow the above specifications

.2 Instruct the Sheet Metal Trade on damper installation.

.3 Indicated size is outside frame dimension. Increase size of damper and oversize ductwork, to include for depth of the frame, for all dampers with a pressure drop greater than 12 Pa [0.05" w.g.]. Confirm with the Sheet Metal Sub-Contractor before fabrication.

.4 Check that dampers are installed square and true and that blades close tightly against seals and stops.

.5 Blades to be horizontal in vertical mounted dampers. Refer to drawings for orientation of dampers.

.6 Ensure that damper end-linkages are easily accessible (coordinate with the Sheet Metal Sub-Contractor).

.7 Provide an additional drive shaft bearing if the drive shaft is longer than 75 mm [3"].

.8 Do not install dampers within the thickness of any wall unless otherwise indicated (coordinate with the Sheet Metal Sub-Contractor).

.9 Dampers shall be adequate for the maximum system pressure. Refer to the appropriate Section of the specification.

2.6 CONTROL DAMPER ACTUATORS

.1 General:

.1 Valve operators shall allow smooth operation of the valve throughout its entire range and assure tight shut-off against system pressure.

.2 Valve actuator shall be easily removed from the valve body for replacement.

.2 Electric Two Position Valve Actuators (VTE):

.1 Two Position Control Valve Actuators (only to be used where specifically specified):

.3 Incremental Control Valve Actuators (only to be used where specifically specified) (VMI):

.1 The valve actuator shall modulate the control valve between the fully open and closed position based upon a 3-wire control signal (24 VAC). The actuator shall remain in position until the signal is applied.

.2 The valve shall maintain its shutoff force even if power is lost.

.3 The TUC shall calculate valve position based on the motor speed and duration of control signal. The valve shall be driven to a full position and the calculation reset once every 24 hours.

.4 Proportional Control Valve Actuators (VME):

.1 The valve actuator shall modulate the control valve between the fully open and closed position based upon a 0-10 VDC or 4-20 mA control signal. The actuator shall remain in its position until the applied signal changes. In the event of a control signal loss, the actuator shall move to the zero-voltage input position.

.2 The valve shall maintain its shutoff force even if power is lost.

2.7 CONTROL VALVES

.1 All characteristics of control valves shall be suited to the required application. Three-way mixing valves shall be linear for each port giving constant flow, and two-way valves shall have modified linear flow characteristics.

.2 All valves shall be plug type with stainless steel stems and EPT ring pads or teflon packing.

.3 Valve pressure / temperature rating - minimum ANSI Class 125.

.4 Plugs shall be brass with molded composition discs.

.5 Discs (renewable) shall be bronze for media 110°C or less and stainless steel for media above 110°C operating temperature.

.6 Valve bodies for NPS ½ shall be screwed cast brass with integral seat.

.7 Valves NPS ¾ to NPS 2 shall have screened cast brass body and cast brass cage with integral seat.

.8 Valve bodies for NPS 2½ and up shall be cast iron flanged.

.9 All control valves supplied with positive positioning relay shall have a minimum of 27-76 kPa spring range.

.10 Note:

.1 Size control valves according to capacities and pressure drops as indicated in the schedules.

.2 Clearly identify the control valve coefficient (Cv) rating on valve bodies.

.3 All primary building heating valves shall fail open to heating (valves on terminal units may fail either open or to the last operating position). Cooling valves shall fail closed to cooling or to the last operating position. Domestic hot water heating valves shall fail closed to heating.

.4 Control valves to be supplied by this trade for installation by others.

.11 Design: NPS ½ to NPS 2 - Johnson Controls VG7000 series or Delta Equivalent. NPS 2½ and larger - Johnson Controls cast iron flanged globe valves V5252, V5842.

.12 Standard of Acceptance: Honeywell V5011 and V5013 series (V5812 series for terminal units); Barber Colman 9213 and 9313 series; Landis & Gyr Powers 656, 658, 591, 592, 593 series.

2.8 PRESSURE INDEPENDENT CONTROL VALVES

.1 Pressure Independent Actuated Ball Valves and Cartridge: (12 mm to 50 mm)

.2 See Section 25 99 65 – HVAC – Equipment Manufactures for approved manufacturers.

.3 See Section 23 21 13 – Hydronic Specialties for general valve requirements.

.4 The modulating control valves shall be pressure independent and shall include a Pressure Compensating Cartridge, Actuated Ball Valve, and Manual Isolation Ball in a single valve housing.

.5 Valve housing shall consist of forged brass, rated at no less than 360 psig at 250°F.

.6 Valve ball shall consist of chemically plated nickel brass or stainless steel.

.7 Actuated stem shall be removable/replaceable without removing valve from line.

.8 Manufacturer shall be able to provide ball insert to limit flow to maximum flow rate with ±5% accuracy.

.9 Valve shall have EPDM O-rings behind the seals to allow for a minimum close-off pressure of 100 psi with 35 in-lbs of torque for 1/2" – 3" sizes.

.10 Valve shall have a fixed end or union end connection with factory installed air vent to allow for venting of the coil.

.11 Dual pressure/temperature test valves for verifying the pressure differential across the cartridge and flow limiting ball shall be standard.

.12 Pressure compensating cartridge shall automatically compensate for pressure changes in valve and shall maintain a constant pressure drop across the flow limiting actuated ball. The operating pressure range shall be available with the minimum range requiring 5.8 PSID to actuate the mechanism. Valve internal control mechanism includes a diaphragm and full travel linear coil spring. Valves shall include an accessible/ replaceable cartridge.

.13 A universal mounting plate shall allow installation of actuators meeting the system electrical requirements and valve torque requirements. The actuator and plate can be rotated after mounting.

.14 Valve shall include a 600 WOG manual isolation ball valve.

.15 Identification tags shall be available for all valves; tags shall be indelibly marked with Cv, model number and location; tags shall be 3" x 3" aluminum.

.16 Provide 0-10 VDC control operators for terminal units. Floating point or tri-state operators will not be accepted.

.17 Valve operators shall be easily removable for service or replacement.

.18 Size valve operators to close valves against pump shut off head.

.19 All valve operators shall be suitable for continuous operation.

.20 Valves and actuators shall be suitable for operating conditions encountered and shall provide stable operation throughout the range of operating conditions.

.21 Standard of Acceptance: Griswold PIC-V, Delta Valves, and Belimo.

2.9 CONTROL VALVE ACTUATORS

.1 General:

.1 Valve operators shall allow smooth operation of the valve throughout its entire range and assure tight shut-off against system pressure.

.2 Valve actuator shall be easily removed from the valve body for replacement.

.2 Electric Two Position Valve Actuators (VTE):

.1 Two Position Control Valve Actuators (only to be used where specifically specified):

.3 Incremental Control Valve Actuators (only to be used where specifically specified) (VMI):

.1 The valve actuator shall modulate the control valve between the fully open and closed position based upon a 3-wire control signal (24 VAC). The actuator shall remain in position until the signal is applied.

.2 The valve shall maintain its shutoff force even if power is lost.

.3 The TUC shall calculate valve position based on the motor speed and duration of control signal. The valve shall be driven to a full position and the calculation reset once every 24 hours.

.4 Proportional Control Valve Actuators (VME):

.1 The valve actuator shall modulate the control valve between the fully open and closed position based upon a 0-10 VDC or 4-20 mA control signal. The actuator shall remain in its position until the applied signal changes. In the event of a control signal loss, the actuator shall move to the zero-voltage input position.

.2 The valve shall maintain its shutoff force even if power is lost.

2.10 CONTROL PANELS

.1 General:

.1 Fabricate from prime and enamel coated steel suitable for flush mounting.

.2 Panel doors shall be hinged and complete with locks.

.3 Construct so that instruments and gauges are flush mounted.

.4 Provide sub-panel, inside control panel, for mounting control components.

.5 Adhere Lamicoid nameplates on the control panels to clearly identify the service of each device.

.6 Submit shop drawings of control panel for review.

.2 Panel mounted devices:

.1 Temperature gauges and manual reset (where applicable) for:

.1 Outdoor air.

.2 Return air.

.3 Mixed air.

.4 Discharge air (each zone).

.5 Hot water supply.

.6 Hot water return (each coil).

2.11 DIFFERENTIAL PRESSURE TRANSMITTERS (DPT)

.1 Provide differential pressure transmitters having the following minimum specifications:

.1 Internal materials to be suitable for continuous contact with the process material measured including compressed air, water, glycol or steam as applicable.

.2 Output signal of 4 - 20 mA into a maximum of 500-ohm load.

.3 Output variations of less than 0.2% full scale for supply voltage variations of +/- 10%.

.4 Combined non-linearity, repeatability and hysteresis effects not to exceed +/- 1% of full-scale output over entire range.

.5 Integral zero and span adjustment.

.6 Temperature effect of +/- 1.5% full scale/50°C or less.

.7 Output short circuit and open circuit protection.

.8 Over-pressure input protection to a minimum of twice rated input.

2.12 DAMPER ACTUATORS

.1 General:

.1 Provide electric or electronic type damper actuators where indicated or required.

.2 Damper actuators for all fan variable volume devices, all control dampers and all smoke/fire dampers shall be supplied by this trade. Refer to Section 23 99 55 or the drawings for schedule of control and smoke/fire dampers.

.3 Damper actuators for mixing boxes and air valves shall be supplied by this trade for factory installation by unit manufacturer. Damper actuators shall meet the requirements of the unit manufacturer in all cases.

.4 Spring return for "fail-safe" in Normally Open or Normally Closed position where required.

.5 Size actuators to control dampers against maximum pressure or dynamic closing pressure whichever is greater.

.6 Size damper actuators so that they will provide smooth and full travel of the dampers while stroking in both directions.

.7 Where individual dampers are installed, install a separate damper actuator for each damper.

.8 Where multi-section dampers are installed, install a separate damper actuator for each section.

.9 Locate damper actuator so that they are easily accessible for testing and servicing.

.10 Where damper actuator operates outdoor and exhaust air dampers, pretension the damper drive linkage to ensure tight closure.

.11 Where a damper actuator is installed on an insulated surface of a duct or plenum, mount it on a stand-off bracket, so as not to interfere with the continuity of the insulation.

.2 Electronic Damper Actuators (DME & DTE):

.1 Actuators shall be direct coupled enabling it to be mounted directly to the damper shaft without the need for connecting linkage.

.2 The actuators shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.

.3 Proportional actuators shall accept a 2 to 10 VAC or 4 to 20 mA signal.

.3 Incremental Control Damper Actuator (DMI):

.1 For VAV box damper control only.

.2 The damper actuator shall modulate the damper between fully open and fully closed based on a 3-wire control signal (24 VAC). The actuator shall remain in position until the signal is applied.

.3 The TUC shall calculate damper position based on the motor speed and duration of control signal. The damper should be driven to a full position and the calculation reset once every 24 hours.

2.13 ELECTRIC RELAYS (ER)

.1 Provide DPDT relays for control and status indication of alarms and/or electrical starters and equipment.

.2 Relay coils shall be rated for 120V or 24V. Where other voltages occur provide transformer.

.3 Contacts rated at 5 amps at 120V AC.

.4 Relays to be plug in type with termination base.

2.14 ELECTRONIC AIR FLOW MEASURING STATIONS (FMS)

.1 Air flow measuring stations are to be provided by the Sheet Metal Sub-Contractor c/w 4 – 20 mA electronic pressure transmitter for connection by the controls contractor.

.2 Controls contractor to provide required external power supply to pressure transmitters.

.3 Specify range of air flow to ensure station can read the velocity,

.4 Note the required “straight lengths of ducting required for the station to read the flow accurately

2.15 ELECTRONIC AIR FLOW MEASURING STATIONS (FMS)

.1 Air flow measuring stations for the VAV supply, return and exhaust fans shall be supplied and installed by this trade.

.2 The electronic air flow measuring stations shall be as manufactured by Air Monitor Corporation or approved equal. The station shall consist of all necessary components to provide the required VAV control and interface with the BAS.

.3 As a minimum the electronic air flow measuring stations shall consist of FI probes located in the bell mouth of the fans to be controlled and a Vectron DPT 2500 transmitter with digital readout.

2.16 ELECTRONIC WATER FLOW MEASURING STATIONS (WFS)

.1 Water flow measuring stations are to be provided by the Mechanical Contractor(s) c/w electronic transducer for connection by the Controls subtrade.

.2 Refer to Section 23 05 19 Flow Meters.

2.17 FLOW SWITCHES (FSW)

.1 Minimum Requirements:

.1 Single pole double throw action (vapour proof on chilled water).

.2 Adjustable sensitivity.

.3 Extended trimmable paddles.

.4 Selected for minimum flow condition.

.2 Notes:

.1 Install in upright position in horizontal run of pipe.

.2 Install a minimum of 5 pipe diameters downstream of any valves, elbows, orifices or any other obstructions.

.3 Adhere to manufacturer's installation recommendations.

.3 Standard of Acceptance:

.1 McDonnell Miller, Johnson Controls.

2.18 FREEZE PROTECTION

.1 Freeze protection thermostats shall be manual reset type with 6 m averaging element. Provide multiple thermostats for large duct cross sectional areas.

.2 For liquids, elements shall be rigid bulb type mounted in separable wells.

.3 Freeze protection elements shall be hard wired to the fan starter and also wired to the B.M.S. or alarm system.

2.19 PRESSURE SWITCHES (PSW)

.1 Provide pressure or differential pressure switches for ranges as indicated.

.2 Pressure sensing elements shall be Bourbon tube, bellows or diaphragm type.

.3 Adjustable setpoint and differential.

.4 Pressure switches shall be snap action type rated at 120 volts, 15 amps AC or 24 volts DC.

.5 Sensor assembly shall operate automatically and reset automatically when condition returns to normal.

.6 Sensor Ratings: sensors shall have the following pressure and accuracy ratings:

.1 Low and medium steam sensors shall be rated at 1030 kPa. Low pressure shall operate from 0 to 207 kPa with an accuracy of plus or minus 3 kPa. Medium pressure shall operate from 0 to 700 kPa and with an accuracy of plus or minus 7.0 kPa.

.2 Pressure switches for pump operation shall have a range of 20 kPa to 350 kPa and adjustable differential from 1 kPa to 35 kPa.

.3 Pressure switches for fan operation shall have a range of 0 to 1500 Pa and adjustable differential from 10 to 50 Pa.

.4 Sensors on steam humidification lines and high temperature water shall be protected by pigtail siphon installed between the sensor and the fluid line.

.5 All sensors shall have an isolation valve and snubber installed between the sensor and pressure source.

2.20 ROOM THERMOSTATS – TEMPERATURE AND HUMIDITY

.1 Provide network humidity and temperature sensors with a touch-interface to allow users to adjust individual comfort levels. Provide a standard temperature sensor with humidity, CO2 and motion options, with a choice of backlit colors to provide additional user feedback and aesthetic appeal.

.2 The sensor’s NFC technology shall allow installers to use NFC-enabled mobile devices to configure the sensors and enable enteliWEB integration.

.3 Minimum Requirements

.1 RGB back-light allows choice of colors to indicate conditions, alarms and night mode Large easy-to-read LCD screen. Onscreen visual feedback on button selection.

.2 Capacitive touch zones allow custom button sizes Multiple button layout options. Simple one-touch buttons, or two-touch buttons for added functionality

.3 Slider to quickly adjust setpoint or tap for precise changes

.4 Fully programmable in GCL+

.5 USB Service port, software enabled or disabled. Service tool not required.

.6 Smartphone and tablet integration and setup using NFC technology

.7 Recessed mount for minimal profile or surface mount backplate options

.8 **LCD:** 2-line custom segmented display with icons

.9 **Buttons:** 2 rows of 4 capacitive touch zones, allowing up to 8 individual buttons or combined to form larger buttons

.10 **Backlight:** RGB LED backlight for multicolor LCD and button illumination

.11 Sensors:

.1 Digital Temperature Sensor: +/- 0.2° C (+/- 0.36°F)

.2 Humidity Sensor: Accuracy +/- 3%

.3 CO2 Sensor (High Occupancy Rooms)

.1 Dual Beam, Self-Calibrating NDIR Detection

.2 Provide CO2 Sensor for high occupancy rooms only: Conference rooms, staff rooms and meeting rooms

.3 Range: 0-2000 ppm

.4 Accuracy @ 77°F (25°C):

.5 ± (50ppm + 2% of value)

.4 Occupancy Sensor ()

.1 Passive infrared motion (PIR) sensor

.2 Range: 5m (16.4 ft.)

.3 Coverage: 100° Horizontal

.12 Mounted Surface Profile

.1 Recessed (both R backplates): 0.75 in. (1.9 cm)

.2 Surface Mount (SM backplate):

.1 0.9 in. (2.3 cm)

.13 Adjustable sensitivity and set point.

.4 Refer to the drawings for Temperature and Humidity range requirements for each room Sensor able to be cleansed of oil vapour, dust or other anticipated air borne contaminants by a simple field method such as solvent or mild detergent solution washing.

.5 Standard of Acceptance:

.1 Delta Controls: EZNS-T100

2.21 STATIC PRESSURE TRANSMITTERS (SPT)

.1 Output of 4 - 20 mA linear into maximum of 500-ohm load.

.2 Calibrated span: not greater than twice the static pressure at maximum flow.

.3 Accuracy: +/- 1% of span.

.4 Repeatability: within 0.5% of output.

.5 Linearity: 1.5% of span.

.6 Deadband or Hysteresis: 0.1% of span.

2.22 TEMPERATURE SENSORS

.1 General: Temperature sensors shall be thermistor, resistance or thermocouple type, however, thermocouples shall be restricted to temperature range +200°C and above.

.2 The following shall apply to thermistor, resistance or thermocouple temperature sensors as applicable.

.1 RTDs shall be 100 ohm or 1,000 ohms at 0øC (+/- .2 ohm) nickel or platinum element with strain minimizing construction and 3 integral anchored leadwires

coefficient of resistivity of 0.000385 ohms/ohm/ deg.C. Thermistors shall be 3,000 or 10,000 ohms.

.2 Sensing element to be hermetically sealed.

.3 Stem and tip construction to be copper or 304 stainless steel as noted.

.4 Sensors to have a time constant response of less than 3 seconds to a temperature change of 10°C.

.5 Sensors shall operate over the following ranges with the accuracies over the noted range of the sensor.

.1 -50°C to +50°C, plus or minus 0.5°C.

.2 0°C to +50°C, plus or minus 0.25°C.

.3 0°C to 25°C, plus or minus 0.1°C.

.4 0°C to 100°C, plus or minus 1°C.

.6 Immersion wells shall be of stainless-steel materials for steam and domestic hot water and brass for other applications. Heat transfer compound to be compatible with sensor.

.3 Temperature sensors shall be of the following types:

.1 General purpose duct type (DTS) - suitable for insertion into air ducts at any angle, insertion length shall be suitable for application. Copper sheathed construction.

.2 Spring-loaded thermowell type (ITS) - spring loaded construction with compression fitting for 20 mm NPT well mounting. Lengths shall be suitable for application. Stainless steel sheathed construction.

.3 Averaging duct type (ATS) - continuous filament with immersion length of 6000 mm minimum. Probe to be bent, at field installation time, to a minimum radius of 100 mm at any point along the probe length without degradation in performance. Copper sheathed construction. Or multiple sensors mounted on a cable connected to provide an average temperature reading

.4 Outside air type (OTS) - complete with non-corroding shield designed to minimize solar and wind effects, threaded fitting for mating to 12 mm conduit, probe length of 100 - 150 mm.

2.23 TEMPERATURE SWITCHES (TSW)

.1 Provide high/low temperature switches for ranges as indicated on point schedule.

.2 Temperature sensing element shall be liquid, vapour or bimetallic type.

.3 Adjustable setpoint and differential.

.4 Snap action type rated at 120 volts, or 24 V DC as required.

.5 Sensors shall operate automatically and reset automatically. Sensors used for freeze detection or fire detection shall be manually reset type.

.6 Temperature accuracy shall be +/-1°C.

.7 Temperature switches shall be of the following types:

.1 Room type - suitable for wall mounting on standard electrical box with or without protective guard.

.2 General Purpose Duct type - suitable for insertion into air ducts, insertion length of 457 mm.

.3 Thermowell type - with compression fitting for 20 mm NPT well mounting, length of 100 mm. Immersion wells shall be brass (stainless steel for domestic water and steam).

.4 Freeze detection type - continuous element with insertion length of 6000 mm minimum, suitable for duct mounting to detect the coldest temperature in any 30 mm section of its length.

.5 Strap-on type - with helical screw stainless steel clamps.

2.24 VELOCITY PRESSURE TRANSMITTERS (VPT)

.1 Output of 4 - 20 mA linear into maximum of 500-ohm load.

.2 Calibrated span: not greater than twice the static pressure at maximum flow.

.3 Calibrated accuracy: +/- 1.0% of span.

.4 Repeatability: within 0.1% of output.

.5 Linearity: 0.5% of span.

.6 Deadband or Hysteresis: 0.1% of span.

2.25 VARIABLE SPEED DRIVE CONTROLLER

.1 Refer to Section 23 05 14.

Part 3 Execution

3.1 GENERAL

.1 All equipment shall be installed according to manufacturers' published instructions.

.2 Temperature, Humidity Sensors, Thermostats and Humidistats:

.1 All sensors shall be stabilized to such a level as to permit on-the-job installations that will require minimum field adjustments or calibration.

.2 Sensor assemblies shall be readily accessible and adaptable to each type of application in such a manner as to allow for quick, easy replacement and servicing without special tools or skills.

.3 Outdoor installation shall be weatherproof construction in NEMA 4 enclosures. Install space instruments at a height of 1.5 m above the finished floor, unless otherwise indicated.

.4 Install corridor instruments at a height of 2.1 m above the finished floor.

.5 Locate instruments in the same vertical centreline as light switches.

.6 Where instruments are indicated on an outside wall install on a stand-off wall bracket which provides an air space between the instrument and the wall; or on an insulating base (e.g. a cork pad).

.7 Install protective metal guards on instruments in areas where they may be subject to damage (loading areas, gymnasiums, workshops, public corridors and storage areas). Bolt guards, independent of instruments to separate baseplates. Provide backing in wall for securing mounting bases.

.8 Sensors in ducts shall be mounted in locations to sense the correct temperature of the air only, and shall not be located in dead air spaces. The location shall be within the vibration and velocity limits of the sensor. Where an extended surface element is required to properly sense the average temperature it shall be securely mounted within the duct to measure the best average temperatures. Elements shall be thermally isolated from brackets and supports to respond to air temperature only. Sensor element to be supported separately and not connected to coils or filter racks.

.9 Wells shall be installed in the piping at elbows where piping is smaller than the length of the well to effect proper flow across the entire area of the well. Well shall not restrict flow area to less than 70 percent of line-size-pipe normal flow area.

.3 Temperature Transmitters, Humidity Transmitters, Controllers and relays to be installed in NEMA I enclosures.

.1 Panels to be either free standing or wall mounted ANSI 61 polyester powder coated steel cabinets with hinged and key locked front door. Arrange for conduit and tubing entry from top, bottom or either side.

.2 Panels shall be modular multiple panels being used if required for capacity in any particular location.

.3 All panels shall be lockable with same key.

.4 All wiring and tubing within panels to be located in trays or individually clipped to back of panel, and clearly identified.

.4 All field devices to be properly identified.

.5 Mount electrical instruments on standard electrical rough-in boxes fastened to structure.

.6 Testing:

.1 All field devices shall be properly calibrated and tested for performance and accuracy. A report detailing test performed and results to be submitted to the consultant for approval. The consultant will verify results at random. Provide all testing equipment necessary. Provide manpower necessary to assist consultant's verification.

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 The new control systems and components must be compatible with, and be connected to, the existing Building Automation System installed in the existing facility.

.2 The following new components shall be monitored, controlled and programmed from the existing facility. Include for the programming required to incorporate the stand-alone system into the existing system.

.1 New Exhaust Fan system and all associated equipment

.3 The following new components shall be monitored and integrated into the existing facility as required to create a fully functioning Pharmacy Control System. Include for the programming required to incorporate the stand-alone system into the existing system.

.1 New Pharmacy Air, Temperature and Pressure Differential Control system (Please refer to Section 23 09 35 for additional information

.4 All new control systems should either be:

.1 Compatible with, and be connected to, the existing Building Automation System installed in the existing facility or provided with alarm connections to the existing BMS.

1.3 GENERAL REQUIREMENTS

.1 The B.A.S. system is an existing real-time, online, multitasking, multi-user, microprocessor based system.

.2 All of the specified programming features must be written by the controls contractor and available for use by the owner. These features will all be tested and verified during commissioning. It shall not be satisfactory to merely provide software that is capable of these features if programmed by the owner.

.3 Environmental Conditions: The BAS and its immediate associated devices shall be able to operate properly under environmental conditions of -5 deg.C. to 44 deg.C. and a relative humidity of 10 to 95 percent noncondensing.

1.4 RADIO FREQUENCY INTERFERENCE (R.F.I.)

.1 Ensure that all equipment installed under this division is capable of operating properly when subjected to the ambient radio frequency signals existing at the site and in accordance with the Radio Interference Regulations (RIR).

.2 Take into consideration all A.M., F.M., T.V., U.H.F. and V.H.F. signals generated by private and commercial transmitters as well as spurious signals generated by hospital equipment such as X-ray and linear accelerator treatment equipment, etc.

.3 Provide traps as required to reduce all radio frequency and electromagnetic interference signals to acceptable levels.

1.5 SOFTWARE UPDATE

.1 Patches to the software package shall be provided at no cost for the lifetime of the system. These shall include all patches and fixes to the original software package supplied, but shall not include new software products subsequently released by the manufacturer after substantial completion.

1.6 SPARE PARTS

.1 Provide written assurance that in the event of a catastrophic failure of the system or portion thereof, the manufacturer or the system sub-contractor is able to obtain components for replacement with a maximum turn-around of 24 hours.

Part 2 Products

2.1 GENERAL PRODUCT DESCRIPTION

.1 The Building Management System (BMS) shall be capable of integrating multiple building functions including equipment supervision and control, alarm management, energy management, and historical data collection and archiving.

.2 The Building Management System shall consist of the following:

.1 Existing and New Standalone Panels (SAPs).

.2 Existing and New Terminal Unit Controllers (TUCs).

.3 Existing Personal Computer Operator Work Station(s) (OWSs).

.4 Refer to 25 09 35 for additional requirements

.3 New components added to the system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, SAPs, applicable TUCs and operator devices.

.4 System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each SAP shall operate independently by performing its own specified control, alarm management, operator I/O, and historical data collection. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

.5 SAPs shall be able to access any data from, or send control commands and alarm reports directly to any other DDC panel or combination of panels on the network without dependence upon a central processing device. SAPs shall also be able to send alarm reports to multiple operator work stations without dependence upon a central processing device.

.6 The Building Management System shall be capable of accepting Revit and Autocad drawing files. The drawings shall be interfacial with the control system graphics software via stripped down files, which are converted into Windows Metafiles for use as graphics for BMS.

2.2 NETWORKING/COMMUNICATIONS

.1 Networking/Communications capabilities shall consist of:

.1 Peer to Peer Communications between SAPs.

.2 Operator Work Station Interconnection.

.3 Terminal Unit Controller (TUC) communications.

.4 Off-site modem communications.

.2 Peer to Peer Interpanel Communications:

.1 SAPs shall communicate with one another over a high speed peer to peer protocol communications bus. All devices on the bus shall be peers and no specific device shall be designated as the master for communications purposes. The failure of any one device on the peer bus shall not result in a loss of communications between any of the other devices on the bus.

.2 Communication protocol shall employ token passing or collision detection to manage access to the bus in a peer to peer fashion. Minimum baud rate shall be 38.4K and system throughout capability shall be sufficient to satisfy the requirements in Section 2.3.2.

.3 The system shall have the ability to establish priority levels in terms of accessing the peer bus. The peer protocol shall be able to distinguish between alarms, automatic data transfer, manual commands and database transfers and the relative priorities between these events shall determine their access to the bus and consequently the relative speeds of these transactions.

.3 Operator Work Station Interconnection:

.1 Operator work stations shall access the peer bus by either directly connection to a SAP via an RS232 port or directly to the peer bus. If directly connected, it shall be via a device that resides on the bus as a true peer with only one OWS per such device.

.2 The systems shall support multiple OWSs connected to the peer bus either through multiple SAPs or multiple peer devices or a combination of both. When changes are made to datafiles at one OWS (including but not limited to graphics files, graphics link files, point datafiles, point labels and panel datafiles), they shall be automatically updated at all other OWSs (except those that are off-site). This shall be accomplished directly over the peer bus or via a parallel Local Area Network (LAN).

.4 Terminal Unit Controller (TUC) Communications:

.1 TUCs shall communicate with one another and a higher order device on the peer bus via a communications bus with a minimum 9600 baud rate. The TUC communications bus shall access the main peer bus via an SAP or a node device that acts as a full peer on the main bus.

.2 The TUC communication protocol shall be either poll / response (with the peer device acting as the master) or peer to peer.

.5 Off-Site Communications:

.1 Each SAP shall support connections of an offsite OWS (via the internet).

.2 SAP shall be able to automatically dial out to a user definable number upon the occurrence of any programmable event or alarm occurrence.

.3 The system shall support dialing in from an off-site OWS which will have all of the capabilities specified for a directly connected OWS except for the automatic updating of datafile changes. The hardware and software for an off-site OWS need only be provided if specified herein.

.4 The system for this project shall be provided complete with one autodial modem connected to one of the SAPs.

2.3 PROCESSING SPEED

.1 Effective Panel Processing Speed (All Panels):

.1 The maximum permissible execution time is TWO (2) seconds and is defined as follows:

.1 The time required for the CPU in the stand-alone panel to execute all application software in the panel, from the same point in the software back to the same point, assuming full memory usage as defined in 1.3, while simultaneously responding to operator or terminal display requests and carrying on normal inter-panel communications averaged over a ONE (1) minute period.

.2 The execution time will be verified by setting up a counter in each panel and monitoring the counting rate.

.3 Provide with the proposal the estimated execution time for each panel in the system as configured to this job.

.2 Effective System Processing Speed:

.1 The effective system processing speed applies to multi-panel systems only. The system processing speed is intended to address inter-panel communications and will be monitored by evaluating the delays in inter-panel data transfer.

.2 The effective system processing speed will be verified by initiating a cyclical flag in one panel every minute. This flag will initiate a counter and at the same time command a flag in a remote panel. The remote flag will be used to terminate the counter in the original panel. The value of the counter will be compared to a continuous counter over a one hour period to determine the average delay in inter-panel data transfer. The test will be carried out with the system fully commissioned and all memory requirements specified herein invoked.

.3 The maximum allowable delay for data transfer between SAPs shall be 5 seconds for normal data and 1 second for alarms (not including panel cycle times).

.4 If critical alarm generating points are connected to TUCs then the maximum delays for getting the information to the applicable SAP shall be as per 2.3.2.3 above.

.5 The maximum delay between an alarm event in a SAP or TUC and having that alarm annunciated to the OWS(s) shall be four (4) seconds including panel cycle time. This will be verified with the system fully loaded and commissioned.

2.4 STANDALONE PANELS (SAPS)

.1 General: SAPs shall be microprocessor based, multi-tasking, multi-user, real-time digital control processors. Each SAP shall consist of all required hardware including but not limited to processors, communication controllers, power supplies, and input/output modules. A sufficient number of controllers shall be supplied to fully meet the requirements of this specification and the attached point list.

.2 Memory: Each DDC panel shall have sufficient memory to support its own operating system and databases including:

.1 Control processes

.2 Energy Management Applications

.3 Alarm Management

.4 Historical/Trend Data for all points

.5 Maintenance Support Applications

.6 Custom Processes

.7 Operator I/O

.8 Dial-Up Communications

.9 In addition to the memory required to accommodate all of the points and sequences specified, each SAP shall have memory capacity to accommodate trending of all inputs and outputs with 100 samples per point. This shall include all points connected to subordinate TUCs if they do not have their own on-board trending capabilities.

.3 Point Types: Each DDC panel shall support the following types of point inputs and outputs if applicable:

.1 Analog inputs:

.1 4 - 20 Milliamps

.2 0 - 10 Volts DC

.3 120 Volts AC

.4 10,000 ohm thermistor

.5 100,000 ohm thermistor

.6 100 or 1000 ohm Pt
.7 1000 ohm Ni
.8 20.7 - 103.4 kPa [3 - 15 psi] (via external transducer)

.2 Digital inputs:
.1 Dry contact closure
.2 Pulse accumulator (i.e. electrical consumption)

.3 Actuators/Output Signals:
.1 Digital outputs (contact closure):
.1 Motor starters, sizes 1 to 4 (via external relays)
.2 Analog outputs:
.1 4 - 20 Milliamps
.2 0 - 10 Volts DC
.3 Triac 24 Volts AC
.4 20.7 - 103.4 kPa [3 - 15 psi] (via external transducer).

.4 The DDC panel electronics shall be housed in a metal cabinet with keylock utilizing a master key.

.5 Serial Communication Ports: SAPs shall provide at least two (2) serial data communication ports in addition to the network communication port, for simultaneous operation of multiple operator I/O devices such as industry standard printers, OWSs and Portable Operator's Terminals. SAPs shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers, or network terminals.

.6 Hardware Override Switches: The operator shall have the ability to manually override automatic or centrally executed commands at the SAP via local, point discrete, onboard hand/off/auto operator override switches for binary control points and analog control type points.

.7 Integrated On-Line Diagnostics: Each DDC panel shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all subsidiary equipment. The DDC panel shall provide both local and remote annunciation of any detected component failures, or repeated failure to establish communication.

.8 Surge and Transient Protection: Isolation shall be provided at all network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standard 587-1980. Isolation levels shall be sufficiently high as to allow all signal wiring to be run in the same conduit as line voltage wiring where acceptable by electrical code.

.9 Powerfail Restart:

.1 In the event of the loss of normal power, there shall be an orderly shutdown of all SAPs to prevent the loss of database or operating system software. Non-Volatile memory (EPROM, EEPROM or FLASH RAM) shall be incorporated for all critical controller configuration data, and battery back-up shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.

.2 Provide automatic power failure routine to accomplish orderly shutdown of the automation system when loss of power is detected. Do not place any equipment in an unacceptable or dangerous condition as a result of power failure or restart procedures.

.3 Restart the system automatically and in an orderly fashion upon power restoral.

.4 Restart equipment based on priority to minimize in-rush currents as large loads are reintroduced.

.5 Restart only those systems or loads which were operating at the time of shutdown.

.6 Alarm any equipment which fails to restart when requested.

.7 Provide manual restart lockout capability.

.10 Upon restoration of normal power, the DDC panel shall automatically resume full operation without manual intervention.

.11 Should SAP memory be lost for any reason, the system shall generate an alarm. The user shall have the capability of reloading the SAP via an OWS which is either on-site or via modem.

2.5 SYSTEM SOFTWARE FEATURES

.1 New software components shall be integrated and be compatible with the existing system..

2.6 TERMINAL UNIT CONTROLLERS (TUCS)

.1 Terminal Unit Controllers (TUCs) shall be used to control terminal equipment and other miscellaneous points as noted on the points list.

.2 Each TUC shall operate as a standalone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each TUC shall be a microprocessor-based, multi-tasking, real-time digital control processor.

.3 Each TUC shall have sufficient memory to support its own operating system and data bases including:

.1 Control Processes

.2 Energy Management Applications

.3 Portable Operators Terminal (POT)

.4 The operator interface to any TUC point data or programs shall be through any OWS or any POT connected to any SAP or TUC in the network.

.5 TUCs shall directly support the temporary use of a POT. The capabilities of the portable operators terminal shall include, at minimum, the following:

.1 Display temperatures

.2 Display status

.3 Display setpoints

.4 Display control parameters

.5 Override binary output control

.6 Override analog setpoints

.7 Modification of gain and offset constants

.8 Program parameter adjustments

.9 Trend log displays edit/create trend logs

.10 Display/Command any point connected to any TUC or SAP in the system.

.6 Powerfail Protection: All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the controller. TUCs shall employ EEPROM or FLASH RAM for this functionality.

.7 Application Descriptions:

.1 VAV cooling Coils. Terminal Unit Controllers shall support, but not be limited to, the control of the terminal units to address current requirements as described in the Execution portion and points list of this specification.

.2 It is anticipated that TUCs will be application specific and thus not custom user programmable. The application software provided with the TUCs shall meet the requirements of the sequences of operation as specified herein. Include for reprogramming as required.

.3 For TUCs used in VAV applications, they shall have a built-in solid state flow transmitter for sensing air flow. Heated wire flow sensors will not be acceptable. It shall be the responsibility of this contractor to ensure that the flow transmitter is compatible with the velocity pressure probe supplied with the VAV box.

2.7 OPERATOR INTERFACE

.1 New interface elements shall be integrated and be compatible with the existing system. In addition, the new systems will provide access to Facility & Energy Management Software. Base building controls contractor is ESC Automation (Delta controls).

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 Definitions & Abbreviations

.2 The following are abbreviations used throughout the section defining computerized control systems specified herein or defined on plans:

.1 BAS - Building Automation System

.2 SAP - Stand Alone Panel - generic term that applies to BC, AAC, ASC

.3 DI - Digital Input

.4 DO - Digital Output

.5 AI - Analog Input

.6 AO - Analog Output

.7 HVAC - Heating, Ventilation, Air Conditioning

.8 MCC - Motor Control Center

.9 DDC - Direct Digital Control

.10 LAN - Local Area Network

.11 OS - Operating System

.12 OT - Operator Terminal

.13 PC - Personal Computer

.14 OWS - BACnet Operator Work Station – same as B-OWS

.15 Native - Native BACnet

.16 BC - BACnet Building Controller – same as B-BC

.17 AAC - BACnet Custom Application Controller - same as B-AAC

.18 ASC - BACnet Application Specific Controller - same as B-ASC

.19 SS - BACnet Smart Sensor – same as B-SSEthernet – BACnet TCP/IP Ethernet

.20 MS/TP - BACnet Master-Slave/Token Passing

.21 PTP - BACnet Point–to-Point Protocol

.22 Gateway - BACnet Gateway

.23 Micropanel - Generic term that applies to AAC and ASC

1.2 REFERENCES

.1 Canadian Standards Association - CSA C22.2no.205- M1983, Signal Equipment.

.2 Institute of Electrical and Electronic Engineers - IEEE 472, IEEE 587.

.3 National Institute of Standards and Technology - NISTIR 6392 GSA Guide to Specifying Interoperable Building Automation and Control Systems Using ANSI/ASHRAE Standard 135-1995, BACnet.

.4 Native BACnet - Native BACnet means that no translation software will be used internal to the OWS, BC, AAC, and ASC to convert from a proprietary protocol to BACnet Standard Object Types, Standard Application Services and devices. Gateways are not native BACnet.

.5 BACnet Gateways

.1 Any use of a proprietary protocol (non-BACnet) internal to a SAP, OWS, or communication bridge shall deem the SAP or OWS as a gateway not native BACnet.

.2 BACnet gateways shall be used only where identified in the specifications and nowhere else.

1.3 SCOPE OF WORK:

.1 Supply, installation and mounting of all hardware (unless specifically stated otherwise).

.2 Supply and mounting of sensor elements and associated hardware, wiring or piping connecting sensors to SAP's.

.3 Wiring connecting SAP's to transducers, fire alarm and smoke control.

.4 Supply and wiring connection of solid state relays and relays to terminal connections at MCCs and to SAP's.

.5 Supply and installation of SAP's comprising of BC's, AAC's, and ASC's;

.6 The controls sub-contractor will do the complete installation of all sensors, associated control panels, relays, transducers, actuators, flow switches, gauges, air receivers, SAP computer board, associated power supplies, conduit, wiring, tubing, and all other control devices including isolation room panels, and all terminations.

.7 The controls sub-contractor will participate and provide coordination required between the Client, the Consultant, other sub-contractors where controls are involved and the commissioning agent.

.8 The controls sub-contractor will provide verification and commissioning as follows:

.9 End to end continuity checks will be performed on all wiring and control tubing.

.10 All sensors, transducers, relays, actuators, control valves and dampers will be calibrated and operationally checked by this Sub-Contractor.

.11 Provide a point checkout sheet for verification of system. This Sub-Contractor to initial each point as it is verified.

.12 The controls sub-contractor will test the SAP computer hardware and operator consoles.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 A complete, fully tested, commissioned and operational Native BACnet Building Automation System (BAS) utilizing fully electronic Direct Digital Control (DDC) to meet the requirements described herein and in complete accordance with applicable codes and ordinances.

.2 The system software and control devices shall be fully compatible with the existing ESC Automation/Delta System programs and hardware, latest BACnet versions.

.3 Unless specified otherwise:

.1 Provide proportional plus integral electronic components.

.2 The design, installation, supervision and labor services, calibration, software programming and de-bugging, checkout and commissioning required for the BAS.

.3 Supply and installation of electronic packaged zone controllers for terminal unit control.

.4 Devices, components, wiring and materials as required for a fully operating control system.

.5 Include full graphics operating package with modification of existing site graphics and navigation sequences via customized software programming.

.6 Instruction to the Facility's maintenance and operating personnel.

.7 Complete system documentation including:

.1 As-built site diagrams showing location of wiring and panels and system architecture.

.2 Operating and Maintenance manuals.

2.2 CABLE

.1 Primary Data transmission cable shall be CAT 6 Ethernet cable

2.3 ELECTRONIC TERMINAL EQUIPMENT (AAC) CONTROLLERS

.1 Each zone controller will be microprocessor-based, multi-tasking, real-time digital control processor. The zone controllers will monitor space temperature sensors and control operation of terminal air valves, air valve reheat coils, fan coil units, and perimeter radiant panels in the corresponding zone.

.2 Each zone controller will have sufficient memory to support its own operating system and data base including:

.1 Control functions

.2 Energy management applications

.3 Interface with operator portable personal computer

.4 Zone controller panels will have the following features:

.5 Setpoint adjustments

.6 Modify gain and offset constants

.7 Program parameter adjustments

.8 Trend log display edit/create trend logs through DDC system main panels

.9 Zone controllers shall NOT be mounted in ceiling spaces.

2.4 ELECTRONIC AIR VALVE CONTROLS, SENSORS & ACTUATORS

.1 Control sub-contractor shall include for the supply and installation of pressure sensors, operators and stand-alone controllers for the air valves.

.2 Control components shall be pre-assembled for testing and performance verification prior to arrival on site.

.3 Multipoint crossflow sensors shall be supplied by air valve manufacturer.

.4 Flow transducer shall be a full differential pressure unit not hot wire or thermister type.

.5 Electronic operators shall be provided for air valve dampers with piston or gear driven type damper operators.

.6 Air valve damper motors shall be Belimo LM24-T floating control or approved equal.

.7 Damper operators shall operate with floating point signal for full modulation.

.8 Damper operators shall be rigidly attached to the support structure and linkage shall have no "slop".

.9 These control components shall be field tested with air valve for testing and performance verification.

.10 Submit written test data for the terminal unit controllers for each size of air valve and fan coil unit.

.11 Supply air temperature measurement shall be provided on each air valve with reheat coils.

2.5 DDC SYSTEM FUNCTIONS

.1 The DDC system shall utilize "BACnet open architecture" and have a proven Operator Control Language (OCL), which shall be capable of reading the value, and/or status of all

control devices from any user defined combination of calculations and logical expressions.

.2 All SAP's and BACnet Gateways shall conform to the BACnet Protocol Implementation Conformance Specification.

.3 Other mandatory monitoring and control features of the DDC system are:

.1 Provide two level security system access with passwords.

.1 Level 1: to allow assignment of Level 1 and Level 2 passwords. Creation of new system operators, ability to create, delete and modify system components, modify selected system components, and alarm levels, and generally full system access.

.2 Level 2: to allow command and override of system components, alarm acknowledgment, monitor system, display information including alarm messages, graphics, points log, help menus.

.2 Operator defined digital and analog alarms and automatic alarm condition reporting.

.3 Auto lockout of alarms when alarmed system is shut down.

.4 Direct keyboard override of all digital and analog outputs, with an indication of the display of any point that is operating under keyboard override.

.5 Addition, deletion, definition and modification of points and point types from operator keyboard.

.6 Trend log graphing of user selected points and times.

.7 Run time totalization.

.1 The DDC system shall have the capability to be taken off line in the event of failure or for maintenance and returned to operation without the need for entering any portion of the software program manually. To accomplish this, an off-line disk storage device shall be utilized to provide software backup and reload.

.8 On-site backup and verification of the entire system, with full applications software, shall be less than TEN (10) seconds per SAP.

.9 The DDC system shall be provided with automatic protection from any power failure of up to seventy two (72) hours duration.

.10 This protection shall at a minimum include continuous real-time clock operation and automatic system restart upon power return. System will be tested to confirm rated hours.

.11 Panel replacement shall be possible without any hardware modification. Describe replacement procedure in technical data submitted.

.12 Any panel malfunction shall not affect the operation of the multi-panel system.

.13 Indicate how points located on one panel can be accessed and utilized by another panel. Explain any limitations of the above.

.14 Each BC and AAC standard panel proposed shall have enough random access memory for all of the following:

.1 Trend Logs - two for each input and output point connected to the panel with 100 samples each.

.2 Controllers - two for each analog output point connected to the panel.

.3 Variables - three for each output point connected to the panel. Variables are "virtual points" (as opposed to physical points) but which have all the attributes of real or physical points.

.4 Operator Control Language (OCCL) - twenty syntactically correct lines each with at least 4 operators, for each output point connected to the panel, or TEN (10) syntactically correct lines, each with at least four operators, for each output point connected to the panel, if the OCL has the ability to call common routines or use wild card commands.

.5 Descriptor - one for each user definable point, real or virtual, in the panel. In addition, on multi-panel systems, every descriptor in the system must be accessible from a single I/O port.

.6 Time Schedules - one for every 3 output points connected to the panel.

.7 Totalizers - one for each digital point in the panel.

.15 Processing Speed

.1 Effective Panel Processing Speed - Maximum permissible execution time is half a second. Execution time is defined as the time it takes the stand alone panel CPU to execute all application software in the panel, from some point in the software back to the same point, assuming full memory usage, while simultaneously responding to operator or terminal display requests and carrying out normal inter-panel communications averaged over a one - minute period. This will be done by setting up a counter in each panel and monitoring the counting rate.

.2 Effective System Processing Speed - This applies to multi-panel systems only. System processing speed is intended to address inter-panel communication and will be checked by evaluating system display response. This will be done by setting up a display of all panel counters and checking how frequently each counter updated on the refreshed display.

.3 Displays shall load real time current values, not stored values, within ten seconds. Every counter shall show an updated value on the display within sixty seconds at the previous update appearing. Provide confirmation that required system processing speed will be achieved.

.16 DDC System Inter-Panel Communication.

.1 Means shall be provided to ensure communication integrity. Provide detail of the system.

.2 To prevent damage to the system, each data highway line shall be provided with a means of isolation, either optically or by some other means. Provide detail of protection system in proposal.

.17 Sensors and Associated Equipment.

.1 BAS shall be supplied with all sensors, relays and associated equipment to fully connect the listed DDC points. Field point installation shall be performed in a neat and orderly fashion with all components marked or labeled to correspond with the making or labeling in the as built drawings.

.2 All sensors and controllers shall be of commercial grade and shall be installed according to the manufacturer's recommendations. Provide full details of all sensors and controllers proposed, including their range and accuracy.

2.6 DDC SYSTEM PANELS

.1 References:

.1 National Institute of Standards and Technology - NISTIR 6392 GSA Guide to Specifying Interoperable Building Automation and Control Systems Using ANSI/ASHRAE Standard 135-1995, BACnet.

.2 DDC Panel Types:

.1 BC minimum capabilities equivalent to the BACnet Building Controller (B-BC).

.2 AAC Local Control Unit minimum capabilities equivalent to the BACnet Custom Application Specific Controller (B-AAC).

.3 ASC Terminal Control Unit minimum capabilities equivalent to the BACnet Application Specific (B-ASC).

.4 AAC Room Control Unit minimum capabilities equivalent to the BACnet Custom Application Specific Controller (B-AAC).

.5 SS Smart Sensor minimum capabilities equivalent to the BACnet Smart Sensor (B-SS).

.6 DDC Panel Applications – This section describes the mechanical systems that shall be connected to the different DDC panel types.

.7 BC main function is to provide direct control of all main central mechanical systems such as chillers, cooling towers, heat exchangers, domestic hot water, fan systems etc. The BC's shall directly reside on the primary Ethernet LAN.

.8 AAC function is to provide control for miscellaneous HVAC components in remote mechanical rooms such as rooftop units, fan coils, unit ventilators, VAV, etc. AAC's shall reside on the secondary RS485 MS/TP network.

.9 ASC level controllers are not acceptable unless specifically specified for a unique application.

.3 All DDC panels shall meet the minimum requirements set out in this section.

2.7 BC BACNET OVERVIEW

.1 A BC (B-BC) is a native BACnet, general purpose, field programmable controller capable of carrying out a variety of building automation and control tasks. It enables the specification of the following:

.2 Data Sharing:

.1 Ability to provide the values of any of its BACnet objects.

.2 Ability to retrieve the values of BACnet objects from other devices.

.3 Ability to allow modification of all of its BACnet objects by another device.

.3 Alarm and Event Management:

.1 Generation of alarm / event notifications and the ability to direct them to recipients.

.2 Maintain a list of unacknowledged alarms / events.

.3 Notification of other recipients that the acknowledgment has been received.

.4 Adjustment of alarm / event parameters.

.4 Scheduling:

.1 Ability to schedule output actions, both in the local device and in other devices, both binary and analog, based on date and time.

.5 Trending:

.1 Collection and delivery of (time, value) pairs.

.6 Device and Network Management:

.1 Ability to respond to information about its status.

.2 Ability to respond to requests for information about any of its objects.

.3 Ability to respond to communication control messages.

.4 Ability to synchronize its internal clock upon request.

.5 Ability to perform re-initialization upon request.

.6 Ability to upload its configuration and allow it to be subsequently restored.

.7 Ability to command half-routers to establish and terminate connections.

.7 Provide sufficient number of BC's to fully meet all requirements of this specification plus specified spare point capacity. An Ethernet gateway connecting the WAN to the building BC is NOT acceptable.

.8 BC to be stand-alone intelligent controller. BC panel to:

.1 Be microprocessor based, multi-tasking, multi-user, real-time digital control processors capable of supervising other lower level programmable controllers through secondary networks.

.2 Consist of modular hardware with plug-in processors, communication controllers, power supplies, I/O modules.

.3 Provide MS/TP BACnet LAN port for local AAC/ASC network.

.4 Provide on board LAN interface for ethernet BACnet peer-to-peer communication between BC’s and at least [1] RS-232C serial data communication ports to support simultaneous operation of multiple operator I/O devices such as industry standard printers, lap-top work-stations, PC work-stations and BC-mounted or portable OT’s. One RS-232C data port will support point-to-point PTP BACnet protocol.

.5 Allow temporary use of portable devices without interrupting normal operation of permanently connected modems, printers, OT’s.

.6 Interface field sensors via local I/O terminations located on BC located in processor cabinet.

.7 In standalone mode execute programmable logic control (direct digital or closed loop process control) of associated HVAC equipment without interacting with other processors or OWS’s.

.9 Dial-up Communications:

.1 Auto-dial/auto-answer communications to allow BC’s to communicate with remote OW’s on non-continuous basis via telephone lines. Or Internet IP communications link to communicate with network

.2 To analyze and set priorities for all alarms to minimize of calls. Non-critical alarms to be buffered in memory and reported as group or until operator manually requests upload of alarms.

.10 Programming and Energy management routines:

.1 BC to provide for the following energy management routines:

.1 Time of day scheduling.

.2 Calendar based scheduling.

.3 Holiday scheduling.

.4 Temporary schedule overrides.

.5 Optimal start.

.6 Optimal stop.

.7 Supply air reset

.8 Duty cycling

.9 Night setback

.10 Heating water reset

.2 All programs to be executed automatically without need for operator intervention.

.11 Programming languages:

.1 Shall meet requirements specified in Custom Programming Capability section of specification.

.12 Priority Level:

.1 BC shall provide for 16 levels of priority from all outputs. The priority levels shall conform to the BACnet object specifications.

.13 Trend Logging:

.1 All trend log information shall be stored at BC and not at OWS.

2.8 CUSTOM PROGRAMMING CAPABILITY

.1 Programming languages:

.2 All GCL General Control Language software to be programmed in general control type or high-level control language supporting full BACnet objects and functionality.

END OF SECTION

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 Installation and site distribution of the Compounding Pharmacy venturi air valves as listed in mechanical schedules, (provided by this section) shall be part of the Sheet Metal sub-contractor scope of work as specified in Section 23 36 00 Air Terminal Units.

.3 Installation and site distribution of the Compounding Pharmacy air valve supply and general exhaust air attenuators sound neutralizers (provided by this section) shall be part of the Division 23 Sheet Metal sub-contractor scope of work as specified in Section 23 36 00 Air Terminal Units.

.4 Supply, installation and site distribution of the reheat coils & duct transitions for the venturi air valves and associated reheat coils shall be part of the Sheet Metal sub-contractor scope of work as specified in Section 23 36 00 Air Terminal Units. Reheat coils for venturi air valves are specified in Section 23 82 00.

.5 The balancing contractor shall verify the air valve factory flow settings & co-ordinate any corrective action required by the air valve supplier.

.6 All conduits, wiring and installation of wiring, for the DDC connections to the Compounding Pharmacy Airflow controllers located in each Pharmacy shall be by the B.M.S. Controls Contractor.

1.2 SCOPE OF WORK

.1 The Compounding Pharmacy Airflow Controls System supplier shall supply and install a Compounding Pharmacy Specific type control system that is catalogued showing proven control strategies for Compounding Pharmacy and biosafety cabinets airflow control.

.2 The Compounding Pharmacy Airflow Controls System package includes the supply of the all Compounding Pharmacy pressure independent venturi air valves as listed in Mechanical Schedules and specifications. This includes all Compounding Pharmacy and associated rooms as indicated on the drawings (supply and exhaust), variable volume, venturi air valves, constant volume venturi air valves (where noted) and Bio-Safety Cabinet exhaust venturi air valves.

.3 The Compounding Pharmacy Airflow Controls System supplier shall provide all air valve factory mounted control components including the valve actuators, airflow controllers, actuator transducers, flow feedback electronics and air flow differential pressure switches as called for in the sequences of operation. Coordinate all control devices with the base building controls contractor.

.4 The Compounding Pharmacy Airflow Controls System supplier shall provide the air valve make up airflow controllers, bio-safety cabinet hood monitors, biosafety cabinets sash sensors, switches including all +/- 15VDC and/or 24vac power supplies for the operation of venturi air valves and related controls as required to satisfy the sequences of operation.

.5 The Compounding Pharmacy Airflow Controls System supplier shall provide onsite support, as required, to install and wire the controls provided under this section of work.

.6 The Compounding Pharmacy Airflow Controls System supplier shall provide all support, as required, to co-ordinate all DDC System inputs and outputs being wired to the Compounding Pharmacy airflow controls system by the B.M.S. Controls contractor.

.7 The Compounding Pharmacy Airflow Controls System supplier provide onsite support as required to co-ordinate all valve airflow’s performance issues with the balancing

contractor and/or commissioning agent to ensure actual airflow's are within +/- 5% of specified airflow's.

.8 The Compounding Pharmacy Airflow Controls System supplier provide on-site owner instruction and on site preventative maintenance and repair service during the warranty period.

.9 The Compounding Pharmacy Airflow Controls System (CPACS) supplied is to be a Compounding Pharmacy Specific type control system and shall be catalogued showing proven control strategies for Compounding Pharmacy and biosafety cabinets airflow control.

1.3 GENERAL

.1 Existing BMS

.1 The Compounding Pharmacy Airflow Control System and components shall be furnished under this section. The control system shall be capable of operating as a standalone system and shall also be fully integrated with the Building Automation System (BAS) including picking up alarm points from the pharmacy system.

.2 Control Devices - General

.1 Please note that the Base Building Controls Contractor shall be ESC automation and that the Standard for Acceptance for General Control Devices shall be Delta Controls

.2 In addition, the standard for Acceptance for the Compounding Pharmacy Airflow Control System shall be the Vantage System by Phoenix Controls

.3 Warranty (Pharmacy Control Systems):

.1 Warranty shall commence upon the date of Substantial Completion of the Pharmacy Department and extend for a period of twenty-four months whereupon any defects in materials or system performance shall be repaired by the manufacturer at no cost to the owner.

.2 The Compounding Pharmacy Airflow Controls System supplier shall provide all onsite support to service & repair any problems identified by the owner or consultant during the two year warranty period.

.3 For warranty requirements for the general control systems refer to specifications section 25 05 00 WARRANTY

.4 The Warranty shall commence upon the date of shipment and extend for a period of 60 months for all airflow control devices and 36 months for all other control system components.

.4 Preventive Maintenance:

.1 The Compounding Pharmacy airflow controls system supplier shall provide at no additional cost to the owner during the warranty period, all required preventive maintenance for the airflow controls provided under this section.

.5 Standard of Acceptance

.1 The plans and specifications have been based on the Vantage system by Phoenix Controls and equipment as manufactured by Phoenix Controls.

.2 In strict accordance with this specification, alternative Compounding Pharmacy airflow control systems and equipment shall only be considered for approval provided that the equipment be equal in every respect to the operational characteristics, capacities, and intent of control sequences specified herein.

.3 Approval to bid does not relieve the Compounding Pharmacy controls supplier from complying with the minimum requirements or intent of this specification.

.4 The consultant and owner or the owner's designated representative shall be the sole judges of quality and equivalence of equipment, materials, methods, and life cycle cost.

.5 Only those systems specifically named in this specification or by addendum prior to tender closing shall be considered for approval

1.4 REFERENCES.

.1 Abbreviations and Acronyms

.1 ATC – Advanced Temperature Control

.2 BMS – Building Management System

.3 BAS – Building Automation System

.4 CPACS – Compounding Pharmacy Airflow Control System

.5 UBC – Usage Based Controls

.6 VAV – Variable Air Volume

.7 TTW – Through The Wall (sensor)

.8 ZPS – Zone Presence Sensor

.9 PIN – Personal Identification Number

.10 Noted on the drawings:

.1 TDU – Terminal Display Unit

.2 PMU – Pressure Differential Monitor Unit

.3 TS – Temperature and Humidity Sensor

.4 T – Adjustable Thermostat + Temperature and Humidity Display

.2 Reference Standards

.1 Air Conditioning and Refrigeration Institute

.2 ARI 880 Performance Rating of Air Terminals

.3 American Society of Heating, Refrigeration, and Air Conditioning Engineers / American National Standards Institute

.4 ASHRAE/ANSI Standard 130, Methods for Testing Air Terminal Units

.5 American National Standards Institute / American Society of Heating, Refrigeration, and Air Conditioning Engineers

.6 ANSI/ASHRAE 135-2012: BACnet® - A Data Communication Protocol for Building Automation Systems (including Standard and all published Addenda)

.7 NAPRA: Hazardous Sterile Compounding Model Standard

.8 NAPRA Non-Hazardous Sterile Compounding Model Standard

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordination

.1 The Pharmacy Controls representative and the controls contractor (Twin Rivers) shall coordinate all details of the applicable controls scope prior to install.

.2 All ductwork installation of the air valves is completed by the sheet metal contractor.

.3 All wiring and terminations shall be completed by the control contractor.

.4 All piping connections completed by the mechanical contractor.

.2 Pre-installation Meetings

.1 The Pharmacy Controls representative shall review the proper installation of the system with the sheet metal contractor and controls (BAS / BMS) base building contractor (Twin Rivers).

.2 The contractor installing the air valves must confirm the air valve orientation (horizontal / vertical) with the Pharmacy Controls representative prior to releasing equipment for production.

.3 Project Installation Phase – Any discrepancies of the installed equipment / materials shall first be brought to the attention of the appropriate subcontractor. If no action is taken by said contractor, the representative shall bring these issues to the project manager, engineer or owner's representative for resolution.

1.6 SUBMITTALS

.1 General: Submit listed Submittals in accordance with Conditions of the General Contract and Division 1 Submittal Procedures Section. CPACS (Pharmacy Controls) submittals shall contain, at a minimum, the following information:

.1 Product Data Sheets

.2 Equipment Schedule Sheets containing Room#, Tag#, Min/Max flows, Catalog# and other configuration data as required to provide a fully engineered CPACS.

.1 Installation Instructions

.2 Project-specific Wiring Diagrams

.3 Points Lists

1.7 CLOSEOUT SUBMITTALS

.1 Operation and maintenance manuals, including as-built wiring diagrams and component lists, sequence of operation, shall be provided as closeout submittals.

.2 Checklists for connection of points between BAS / BMS are encouraged. The checklists should include:

.3 Testing points to ensure communication

.4 Testing setpoints such as Air Changes per hour, humidity, temperature, occupancy, differential pressure, room offset, etc

.5 Testing various alarms in different parts of the system

.6 Testing to ensure that equipment will cycle after a power loss

1.8 QUALITY ASSURANCE

.1 The Compounding Pharmacy airflow system provider shall be an entity that designs, develops, manufactures and sells products and services to control the environment and airflow of critical spaces using a Quality Management System registered to ISO 9001:2008.

.2 The Venturi valves shall be calibrated using NIST traceable equipment AND NVLAP accredited air stations.

1.9 DELIVERY, STORAGE, AND HANDLING

.1 Storage and Handling Requirements:

.1 Prior to installation, the CPACS shall be stored in dry conditions within an environment complying with CPACS product specifications as shown on product data sheets within the submittals.

.2 The CPACS products shall be handled and transported in a manner consistent trade practices for control systems and instruments.

1.10 SITE CONDITIONS

.1 The ambient environmental conditions during installation and operation shall comply with CPACS product specifications as shown on the product data sheets within the submittals.

Part 2 Products

2.1 COMPOUNDING PHARMACY AIRFLOW CONTROL SYSTEM - GENERAL

.1 The Compounding Pharmacy Airflow Control System shall precisely control the supply, return and exhaust flow rates from the Compounding Pharmacy rooms and biosafety cabinets. The intent is to maintain a constant differential pressure between the rooms and a constant average airflow towards the biosafety cabinets and laminar air flow workstations. The Compounding Pharmacy control system shall vary the amount of make-up/supply air into the room to operate the Pharmacy at the lowest possible airflow rates necessary to maintain temperature control, achieve minimum air change per hour (ACH) ventilation rates, and maintain the differential pressurization relationships to adjacent spaces (positive or negative as per NAPRA Requirements).

.2 The airflow control system shall use volumetric offset control to maintain room pressurization. The system shall maintain proper room pressurization polarity (negative or positive) regardless of any change in room/system conditions (dynamic conditions as outlined in NAPRA) such opening doors or rapid changes in duct static pressure. Systems.

.3 Using differential pressure measurement or velocity measurement to control room pressurization is unacceptable.

2.2 COMPOUNDING PHARMACY AIRFLOW CONTROL SYSTEMS – PRESSURE CONTROL

.1 A CPACS shall be furnished and installed to control the airflow into and out of Compounding Pharmacy rooms.

.2 The exhaust flow rate of a Compounding Pharmacy biosafety cabinets, shall be controlled precisely to maintain a constant average face velocity into the biosafety cabinets at either a standard/in-use or standby level based on an operator's presence in front of the biosafety cabinets.

.3 The Compounding Pharmacy control system shall vary the amount of make-up/supply air into the room to operate the Pharmacy at the lowest possible airflow rates necessary to maintain temperature control, achieve minimum ventilation rates and maintain Compounding Pharmacy pressurization in relation to adjacent spaces (positive or negative). The CPACS shall be capable of operating as a standalone system or as a system connected with the Building Management System (BMS).

.4 Locally mounted user interface terminals (Vantage by Phoenix Controls) shall be provided to allow room-level control variables to be displayed, alarms, and edited to adjust control operation.

2.3 AIRFLOW CONTROL DEVICES – VENTURI VALVES

.1 The airflow control device shall be a Vantage by Phoenix Controls Accel II pressure independent venturi valve or approved equivalent.

.2 The valve assembly manufacturer's Quality Management System shall be registered to ISO 9001:2008.

.3 Airflow control device shall be OSHPD tested and certified per 2013 CBC, 2012, IBC, ASCE 7-10, and ICC-ES-AC-156.

.4 All Components of the valve, its controllers, and wiring shall be ROHS compliant.

.5 The airflow control device shall be pressure independent over its specified differential static pressure operating range, as specified (150Pa to 750Pa) / (75Pa to 750Pa). An integral pressure independent assembly shall respond and maintain specific airflow within one second of a change in duct static pressure irrespective of the magnitude of pressure and/or flow change or quantity of airflow controllers on a manifolded system.

.6 The airflow control device shall maintain accuracy within ±5% of signal over an airflow turndown range of no less than:

.1 12.5 to 1 (medium pressure all valve sizes)

.2 16 to 1 (medium pressure w/o 14” valve)

.3 7 to 1 (low pressure all valve sizes)

.4 11 to 1 (low pressure w/o 14” valve)

.5 8 to 1 (medium pressure shut-off all valve sizes)

.6 14 to 1 (medium pressure shut-off w/o 14” valve)

.7 5 to 1 (low pressure shut-off all valve sizes)

.8 9 to 1 (low pressure shut-off w/o 14” valve)

.7 No minimum entrance or exit duct diameters shall be required to ensure accuracy and/or pressure independence.

.8 No rotational/axial orientation requirements shall be required to ensure accuracy and/or pressure independence.

.9 The airflow control device shall maintain pressure independence regardless of loss of power.

.10 The airflow control device shall be constructed to the following:

.1 Class A—The airflow control device for non-corrosive airstreams, such as supply and general exhaust, shall be constructed of 16-gauge aluminum. The device's shaft and internal “S” link shall be made of 316 stainless steel. The shaft support brackets shall be made of galvaneal (non shutoff valves) or 316 stainless steel (shutoff valves). The pivot arm shall be made of aluminum (for non shutoff valves) and 303/304 stainless (for shut off valves). The pressure independent springs shall be a spring-grade stainless steel. All shaft bearing surfaces shall be made of a PP (polypropylene) or PPS (polyphenylene sulfide) composite. Sound attenuating devices used in conjunction with general exhaust or supply airflow control devices shall be constructed using 24 gauge galvanized steel or other suitable material used in standard duct construction. No sound absorptive materials of any kind shall be used.

.11 Actuation

.1 For high speed electrically actuated VAV operation, a CE certified electronic actuator shall be factory mounted to the valve. Loss of main power shall cause the valve to position itself in an appropriate failsafe state. Options for these failsafe states include

.1 Normally open-maximum position;

.2 Normally closed-minimum position and

.3 last position.

.2 This position shall be maintained constantly without external influence, regardless of external conditions on the valve (within product specifications). High Speed Actuation shall, within 1 second, drive the valve to its commanded position, and park without over-driving, under-driving, back-driving, or hunting.

.3 For Standard Speed electrically actuated VAV operation, a CE certified electronic actuator shall be factory mounted to the valve. The failsafe state for standard speed operation valves shall fail to last position to allow the pharmacy to operate during an emergency or catastrophic event.

.4 Standard speed actuators shall drive the valve to its commanded position and park without over-driving, under-driving, back-driving, or hunting within a typical time period of approximately 30-45 seconds.

.5 Standard speed actuation shall not be used for valves that are connected to the compounding rooms, anterooms or Bio-Safety Cabinets.

.6 The controller for the airflow control devices shall be microprocessor based. The room-level airflow control devices shall function as a standalone network.

.7 There shall be no reliance on external or building-level control devices to perform room-level control functions. Each Compounding Pharmacy control system shall have the capability of performing Biosafety Cabinet control, pressurization control, temperature control, humidity control, BSC control (with BSC controller), and implement occupancy and emergency mode control schemes.

.8 The CPACS shall be capable of digital integration with the existing Building Automation System and the new proposed enteliWEB system.

.12 Accreditation (Lab Code 200992-0)

.1 Each airflow control device shall be factory characterized on air stations NVLAP Accredited (a program administered by NIST) to ISO/IEC 17025:2005 standards.

.2 Each airflow control device shall be factory characterized to the job specific airflows as detailed on the plans and specifications using NVLAP Accredited air stations and instrumentation having a combined accuracy of no more than ±1% of signal (5,000 to 250cfm), ±2% of signal (249 to 100cfm) and ±3% of signal (199 to 35cfm). Electronic airflow control devices shall be further characterized and their accuracy verified to ±5% of signal at a minimum of 48 different airflows across the full operating range of the device.

.3 Each airflow control device shall be marked with device-specific factory characterization data. At a minimum, it should include the room number, tag number, serial number, model number, eight-point characterization information (for electronic devices), date of manufacture and quality control inspection numbers. All information shall be stored by the manufacturer for use with as-built documentation. Characterization data shall be stored indefinitely by the manufacturer and backed up off site for catastrophic event recovery.

.4 Airflow control devices that are not venturi valves and are airflow measuring devices (e.g., pitot tube, flow cross, air bar, orifice ring, vortex shedder, etc.) shall not be acceptable for the compounding pharmacy.

.13 Airflow sensors shall be of a multi-point averaging type, 304 stainless steel for all supply, return and general exhaust applications, 316L stainless steel for all hazardous compound rooms (including bio-safety cabinets). Single point sensors are not acceptable.

.14 Suppliers of airflow control devices or airflow measuring devices requiring minimum duct diameters shall provide revised duct layouts showing the required straight duct runs upstream and downstream of these devices. Coordination drawings reflecting these changes shall be submitted by the supplier of the CPACS. In addition, suppliers shall include static pressure loss calculations as part of their submittals. All costs to modify the ductwork, increase fan sizes and horsepower and all associated electrical changes shall be borne by the CPACS supplier.

2.4 EXHAUST AND SUPPLY AIRFLOW DEVICE CONTROLLERS

.1 The airflow control devices shall be a microprocessor-based design and shall use closed loop control to linearly regulate airflow based on a digital control signal. The devices shall generate a digital feedback signal that represents its airflow.

.2 The airflow control devices shall be able to command a venture valve to a flow setpoint, drive the valve to that setpoint, record the appropriate feedback without under-driving, over-driving, or hunting within:

.1 1 second or less with high speed actuation

.2 30-45 seconds for standard speed actuation

.3 The airflow control device shall store its control algorithms in non-volatile, re-writeable memory. The device shall be able to stand-alone or to be networked with other room-level digital airflow control devices using an industry standard protocol.

.4 Room-level control functions shall be embedded in and carried out by the airflow device controller using distributed control architecture. Critical control functions shall be implemented locally; no room-level controller shall be required.

.5 The airflow control device shall use 24 VAC power.

.6 The airflow control device shall have provisions to connect a Phoenix Controls Workbench commissioning tool and every node on the network shall be accessible from any point in the system.

.7 The airflow control device shall have built-in integral input/output connections that address fume hood control, temperature control, humidity control occupancy control, emergency control, and non-network sensors switches and control devices. At a minimum, the airflow controller shall have:

.1 Three universal inputs capable of accepting 0 to 10 VAC, 4 to 20 mA, 0 to 65 K ohms, or Type 2 or Type 3 10 K ohm @ 25 degree C thermistor temperature sensors.

.2 One digital input capable of accepting a dry contact or logic level signal input.

.3 Two analog outputs capable of developing either a 0 to 10 VAC or 4 to 20 mA linear control signal.

.4 One Form C (SPDT) relay output capable of driving up to 1 A @ 24 VAC/VAC.

.8 The airflow control device shall meet FCC Part 15 Subpart J Class A, CE, and CSA Listed per file #228219.

.9 The airflow control device shall be ROHS compliant

2.5 VENTURI AIR VALVES ATTENUATORS / NEUTRALIZERS

.1 Internal insulation shall be fiber free per CSA Z317.2

.2 Sound Attenuators:

.1 Casing constructed from 0.76 mm [24 ga] thick galvanized steel. All attenuators are to be mounted inside the ducting. Ensure duct size is compatible with attenuator size.

Table No. 1
MAXIMUM ALLOWABLE AIR VALVE
DISCHARGE SOUND POWER LEVELS, dB
(Re: 10^{-12} Watts)

NC Rating	Octave Bands					
	1	2	3	4	5	6
35	72	71	67	75	72	68
40	75	75	72	78	73	70

Table No. 2
MAXIMUM ALLOWABLE AIR VALVE
RADIATED SOUND POWER LEVELS, dB
(Re: 10^{-12} Watts)

NC Rating	Octave Bands					
	1	2	3	4	5	6
35	53	53	56	57	55	53
40	69	68	60	65	63	57

Notes:
The Table refers to a single air valve equipped with the manufacturer's attenuator section.

.1 For more than one air valve located over an area, the following corrections must be applied:

.1 For **two (2)** venturi air valves, subtract 3 dB from the figures contained in the table.

.2 For three **(3)** venturi air valves, subtract 4 dB from the figures contained in the table.

.3 For more **than 3** venturi air valves, subtract 6 dB from the figures contained in the table.

.4 The final air valve radiated levels must be met with or without the addition of shrouds or other appropriate measures necessary to meet the design levels stipulated.

Table No. 3
MAXIMUM ALLOWABLE BACKGROUND NOISE LEVELS, NC

Max. NC	Areas
35	Sterile Compounding Pharmacy Rooms (Hazardous and Non-Hazardous).
35	Compounding Ante Room

2.6 TERMINAL DISPLAY UNITS - TOUCH SCREEN

.1 Provide Phoenix Controls View touch screen monitors to display data and edit setpoints for the pharmacy compounding rooms.

Terminal Display Unit

.2 Provide, at a minimum, 7-inch diagonal capacitive touch screen panels that are flush mounted using a standard 90 cu. In. electrical box. The display panel shall be capable of displaying up to 24 parameters simultaneously, capable of high and low limit, change of state and multi-state alarms. Units shall be 3rd party BACnet MS.TP device compatible and be capable of displaying data from Phoenix Control devices. Standard Features shall include:

.1 7" capacitive touch screen, Tile-based display with custom tile setup per the descriptions below for each touch screen monitor.

.2 Light or dark user interface theme to allow flexibility in the display with PIN protection enabled for setpoints and configuration changes

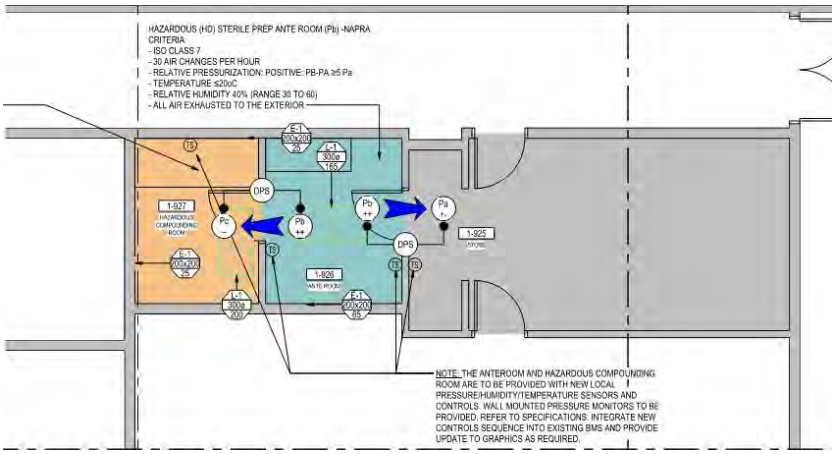
.3 Resistant to spray washdowns

.4 Compatible with Phoenix Controls and 3rd party BACnet MS/TP devices.

.5 Alarms to be configured for point-by-point and tile based on pharmacy staff / user preference (see below)

.6 Room Air changes per hour to be calculated and displayed from live data.

.3 **Terminal Display Unit (TDU) - Main Monitoring Panel (1-925 – Store Rm.):** Provide master overview panel for the entire sterile compounding pharmacy suite. located panel beside main door entering the compounding suite (leading to the Ante Room 1-926). Control panel shall display and monitor the following elements for each room listed below:



.1 **Differential Pressure** (Pa) between the following rooms:

.1 **1-926** – Ante Room relative to

.1 1-925 - Store Room

.2 1-927 – Hazardous Compounding Room

.2 **1-927** – Hazardous Compounding Room relative to

.1 1-925 - Store Room

.2 1-926 – Ante Room

.2 **Air Change Per Hour** (ACH) for the following rooms:

.1 1-926 – Ante Room

.2 1-927 – Hazardous Compounding Room

.3 **Room temperature** (°C) for the following rooms:

.1 1-926 – Ante Room

.2 1-927 – Hazardous Compounding Room

.4 **Humidity** (% RH) for the following rooms:

.1 1-926 – Ante Room

.2 1-927 – Hazardous Compounding Room

.4 **Pressure Differential Monitoring Unit (PDU) - Pressure Critical space monitoring panels (Room Level):** Provide critical space monitoring touch screen panels monitoring panels to monitor / alarm the adjacent room conditions prior to entry. Program each display to show the Occupancy, Air Changes per hour, Airflow offset, Temperature, relative humidity and Relative Pressure of the space in the room adjacent to the panel. All values should be displayed in Metric. Provide panels in the following location:

.1 1-926 – Ante Room

.2 1-927 – Hazardous Compounding Room

2.7 DIFFERENTIAL PRESSURE MONITORING REQUIREMENTS

.1 Additional information on the differential Pressure Monitoring requirements: Provide network connected pressure monitors to allow the continuous monitoring of the differential pressure between spaces required by NAPRA. The specific rooms requiring monitoring, for this project, include:

.1 1-926 – Ante Room

.2 1-927 – Hazardous Compounding Room

.2 Refer to the drawings and the following NAPRA links and documents for additional information on required pressure differentials for Sterile compounding:

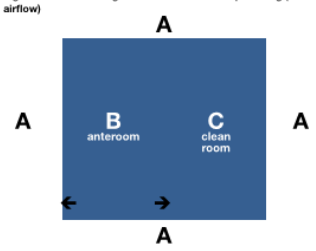
.1 Hazardous Sterile Compounding Model Standard:

.1 https://napra.ca/general-practice-resources/model-standards-pharmacy-compounding-hazardous-sterile-preparations

.2 https://napra.ca/sites/default/files/2017-09/Mdl_Stnds_Pharmacy_Compounding_Hazardous_Sterile_Preparations_Nov2016_Revised_b.pdf

.3 Hazardous Pressure Diagram (Refer to the Model Standard for additional information):

Figure 1: Pressure diagram for hazardous compounding (arrows indicate direction of airflow)



Pressure differentials:	
Pressure differentials to be maintained at all times:	1) $(P_A - P_B) \geq 5.0$ Pa 2) $(P_B - P_C) > 2.5$ Pa 3) -2.5 Pa $< (P_C - P_A)$
Legend:	A = facilities environment B = anteroom C = clean room P = pressure Pa = pascal (SI unit of measure for pressure)

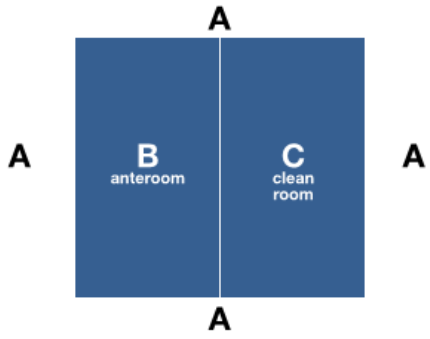
.2 Non-Hazardous Sterile Compounding Model Standard

.1 https://napra.ca/general-practice-resources/model-standards-pharmacy-compounding-non-hazardous-sterile-preparations

.2 https://napra.ca/sites/default/files/2017-09/Mdl_Stnds_Pharmacy_Compounding_NonHazardous_Sterile_Preparations_Nov2016_Revised_b.pdf

.3 Non-Hazardous Pressure Diagram (Refer to the Model Standard for additional information):

Figure 1: Pressure diagram



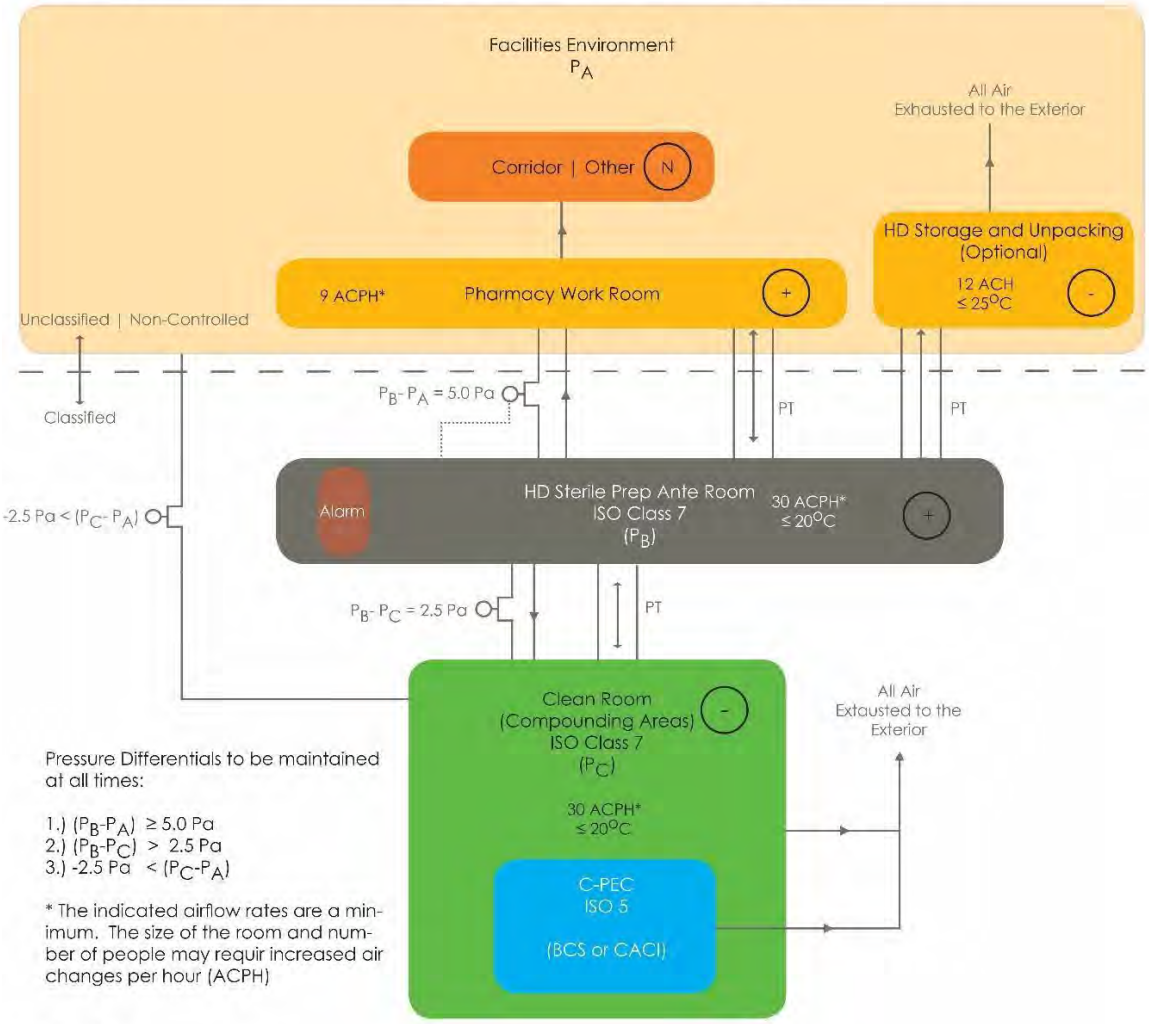
Pressure differentials:		
Pressure differentials to be maintained at all times:	1)	12.5 Pa ≥ (Pc – P_B) ≥ 5.0
	2)	12.5 Pa ≥ (P_B – P_A) ≥ 5.0

Legend:
A = facilities environment
B = anteroom
C = clean room
P = pressure
Pa = pascal (SI unit of measure for pressure)

.3 The following diagrams show the required pressure differentials required for NAPRA compliance (Refer to drawings for additional information):

Flow Diagram for Hazardous Drug Preparation - Compounding Pharmacy

Reference: NAPRA / ANORP - Model Standards for Pharmacy Compounding of Hazardous Sterile Preparations



Pressure Differentials to be maintained at all times:

1.) (P_B-P_A) ≥ 5.0 Pa
2.) (P_B-P_C) > 2.5 Pa
3.) -2.5 Pa < (P_C-P_A)

* The indicated airflow rates are a minimum. The size of the room and number of people may requir increased air changes per hour (ACPH)

Legend

+ - N	Room pressurization (Positive, Negative, Neutral)
→	Directional air flow from higher room pressure to lower room pressure.
	Room differential pressure gauge
PT	Pass Through
C-PEC	Containment primary engineering control (e.g., BSC or CACI)

2.8 PRESSURE MONITORS: ADDITIONAL GENERAL INFORMATION

.1 Pressure monitors shall have the following minimum environmental and performance specifications:

- .1 IP-54 rated housing, resistant to spray washdown
- .2 Resistant to decontamination chemicals (e.g. VHP, Clidox, Formaldehyde, sodium hypochlorite 3-6%
- .3 Standard accuracy RSS of at least +/-0.5% full scale (non-linearity, hysteresis and non-repeatability)
- .4 Optional high accuracy RSS of at least +/-0.25% full scale (non-linearity, hysteresis and non-repeatability)
- .5 Integral zero and span adjustment
- .6 Temperature effect on zero/span shift ±0.03 % FS/°F
- .7 Pressure ranges, selected by engineer, shall be up to (+/-0.05" to +/-1.0" WC)
- .8 Temperature Range: 32 to 120 deg. F

.2 Monitor configuration can be copied to an external USB memory device for the purpose of duplicating configuration on like devices

.3 Pressure setpoints shall be externally switchable between positive, negative and neutral modes.

.4 Monitor shall be directly connected to the BACnet MS/TP network:

- .1 Be able to change occupied and unoccupied heating and cooling temperature setpoints via BACnet MS/TP
- .2 Device shall be remotely configurable via BACnet MS/TP
- .3 Device BACnet points list as shown in Table 3 of Section 2.06

.5 Monitors shall store an audit record of the last five configuration changes (FIFO log)

.6 Home screen language shall be selectable between English and French

.7 Firmware upgradable via USB port

2.9 TOUCH-SCREEN DISPLAY UNIT (TDU)

.1 Standard of acceptance: Phoenix Controls View Touch screen (Vantage by Phoenix Controls): MKT-0374

.2 General

- .1 Min 7” (17.8 cm) color LCD capacitive touch screen display (800 x 480 pixels) WVGA.
- .2 The touch screen local display device shall access to pertinent flow, temperature, humidity, pressure, occupancy, and emergency mode control status.
- .3 Set points shall be viewable and editable on the display interface.
- .4 Control parameters shall be able to be commanded on the display interface.

.5 A capacitive touch-screen pane with variable contrast adjustment and selectable alternate color scheme to adapt the display to various lighting conditions shall be provided.

.6 Construction shall have a gasket faceplate and meet IP54 rating to prevent the incursion of dust and moisture for use in areas with exposure to moderate to high particulate and humidity.

.7 Installation shall be flush mounted to a standard electrical enclosure.

.8 Electrical conductors shall terminate directly to the touch screen local display module housing by way of a pluggable terminal block and shall not be exposed when the unit is installed.

.9 A front mount USB port to support configuration backup and restore functions must be provided.

.3 Power: The device shall be powered by 24 VAC ±15% at 16 VA, 50 – 60 Hz.

.4 Configuration

.1 Configuration shall be done on the unit itself and shall not require any plug-in or 3rd party software to configure.

.2 Native functionality shall provide the ability to upgrade to a translated language for the locale in which it is installed.

.3 The device shall be capable of being added to an existing BACnet MS/TP installation (BACnet compliant on MS/TP LAN at 9.6 to 115.2 Kbps).

.5 Communication

.1 The touch screen local display unit shall connect to the MS/TP network bus and provide access to all MS/TP control data.

.6 Device functionality shall be able to pull data from 3rd party devices over the BACnet MS/TP bus.

.7 The device must be able to display and command information from multiple networked devices.

.8 Information Display

.1 The device shall have the ability to display up to 2 screens which will automatically toggle.

.1 Each screen shall be organized into 6 interactive tiles per screen, and each tile shall be customizable with up to 4 points programmed per tile (48 points total can be displayed – 24 at a time).

.2 Each tile shall have the ability to have a customizable title.

.3 Each point shall have the ability to have a customizable name for clarity.

.4 Each parameter being displayed shall have the ability to include such information as units of measure and configurable number of decimal places (up to 7).

.9 The device shall read present values directly off the network or scaled to output the displayed value in another desired unit of measure. The scaling shall be done within the software of the monitor.

.10 Settings must support data view in local units of measure.

.11 The device shall have the ability to have a customizable alarm for every readable parameter that is programmed in the unit.

.1 The alarm shall show full screen and have an audible tone on first trigger and have a visual indication present as long as the alarm is still active.

.2 Users shall have the ability to change the volume of the alarm, as well as mute the alarm and only show visual indication of alarm state.

.12 Security

.1 End users shall have the ability to enable a PIN pass code to prevent unauthorized changes to set points, notes, and editable control parameters.

.13 Compliance

.1 The unit shall be certified as meeting regulatory compliance with CE, CSA, and RoHS.

.2 The unit is suitable for use with non-solvent wipe down and when properly installed on a smooth wall surface is designed to meet IP54 test standards. Wall surfaces other than smooth or painted wallboard may require additional sealant/sealing methods to prevent equipment damage.

.3 The unit's exposed surfaces shall be chemically resistant to vaporized hydrogen peroxide (VHP), formaldehyde, chlorine dioxide (clidox), perchloric acid, sodium hypochlorite 3-6% (bleach), quaternary ammonium 7% in 1:128 tap water (ammonia)

.14 Environment

.1 The Operating Temperature Range shall be between 32 – 113 ºF (0 – 45 ºC).

2.10 MONITOR ALARMS:

.1 Programmable visual alarm and adjustable audible alarms

.2 Programmable durations for audible alarm delay and silence periods

.3 Alarm on insufficient duct static pressu re

.4 Includes optional methods of alarm configuration to minimize nuisance alarms

.5 Shall have programmable high and low Air Change per Hour (ACH) alarms

.2 Inputs:

.1 Analog Inputs (AI-1, AI-2):

.1 Multi-function input signal of 0-10VAC, 0-5VAC or 4-20 mA

.2 Used for secondary (remote) pressure transducer input or switching pressure alarm setpoints to equal and opposite ranges.

.2 Digital Input (DI-1):

.1 DI can be used for door status indication (contact open = door open, closed = door closed) or valve pressure switch indicator.

.2 DI is alarmable; visual on the LCD, yellow on door open

.3 DI is configurable; door open can disable alarming

.3 Outputs:

.1 Analog output (AO-1):

.1 A filtered output signal of the primary room pressure differential

.2 Range is field selectable for 0-5Vdc, 0-10Vdc or 4-20mA.

.3 Speed of response shall be appropriate for high-speed pressure control algorithms with a 100ms speed of response maximum, 3 time constants.

.2 Alarm contact digital output (DO-1):

.1 SPDT, contact rating of 2.0A @ 30VAC/VAC, 0.6A @ 125VAC

.2 Adjustable alarm dead band of 0-10% of setpoint.

.3 Shall be capable of serving as external occupancy control

.4 Installation

.1 Pressure monitor shall fit into standard commercially available triple-gang, double-deep electrical boxes (e.g. RACO 697, Appleton M3-350)

2.11 ROOM AIR PRESSURE SENSOR PLATES

.1 Provide shielded and sealed static air probes for sensing room pressure levels. Probes shall be flush-mounted in a standard 2" x 4" electrical box.

.2 The pressure-sensing tubing shall be connected to the top of the probe with quarter-inch tubing. Tubing shall also be extended from the pressure sensor to a stable common pressure reference port.

.3 The exact placement of the sensor plates and means of establishing a stable common reference pressure shall be determined by the installed and engineer prior to commissioning. Refer to this specification and the drawings for differential pressure monitoring requirements.

2.12 PHARMACY MAKE UP AIRFLOW CONTROL UNITS

.1 The Compounding Pharmacy make up airflow control unit shall control the supply and Hazardous exhaust airflow control devices to maintain proper room pressurization (positive or negative based on NAPRA Differential requirements). Each individual Compounding Pharmacy shall have a dedicated Compounding Pharmacy control unit.

.2 The control unit shall be electronic. The inputs shall accept linear feedback signals from biosafety cabinets, and supply airflow control devices. The output signals shall control the supply air valves, hazardous exhaust air valves and variable frequency drives with signals that are linearly proportional to the desired supply or exhaust airflows.

.3 The make-up airflow control unit shall maintain a constant design offset between the sum of the room's total exhaust and make up/supply airflows. This offset shall be field adjustable and represents the volume of air, which will enter (or exit) the room from the corridor or adjacent spaces.

.4 The make-up airflow control unit shall generate linear signals that are proportional to all airflow sources, sash sensors, and flow alarms. The signals shall be available for hard-wired connection to the facility's direct digital control (DDC) system, or through an integrated control unit that interfaces directly into the facility's DDC system. Discuss the requirements with Twin Rivers Controls to ensure that the systems functions prior to installation. Discuss any concerns with the Engineer and Interior Health.

.5 The make-up airflow control unit may be either panel or valve mounted.

.6 Refer to the DDC Control specification for the required input/output summary for the necessary points to be monitored and or controlled.

2.13 OPERATION SEQUENCES

.1 Control functions shall include, at a minimum: Air changes per hour (ACH), air volume (l/s) pressurization control, offset airflow (l/s), temperature (^{o}C), humidity (%RH), as well as respond to occupancy and emergency control commands.

.2 Room Pressurization Control

.1 The Compounding Pharmacy control system shall use the relative pressure of each room compared to the adjacent rooms, as outline in the NAPRA and listed

in this document. It shall do this by changing the volumetric offset with an algorithm know as Progressive Offset Control (POC).

.2 The POC controller shall monitor the room pressure and increase or decrease the exhaust to maintain the desired pressure. A door switch shall be provided on every door to freeze or alternate offset the pressure control loop in order to stop any winding up of the control loop.

.3 Emergency Mode Control

.1 The Compounding Pharmacy control system shall provide a means of overriding temperature and pressurization control in response to a command indicating an emergency condition exists, and airflow control devices are to be driven to a specific flow set point. The system shall support up to four emergency control modes.

.2 The emergency control modes may be initiated either by a local contact input or BMS command. Valve level emergency modes can be individually programmed on each valve as one of four emergency control modes. Zone level emergency modes will drive supply and exhaust valves to maintain or ignore zone offset (excludes control of hood valves).

.3 Once an emergency mode is invoked, pressurization and temperature control are overridden for the period that the mode is active. Emergency modes shall have a priority scheme allowing a more critical mode to override a previously set condition.

.4 Local Alarm Control

.1 The Compounding Pharmacy control system shall provide the means of summing selective alarm activity at the room-level network and generating a local alarm signal. The local alarm signal may be directed to any available pharmacy e output, as well as to the BMS. The alarm mask may be configured differently for each room-level system.

.5 The Compounding Pharmacy control system shall be segregated into subnets to isolate network communications to ensure room-level control functions and BMS communications are carried out reliably. Each Compounding Pharmacy space or pressurization zone shall be its own subnet.

.6 The CPACS shall support at least 20 networked devices in each pressurized zone.

.7 All points shall be available through the interface to the BMS for trending, archiving, graphics, alarm notification and status reports. CPACS performance (speed, stability and accuracy) shall be unaffected by the quantity of points being monitored, processed or controlled.

.8 Refer to the BAS specification for the required input/output summary for the necessary points to be monitored and/or controlled.

2.14 INTERFACE TO BUILDING MANAGEMENT SYSTEMS

.1 The CPACS network shall have the capability of digitally interfacing with the BMS. The required software interface drivers shall be developed and housed in one or more dedicated interface devices furnished by the CPACS supplier.

.2 All room-level points shall be available to the BMS for monitoring or trending. The CPACS shall maintain a cache of all points to be monitored by the BAS / BMS. The room-level airflow control devices shall update this cache continually.

.3 Interface with BAS / BMS

.1 Phoenix Controls PCI8000’s (PCI’s), or equivalent’s, shall be provided to interface with the BAS / BMS.

.2 After the Room Level Interface is commissioned it shall provide a web based user interface for device, network, and platform diagnostics as well as a Test and Balance web application for zone balance and airflow validation. Room Level interface will also provide a means of integrating on an open BACnet network via IP, Ethernet, or MS/TP to be field selectable at time of commissioning.

.3 The PCI, or equivalent, shall operate with the following platform and Operating System:

.4 Platform

.1 ARM Cortex A8 or greater processor

.2 1GB DDR SDRAM & 4 GB or greater Flash Memory

.3 Data Recovery Services with SDRAM

.4 Real-time clock

.5 Operating System

.1 Niagara 4.4 or later for N4 implementation

.2 Niagara AX 3.8.213or later for AX implementation

.4 The PCI, or equivalent, shall support a combination of the following network connection ports, communication protocols, local I/O, as standard or orderable options as required:

.1 2 Ethernet Ports (RJ-45 Connectors) – 10/100 Mbps

.2 2 RS-485 on board port (3 Screw Connector on base board)

.3 Up to 2 Dual port RS-485 expansion modules

.4 Up to 4 LON modules 78 Kbps FTT 10, room network: ANSI 709.1 LonTalk protocol.

.5 BAS / BMS protocol: BACnet over Ethernet, or BACnet over IP, or BACnet over MS/TP

.6 BAS Implementation: Conformance Class 3 BIBBS-BBC (BACnet Building Controller)

.7 BAS data transfer rates (points per second): Read requests – 50 sustained, 100 peak; Write commands – 30 maximum

.8 A total 5,000 points can be reported per PCI or equivalent.

.9 To support pluggable local Input/Output (I/O) modules with the following options,16-Point Module:

.1 8 Universal Inputs (Type 3 (10 k) Thermistors, 0 - 100,000 ohms, 0 -

.2 10 volts, 4 - 20 mA with external resistor), Binary (pulse or dry contact) Input

.3 4 Relay Outputs (Form A contacts, 24 VAC or 24VDC @ 0.5 amp rated)

.4 4 Analog Outputs (0 - 10 VDC @ 4mA max (2500 ohms or greater)

.10 34-Point Module

.1 16 Universal Inputs (Type 3 (10 k) Thermistors, 0 - 100,000 ohms, 0 - 10 volts

.2 4 - 20 mA with external resistor), Binary (pulse or dry contact) Input

.3 10 Relay Outputs (Form A contacts, 24 VAC or 24 VDC @ 0.5 amp rated)

.4 8 Analog Outputs (0 - 10 VDC @ 4mA max (2500 ohms or greater)

Part 3 Execution

3.1 INSTALLATION

.1 The base building BMS contractor shall install all PCI or equivalent in an accessible location in or around the designated Compounding Pharmacy room.

.2 The BMS shall install an appropriately sized and fused 24 VAC transformer suitable for NEC Class II wiring.

.3 All cable shall be furnished and installed by the BMS contractor. The BMS contractor shall terminate and connect all cables as required. The BMS shall utilize cables specifically recommended by the Compounding Pharmacy airflow controls supplier.

.4 The sheet metal contractor shall install all airflow control devices in the ductwork and shall connect all airflow control valve linkages and provide all required transitions.

.5 The mechanical contractor shall pipe all reheat coils. The mechanical contractor shall provide and install insulation as required.

.6 Each pressurization zone shall have either a dedicated, single-phase primary circuit or a secondary circuit disconnect.

3.2 SYSTEM START-UP AND TRAINING

.1 A factory-authorized representative of the Compounding Pharmacy airflow controls manufacturer shall provide system start-up. Start-up shall include calibrating setting of the biosafety cabinet's monitors, face velocity and electronic verification of supply, return and exhaust (including biosafety cabinets exhaust air flows).

.2 Air Balancing – Reporting and verification

.1 The balancing contractor shall be responsible for final verification and reporting of all airflows. The balancing contractor shall be responsible for final verification and reporting of all airflows.

.3 System start-up

.1 Shall include a demonstration that all the Compounding Pharmacy airflow performance requirements of the specification are met. The Compounding Pharmacy airflow manufacturer shall provide a visual demonstration that the Compounding Pharmacy airflow systems are maintaining NAPRA air change and differential performance requirements.

.2 If the performance requirements cannot be demonstrated, then the airflow manufacturer shall be responsible for any costs necessary to meet the minimum performance requirements.

.4 Demonstration and Training

.1 The airflow manufacturer shall demonstrate that the specified room offset the systems are maintaining the proper room relative pressurization under both static conditions and recover to the proper polarity within one second of a change in room / system conditions such as the raising and lowering of hood sashes.

.2 The airflow control system supplier shall furnish a minimum of eight hours of owner training, by factory trained and certified personnel. The training will provide an overview of the job specific airflow control components, verification of initial biosafety cabinets monitor calibration, general procedure for verifying airflows of venturi air valves, and general troubleshooting procedures.

.5 Operating and Maintenance manuals, including as-built wiring diagrams and component lists shall be provided for each training attendee.

3.3 ELECTRICAL COMPONENTS, WIRING AND CONDUIT

.1 Refer to Controls Systems general requirements for control wiring installation standards.

.2 All wiring related to the Pharmacy Airflow controls system shall be installed by this section.

.3 Wiring between the DDC controls system and the airflow controls system make up air control unit shall be supplied and installed by the DDC controls system contractor.

.4 Division 26 Electrical Contractor shall supply and install a dedicated 115VAC emergency power circuits c/w local disconnect switch at each Pharmacy power supply unit supplied and installed by this section of the Pharmacy.

3.4 CLOSEOUT ACTIVITIES

.1 Training

.1 The CPACS supplier shall provide a minimum of eight hours of owner training by factory trained and certified personnel. The training will provide an overview of the job specific airflow control components, verification of initial fume hood monitor calibration, general procedures for verifying airflows of air valves and general troubleshooting procedures.

.2 Operation and maintenance manuals, including as-built wiring diagrams and component lists, shall be provided for each training attendee.

END OF SECTION

Part 1 General

1.1 GENERAL SYSTEM DESCRIPTION

.1 The Queen Charlotte Hospital (QCH) Pharmacy Upgrade – consists of the following infill and renovation components:

.2 The mechanical systems for the addition are generally consist of the following:

.1 **Localized Cooling Coils:** Cooling to the spaces is primarily provided by Cooling coils associated with each venturi valve box. Control valves shall modulate to control to room temperature setpoint.

.2 **Venturi valves:** Primary means of airflow control is via venturi valves. Valve shall modulate to maintain pressure relationships and air change rates as described in other sections.

1.2 CONTROLS CONTRACTOR

.1 Please note that the controls contractor shall be the base building contractor – ESC Automation and that the control systems include:

.1 Delta Controls and

.2 Phoenix Controls Vantage system for the compounding pharmacy (or wherever Venturi valves are shown / specified on the drawings and specifications).

1.3 ADDITIONAL SEQUENCES

.1 Please refer to 25 90 10 – Compounding Pharmacy Airflow control for additional information regarding the pharmacy differential pressure monitoring and control system.

Part 2 Products – Refer to Section 25 09 13

Part 3 Execution

3.1 HVAC CONTROL OBJECTIVES:

.1 Program the system to meet the following objectives:

.1 Set-points shall be adjustable via:

.1 The Pharmacy Terminal Display Unit (TDU) for the following control components:

.1 Pharmacy Differential Pressure Monitoring and Control (Refer to 25 09 13)

.2 Final control of room temperature setpoints and control via. variable volume controls of the venturi valves and associated re-heat coils.

.3 Other elements indicated in specifications section 25 09 35

.2 The existing KLH BMS operator workstation (OWS) will control the Air handling unit, hazardous exhaust fan, all associated equipment (for the AHU and Exhaust fan), Pre-heat control system etc. In addition the BMS will receive alarm conditions from the Pharmacy TDU.

.3 All default set-points shall be tested, set, and recorded during testing and balancing. Work with testing and balancing Agency to assist with TAB and verify default set-points.

.4 Consultant, Commissioning Agent and Controls Contractor shall optimize final control sequences.

.2 Room Temperature, Humidity and Differential Pressure Monitoring and Control:

.1 Temperature

.1 The temperature will be monitored and controlled by the TDU and controlled in each space as indicated on the drawings.

.2 Humidity

.1 Humidity will be monitored in each space. The humidification level will be controlled at the air handling unit based on feedback from the following equipment

.1 The room Temperature / Humidity Sensors (from the TDU) and

.2 Duct supply air humidity sensor

.3 The following rooms shall be provided with temperature / humidity sensors (TS):

.1 1-926 – Ante Room

.2 1-927 – Hazardous Compounding Room

.4 The following rooms shall be provided with Adjustable Thermostats (T) that display temperature and humidity:

.1 1-926 – Ante Room

.2 1-927 – Hazardous Compounding Room

.5 Pressure Control

.1 Refer to specifications section 25 09 35 for additional information

.3 Ventilation (air changes)

.1 The air change rate for each space will be tracked based on room volume and supply and / or return air quantities.

.2 Control the system's minimum outdoor air intake and the supply to each zone to meet code ventilation requirements under all operating conditions. Refer to drawings for additional information.

.4 Energy Objectives

.1 Provide no more heating than is essential (minimize reheat).

.2 Provide temperature, humidity and pressure reset functions for air and water systems to reduce energy consumption.

3.2 ALARMS AND SAFETIES

.1 All room temperature, humidity, and pressure sensors shall alarm their high or low alarm condition, as defined in the system database, at the operators Terminal Display Unit (TDU). Alarm points will be taken from dry contacts on the TDU and connected to the existing BMS.

.2 Other temperature and humidity sensors shall alarm their high or low alarm condition, as defined in the system database, at the operators existing workstation (BMS).

.3 An alarm shall be generated at the OWS when any motor status as sensed by a current sensing relay does not match the commanded value for that motor.

3.3 HD EXHAUST FAN (EF-PHARM-1)

.1 HD Exhaust fan on/off

.2 HD Exhaust fans VFD speed control

.2 System Off:

.1 **HD Exhaust Fan** (EF-PHARM-1)

.1 HD Exhaust Fans shall be off.

.3 System Start-up

.1 **HD Exhaust Fan** (EF-PHARM-1)

.1 Fan shall start once the AHU serving the space (AHU-S2) is operational

.2 Initially at startup, fan will start at 10% and will ramp up to 100% setpoint and to achieve required pressurization in the HD compounding rooms

.3 Refer to specification 25 09 35 and drawings for additional requirements

.4 Normal Operation:

.1 **HD Exhaust Fan** (EF-PHARM-1)– Duty / Standby

.1 The HD Exhaust Fan system consists of a single exhaust fan sized for 100% of the require flow. The fans will operate when the pharmacy is in use.

.2 A single fan is intended to run at all time to ensure adequate upward velocity for the entrained exhaust air stream.

.3 If the fan fails to operate, the BMS shall automatically start the standby fan. An alarm signal shall be sent to BMS.

.5 **HD Exhaust Fan** (EF-PHARM-1) - Static pressure control:

.1 The EF-PHARM-1 fan shall be controlled achieve this duct pressure set point. There shall be one (1) exhaust duct static pressure (SP) sensors, at a location near the ends of the main duct runs.

.2 Additional duct static pressure sensor shall be provided at the exhaust air ductwork adjacent to the EF-PHARM-1 to provide monitoring of fan operation. These static pressure sensors will also be used to control the fans during emergency operation modes such as external catastrophic event.

.3 The exhaust fan speed drive shall modulate as required to maintain remote supply duct static pressure at setpoint. To minimize energy consumption, the static pressure setpoint shall be as low as possible to maintain the air valve flow rates required.

.4 Adjust these setpoints during commissioning phase to determine the minimum possible setting.

3.4 COOLING COIL CONTROL

.1 General Description: A new local cooling coil is provided for the anteroom. Existing cooling coil sequence for the chemo room to be adjusted as required to suit new pharmacy controls.

.2 The cooling coil and associated valve shall operate in sequence with the venturi supply air valves

.3 Thermostat shall modulate 2-way heating control valves via the pharmacy terminal display unit and room temperature sensors / thermostats.

.4 Components

.1 Cooling Coil (CC-113B)

.2 Re-heat 2-way control valves (CC-113B -CV-1)

.5 Related Points
- .1 Outside air temperature
- .2 Heating water modulating two-way control valve
- .3 Air valve reheat coil damper and control valve position
- .4 Space temperature sensors

.6 Related Systems
- .1 Existing Air Handling units
- .2 Heating water system

.7 Normal Operation
- .1 Space temperature / humidity sensor shall modulate re-heat control valve to maintain space temperature at set point.
- .2 Where there are space temperature sensors which control air valves, they shall also control the re-heat control valve.

.8 Alarms
- .1 If any temperature sensor are reading above or below its intended operating range a BMS alarm shall be initiated.

END OF SECTION

			Binary		Analog				
System Name	Point Name	Point Description	BI	BO	AI	AO	Device	Alarm	Notes
ROOM CONTROL (Could be done via Pheonix System)									
ROOMS	CC-CONTROL	Zone Cooling				5	VME		Cooling Coil 2-Way Valve
ROOMS	RM-XXX-TEMP	Zone temps			5		RTS		Room Temperature / Thermostat
ROOMS	ROM-XXX-HUMID	Zone humidity			5		RHS		Room Humidity Sensor
ROOMS	EOL-BYPASS	Bypass valve				2	VME		2-way control valve
ROOMS	EOL-DP	Bypass DP			1		DPT		Water differential pressure sensor
ROOMS	PHARM-ALARM	PHEONIX ALARM POINT	1	1				X	Alarm points from Pheonix Control system
BACKNET POINTS									
	ROOM-TEMP								
	ROOM-HUMIDITY	Room Humidity							
	ROOM-ACH	Air change per hour							
HAZARDOUS EXHAUST FAN									
EF-PHARM-1	EF-PHARM-1-VFD	Exhaust Fan 1 Status			1		VFD	X	Exhaust fan status
EF-PHARM-1	EF-PHARM-1-CR	Exhaust Fan 1 Control		1		1	CR		Exhaust fan control
EF-PHARM-1	EF-PHARM-1-PRESS-EOL	Duct differential			1		STP		Duct Static Pressure (EOL)

ITEM	ACCEPTABLE PRODUCTS / SUPPLIERS / MANUFACTURERS	SHOP DWG.
CONTROL SYSTEMS	ESC Automation (Delta – existing base building control system)	X
COMPOUNDING PHARMACY MONITORING AND VENTURI AIR VALVES	Pheonix Controls	X
CONTROL DAMPERS	Arrow-Foil PBDAF & OBDAF, Honeywell Moduflow D642 & D643, Johnson Proportion/Aire D-1200 & D-1300, Ruskin CD36, Tamco 1000, Nailor 1010,	X
CONTROL DAMPER ACTUATORS	Belimo	X
CONTROL VALVES	By Controls Contractor (ESC Automation)	X
CONTROL VALVE ACTUATORS	Belimo, Siemens	X

NOTE:

.1 The design is based upon the equipment listed in the equipment schedules and/or underlined in the Equipment Supplier Schedules.

.2 **X** Denotes required submission.

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, 27, 28, 33, 34 & 48 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 VGH Pharmacy Renovation 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.

.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

.9 "Consultant" shall mean Stantec Consulting Ltd.

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:

.4 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.

.5 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

.6 Where applicable, include wiring, line and schematic diagrams. Include wiring drawings or diagrams showing interconnection with work of other Sections.

.7 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 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 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.

.8 Format

- .1 PDF
- .2 Bill of Quantities for related components, identified by model number, listed on the front cover with item identification numbers.

.9 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 Consultants.

.10 Keep one [1] copy of shop drawings and product data, on site, available for reference.

.11 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.

.12 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 Consultant 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 Consultant 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 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.

1.10 ASBESTOS REMOVAL

.1 Refer to specification Division 01 for procedures, removal and disposal of asbestos.

.2 If during renovations / demolition, asbestos is discovered (or material suspected to be asbestos), all work in that area shall immediately cease and the General Contractor advised. The General Contractor shall take immediate appropriate action to verify presence of friable asbestos and be responsible for the removal of all friable asbestos.

.3 This division will not be entitled to a claim for any delays resulting from the investigation of or removal of asbestos.

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 Consultant 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 Consultant'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 Architect and Consultant 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 Consultant of space problems before installing any material or equipment. Demonstrate to the Consultant on completion of the work that all equipment installed can be properly, safely serviced and replaced, if and when required.

1.13 PROVISION FOR FUTURE EQUIPMENT AND CONSTRUCTION

.1 Leave clear spaces designated for future equipment or building expansion where indicated. Plan for the installation under this contract and ensure clear accessible, unhindered access to the space is allowed for.

.2 Were contract documents don't clearly indicate the future expansion requirements, but known services are required, provide written "request for information" to the consultant before making assumptions as to intent.

1.14 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.

1.15 EQUIPMENT RESTRAINT

.1 Related Section: 26 05 05 Seismic Restraint.

.2 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.

1.16 REUSED EQUIPMENT

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

1.17 PHASED CONSTRUCTION

.1 See Architectural specifications and drawings for construction phasing. Make all allowances to phase the work in accordance with the project phasing.

.2 All existing services and the existing building must be maintained in operation. Provide and install temporary services as required.

.3 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.

1.18 SEQUENCE OF WORK

.1 Before interrupting major services notify the Owner 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.

1.19 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.

1.20 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 Owner's staff to trace the originating source and points served. Obtain instructions from the Consultant 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 Owner's 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 owner’s 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.

1.21 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 Owner. Handing over to the Owner includes moving to Owner's designated storage place on site. These items shall not become the property of the Contractor. Obtain a written receipt from the Owner detailing each of the items handed over.

.3 Remove all redundant material not required by the Owner from the site.

1.22 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.

1.23 TENDER INQUIRIES

.1 All contractor queries during the tender period shall be made in writing to the consultant. Contractor queries will be collected and suitable addenda will be issued for clarification. No verbal information will be considered valid or issued by the consultant's office during tender. All tender queries may be faxed, mailed or couriered to the consultant's office. No telephone questions will be answered.

1.24 EXAMINATION

.1 Visit the site before preparing the tender and examine all existing conditions. No extra cost will be considered for any misunderstanding of work to be done resulting from failure to visit the site.

.2 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 Consultant 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.

1.25 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 Consultant 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 Owner.

.5 Protect all existing services encountered. Obtain instructions from the Engineer 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 Consultant.

1.26 STANDARD OF ACCEPTANCE

.1 Standard of Acceptance means that the 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 Where two or more manufacturers are listed, the manufacturer's name shown first or underlined or shown with a model name and/or number was used in preparing the base design. Tenders may be based on any one of those named, provided that they meet every aspect of the base design and every aspect of the drawings and specifications.

.3 Where other than the first named or 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. Equipment/materials shall not exceed the available space limitations. Redesign drawings shall be to scale and of a standard equal to the Project Drawings.

.4 A visible manufacturer's nameplate shall indicate manufacturer's name, model number, serial number, capacity data, electrical characteristics and approval stamps.

1.27 ADDITION OF ACCEPTABLE MANUFACTURERS

.1 Material/products considered to satisfy the specification, but of a manufacturer other than those named may be submitted to the Consultant for consideration not later than five (5) working days prior to closing of tender or of bid depository subtrade tender whichever is earlier.

.2 Alternate approvals will be given by written addendum only. No other substitution will be permitted after closing of tenders.

.3 Alternate approvals granted before the closing of tenders will be limited to a manufacturer's system and/or series only. This limited approval will not preclude substitute equipment/material from complying with specific features included with equipment/material specified. Determine that the alternate product meets the specification intent before basing a tender on the product

.4 Where alternate equipment/materials are selected, allow for effects on other parts of the work of this Trade and other Trades. Where substantial changes in arrangement are required, submit shop drawings of the proposed changes with Plan and Section views and show effects on work of other Trades. Alternate equipment/materials shall not

exceed the available space limitations. Maintain installation, access and servicing clearances. No extra will be allowed due to the use of alternate equipment/materials.

.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.

1.28 CASH ALLOWANCES

.1 Coordinate cash allowances with bid documents. Allowances directly affecting this Division include: none.

1.29 PREPARATION OF RECORD DRAWINGS – CASH ALLOWANCE

.1 Refer to Section 01210 for Preparation of Record Drawings – Cash Allowance.

1.30 SEISMIC ENGINEER SERVICES - CASH ALLOWANCE

.1 Refer to Section 01210 for Seismic Engineer Services - Cash Allowance.

1.31 EQUIPMENT LIST

.1 Submit a completed Equipment List, showing the make of equipment and material included in the Tender, including the names of the subtrades, 10 days after the award of the Contract**. Form EF110** in Appendix A shall be used for this purpose.

.2 The equipment list shall be a full list of materials or systems intended for installation.

1.32 PROGRESS CLAIM AND CHANGEORDER BREAKDOWNS

.1 Ten (10) days after the award of contract, submit price breakdowns on photocopies of the Price Breakdown **Form EF112** included in Appendix A.

.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 Consultant. 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.

1.33 PROJECT CLOSE-OUT REQUIREMENTS

.1 Refer to detailed specifications in each section for detailed requirements. Also refer to Specification Appendix A Form EF-142 for list of required substantial completion submissions. Record drawings to be submitted to Consultant and all life safety systems must be operational, verified and tested and demonstrated to Consultant prior to issuance of Schedule C.

1.34 SUBSTANTIAL PERFORMANCE REQUIREMENTS

.1 Before the Consultant 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. **Form EF143** in Appendix A should be used for this purpose.

.3 A complete list of incomplete or deficient items shall be provided. If, in the opinion of the Consultant, 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 Consultant.

.5 All demonstrations to the owner have been completed.

.6 All documents required on **Form EF142** in Appendix A have been submitted.

.7 All documentation required for LEED ™ certification has been submitted.

.3 Consultants 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 (**Form EF130**).

.3 Provincial or City Electrical Inspection - Certificate of inspection.

.4 Seismic Engineers letter of Assurance and final inspection report.

.5 Certificate of Substantial Performance (**Form EF143**).

.6 Signed off copy of Consultants final inspection report.

.7 Fire alarm verification.

1.35 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 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.

2.2 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.

2.3 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.

2.4 WARNING SIGNS

.1 Provide warning signs, as specified or to meet the requirements of Inspection Department, Authority having Jurisdiction, Engineer and Architect.

.2 Use decal signs, minimum 175 x 250 mm [7” x 10”] size

2.5 WIRING TERMINATIONS

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

2.6 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 – eg Conditional/Vital – Size 4 lettering

.2 Line 2 – Panel/CDP designation – Size 4 lettering

.3 Line 3 – eg 225A, 120/208V, 3 phase 4W – Size 2 lettering

.4 Line 4 – Feeder: eg 4#3 – 35mm C – Size 2 lettering

.5 Line 5 – Origin eg: Main Elect. Room – Size 2 lettering

.2 Distribution Circuit Breakers – 4 lines

.1 Line 1 – Conditional/Vital – Size 4 lettering

.2 Line 2 – Main Circuit Breaker – Size 4 lettering

.3 Line 3 – Feeder: eg 4#3 – Size 2 lettering

.4 Line 4 – 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.

.3 Standby/Emergency Power: white letters on red 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 Consultant before installing. Circuit number to agree with Record Drawings.

.2 In Patient Care areas provide receptacle circuit identification in accordance with CSA-Z32 “Electrical Safety and Essential Electrical Systems in Health Care Facilities”. Provide mechanically fastened (with drive rivets, not screws) lamicoid nametags for all receptacles located in Patient Care areas. Nameplates to be located above receptacles in Patient Care areas.

.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.

2.7 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.

2.8 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
High Voltage	Yellow	Purple	Nominal V
347/600V Normal	Dark Blue		
347/600V Conditional	Dark Blue		
347/600V Emergency	Dark Blue	Red	
347/600V UPS	Dark Blue	Orange	
120/208V Normal	Light Blue		
120/208V Conditional	Light Blue		
120/208V Emergency	Light Blue	Red	
120/208V UPS	Light Blue	Orange	
Ground	Dark Green		GR
Fire Alarm	Red		FA
Emg Voice Paging	Red	Dark Green	EP
Fire Fighters Telephone	Red	Light Green	FFT
Computer/Data	Light Green		COM
Telephone	Light Green	Black	TEL
General Intercom	Light Green	Yellow	IC
Low Level Paging	Light Green	White	PA
Commercial TV	Dark Brown		TV
AV/TV Systems	Light Brown		AV/TV
Security Systems	Purple		SEC
Building Alarm	Purple	White	BA
CCTV	Purple	Yellow	CCTV
Door Intercom	Purple	White	DI
Door Lock Release	Purple	Black	ED
Master Clock System	Yellow		CS
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
Health Care:			
Nurses' Call	Orange		NC
Patient Monitoring	Orange	Black	MON
Patient Emergency Call	Orange	Pink	EC
Cardiac Arrest	Orange	Green	CA
Low Voltage Control	White	Yellow	LVC

2.9 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.

2.10 ANCHOR BOLTS AND TEMPLATES

.1 Supply anchor bolts and templates for installation by other Divisions.

2.11 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.

.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 heavy duty anchor for use in concrete with compressive strength not less than 19.6 MPa [2840 psi].

.2 Hilti Kwik-Bolt or UCAN WED stud anchor for concrete. (Do not use in seismic restraint applications).

.3 Hilti HDI or UCAN IPA drop-in anchor for concrete.

.4 Hilti or UCAN Sleeve Anchor (medium and light duty) for concrete and masonry.

.5 Hilti ZBP or UCAN Zamac pin bolt (light duty) for concrete and masonry.

.3 Drilled, adhesive type:

.1 Hilti HVA or UCAN Adhesive Anchor consisting of anchor rod assembly with a capsule containing a two-component adhesive, resin and hardener.

.2 Hilti HY150 consisting of anchor rod with a 2 part adhesive system.

.3 For use in concrete housekeeping bases (in vertical downward position) where the distance to the edge of the concrete base could cause weakness if a mechanical expansion type anchor were used.

.4 Rod assemblies shall extend a minimum of 50 mm [2"] into the concrete slab below the housekeeping bases.

.3 Note:

.1 All drilling for inserts shall be performed using the appropriate tool specifically designed for the particular insert. The diameter and depth of each drilled hole shall be to the exact dimensions as specified by the insert manufacturer.

.2 Refer to manufacturer's recommendations for tightening torques to be applied to inserts.

.3 Where specifically called for, drills shall include a dust vacuum system, Hilti SAV Dust Vacuum System.

2.12 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.

.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.

2.13 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 prime and undercoat painted ready for finish under the related Division.

2.14 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.
- .6 Spare parts list.
- .7 Copies of guarantees and certificates.
- .8 Manufacturer's maintenance brochures and shop drawings.

.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 Consultant before printing.

.5 Submit a draft copy to the Consultant for review thirty (30) days prior to start up of the systems and equipment.

.6 Submit three (3) copies in the final approved form.

2.15 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 Consultant 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" provide the consultant with a copy of the red-lined “As-Built” drawings for production of record drawings.

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 LOCATION OF OUTLETS

.1 Do not install outlets back-to-back or in the same stud space in wall; allow minimum 400mm [16”] horizontal clearance between boxes.

.2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000mm [10”- 0”] and information is given before installation.

.3 Locate light switches on strike side of doors unless otherwise indicated.

.4 Locate light switches on latch side of doors.

.5 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.5 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not indicated verify before proceeding with installation. Confirm the height of devices in handicapped facilities before installation.

.3 Refer to detail on drawings.

.4 In the absence of a drawing detail or drawing note, use the following:

Device	Height		Comment
Local switches	1200	[48”]	
Wall receptacles/data	450	[18”]	General
Wall receptacles/data	200	[8”]	Above top of continuous baseboard heater
Wall receptacles/data	175	[7”]	Above top of counters or counter splash backs – coordinate with Architectural detail
Wall receptacles/data	900	[36”]	In mechanical rooms
Wall receptacles/data Health Care	450 to 900	[18”] to [36”]	Confirm before installation
Panelboards	2000	[80”]	Panelboards: as required by Code or as indicated.
Wall mtd telephone	1500	[60”]	
Card Readers	1200	[48”]	Confirm before installation
Fire alarm stations	1350	[54”]	ULC S524 requires not less than 1200mm or more than1400mm.
Fire alarm bells/audio	2200	[88”]	ULC S524 requires not less than 1800mm to centre. In any event not closer than 50mm to the ceiling
Fire alarm visual devices	2000	[80”]	ULC S524 requires not more than 2000mm to centre. In any event not closer than 150mm to the ceiling
Fire alarm Annunciator	1800 Top	[72”]	ULC S524 requires not more than 1800mm above finished floor.
End of line resistors	1800	[72”]	
Television outlets			As receptacles –coordinate with equipment location
Wall mounted speakers & clocks	2100	[84”]	Coordinate with equipment location
Door bell pushbuttons	1500	[60”]	Coordinate with location
Emergency Lighting (wall mounted)			150mm below ceiling or 4800mm max.
Nurse call (NC) bed station	1350 to 1500	[54”] to [60”]	Coordinate with Architectural detail and/or bedhead layout
NC emergencystation	1350	[54”]	
NC shower station	1650	[66”]	
NC staff/duty station	1500	[60”]	

3.6 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.

3.7 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 and neutral currents to dry-core transformers and motor control centres, operating under normal load,

.3 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 Power generation and distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.4 Systems: fire alarm system and communications.

.5 Main ground resistance (at all grounding locations).

.6 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 Consultant with at least one weeks notice prior to testing.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 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.

.6 Reports:

.1 Provide written reports in a timely manner upon completion of the testing and load balance. Indicate test hour and date.

3.8 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.

3.9 WORKMANSHIP

.1 Workmanship shall be in accordance with well established practice and standards accepted and recognized by the Consultant and the Trade.

.2 The Consultant 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 Consultant.

3.10 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.

3.11 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.

3.12 CONCEALMENT

.1 Conceal wiring and conduit in partitions, walls, crawlspaces and ceiling spaces, unless otherwise noted.

.2 Do not install wiring and conduit on outside walls or on roofs unless specifically directed.

3.13 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 The scope 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.

.3 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.

.4 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.

.5 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.

.6 Provide fire stopping material and system information in the maintenance manuals and via labels at major penetrations that are likely to be repenetrated.

.7 All penetrations are to be firestopped using EZ Path System (Specified Technologies Inc - STI) only.

.8 Allow openings for 100% capacity of raceway or 200% capacity of J-hooks.

.9 Provide split systems where existing cables are involved.

.10 Provide Firestopping approval certificate in including a Building Code / By-Law Schedule B-1, B-2 & C-B signed by a BC registered Professional Consultant. Submit a letter certifying that all work is complete and in accordance with this specification. Electrical Form EF130 in Section 16991 [26 06 02] should be used for this purpose.

3.14 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.

3.15 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.

3.16 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 Consultant.

.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 Consultant's approval.

.5 Locate equipment and junction boxes in service areas wherever possible.

3.17 EQUIPMENT INSTALLATION

.1 Provide means of access for servicing equipment.

.2 CSA identification and equipment labels to be clearly visible after installation.

3.18 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 Consultant.

.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.

3.19 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 is to be read, coordinated and implemented in conjunction with all other parts of the Contract Documents.

1.2 REGULATORY REQUIREMENTS

.1 Restraints shall meet the requirements of the latest edition of the British Columbia Building Code and amendments.

.2 The Seismic Consulting Engineer should be able to provide a proof of professional insurance and the related practice credentials if requested by the Electrical Consultant. The Seismic Consulting Engineer should be familiar with SMACNA, ECABC & NFPA guidelines as well as BCBC and VBBL requirements.

.3 The Contractors Seismic Consultant shall submit original signed BC Building Code “Letters of Assurance” “Schedules B1, B2, and C-B” to the Prime Consultant or Electrical Consultant.

.4 Projects in the jurisdiction of the City Vancouver to comply with the local bylaw as applicable.

.5 Use the City Vancouver details in the absence of any local requirements.

.6 The above requirements shall not restrict or supplant the requirements of any local bylaws, codes, or other certified agencies which may have jurisdiction over all or part of the installation.

1.3 SCOPE

.1 It is the 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.

.2 Manufacturer's shop drawings to be submitted with seismic information on equipment structure, bracing and internal components and as required by Division 01.

.3 Provide restraint on all equipment and machinery, which is part of the building electrical services and systems, to prevent injury or hazard to persons and equipment in and around the structure. Restrain all such equipment in its normal position in the event of an earthquake.

.4 The total electrical seismic restraint design and field review and inspection will be by a B.C. registered professional structural engineer who specializes in the restraint of building elements. Contractor to allow for coordination, provision of seismic restraints, as well as all costs for the services of the Seismic Restraint Engineer. This engineer, herein referred to as the Seismic Consultant, will provide normal engineering functions as they pertain to seismic restraint of electrical installations.

.5 The Contractor shall be aware of, and comply with, all current seismic restraining requirements and make provision for those that may come into effect during construction of the project. Make proper allowance for such conditions in the tender.

.6 The Seismic Consultant shall provide detailed seismic restraint installation shop drawings to the Contractor. Copies of the shop drawings to be included in the final project manual.

.7 Provide seismic restraints on all equipment, and/or installations or assemblies, which are suspended, pendant, shelf mounted, freestanding and/or bolted to the building structure or support slabs.

.8 The Seismic Consultant shall provide inspections during and after installation. The Contractor shall correct any deficiencies noted without additional cost to the contract.

.9 Include all costs associated with the Seismic installation and certification in the base tender.

1.4 SHOP DRAWINGS & SUBMITTALS

.1 Submit shop drawings of all seismic restraint systems including details of attachment to the structure, either tested in an independent testing laboratory or approved by the seismic consultant.

.2 Submit all the proposed types and locations of inserts or connection points to the building structure or support slabs. Follow the directions and recommendations of the Seismic Consultant.

Part 2 Products

2.1 SLACK CABLE SYSTEMS

.1 Slack cable restraint systems shall be as designed and supplied by Vibra-Sonic Control or equal.

.2 Slack cable restraints shall be provided on suspended and shelf mounted transformers along with associated equipment and assemblies connected to them at the points of vertical support (4 points). The restraint wires shall be oriented at approximately 90o to each other (in plan), and tied back to the ceiling slab or its structure at approximately 45o to the slab or basic structure. The restraints shall be selected for a 1 g earthquake loading, i.e. each wire shall have a working load capacity equal to the weight of the transformer. The anchors in the structure shall be selected for a load equal to the weight of the transformers at a 45o pull.

.3 Slack cable systems to allow normal maintenance of equipment and shall not create additional hazard by their location or configurations. Contractor shall rectify any such installations at no additional cost, all to the satisfaction of the engineer and inspection authority having jurisdiction.

.4 Coordinate requirements of slack cables with suppliers prior to installation.

Part 3 Execution

3.1 GENERAL

.1 All seismic restraints systems shall conform to local authority having jurisdiction and all applicable code requirements.

3.2 CONDUITS

.1 Provide restraint installation information and details on conduit and equipment as indicated below:

.2 Vertical Conduit:

.1 Attachment - Secure vertical conduit at sufficiently close intervals to keep the conduit in alignment and carry the weight of the conduits and wiring. Stacks shall be supported at their bases and, if over 2 stories in height, at each floor by approved metal floor clamps.

.2 At vertical conduit risers, wherever possible, support the weight of the riser, at a point or points above the center of gravity of the riser. Provide lateral guides at

the top and bottom of the riser, and at intermediate points not to exceed 9.2 m [30 ft] o.c.

.3 Riser joints shall be braced or stabilized between floors.

.4 Horizontal Conduits:

.1 Supports - Horizontal conduit shall be supported at sufficiently close intervals to keep it in alignment and prevent sagging.

.2 EMT tubing - tubing shall be supported at approximately 1.2 m [4 ft] intervals for tubing.

.5 Provide transverse bracing at 12.2 m [40 ft] o.c. maximum unless otherwise noted. Provide bracing at all 90o bend assemblies, and pull box locations.

.6 Provide longitudinal bracing at 24.4 m [80 ft] o.c. maximum unless otherwise noted.

.7 Do not brace conduit runs against each other. Use separate support and restraint system.

.8 Support all conduits in accordance with the capability of the pipe to resist seismic load requirements indicated.

.9 Trapeze hangers may be used. Provide flexible conduit connections where conduits pass through building seismic or expansion joints, or where rigidly supported conduits connect to equipment with vibration or seismic isolators.

.10 A conduit system shall not be braced to dissimilar parts of a building or two dissimilar building systems that may respond in a different mode during an earthquake. Examples: wall and a roof; solid concrete wall and a metal deck with lightweight concrete fill.

.11 Provide large enough conduit sleeves through walls or floors to allow for anticipated differential movements with firestopping where required.

.12 It is the responsibility of the contractor to ascertain that an appropriate size restraint device be selected for each individual piece of equipment. Submit details on shop drawings. Review with seismic consultant and submit shop drawings to consultants for their reference.

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.

.3 Refer to “Patient Care Wiring” Section 26 05 23H for additional requirements in Health Care Facilities.

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 Aluminium conductors only permitted where indicated on drawings and then typically only for feeder conductors larger than 3/0 AWG. All conductor sizes indicated on drawings are based on copper conductors unless otherwise noted.

.3 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-6 flame spread rating.

.4 Flexible armoured cabling (BX) shall not be used for the general wiring system other than final drops to recessed light fixtures in concealed locations.

.5 Cabling indicated to be 2-Hour Fire-Rated shall be Vitalink 2-hour rated cable compliant to CAN/ULC-S139 and CSA 38-95. Cabling shall be low smoke halogen free.

.6 Provide all control wiring except HVAC controls as specified in Mechanical Divisions.

.7 Refer to Equipment Schedule(s) for detailed responsibilities.

.8 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 Site services sub-circuits, including site lighting, to be minimum #10 AWG for power and #12 for controls. Increase wiring size for lengthy and/or loaded circuits so that system will not exceed the maximum voltage drop as recommended by the Canadian Electrical Code CSA 22.1.

.5 Main feeders to be conduit and copper insulated wiring unless otherwise noted on drawings. Provide ground wiring for all conduits in or below slabs. Increase conduit size as required.

.6 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.

.7 TBS90 #14 AWG stranded shall be used in all switchgear assemblies. Current transformer secondary wiring shall be #12 AWG stranded. Current transformer leads shall incorporate ring type tongues for termination purposes

.8 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 condulet 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 TWO HOUR FIRE RATED CABLE ASSEMBLIES.

.1 Cabling indicated to be 2-Hour Fire-Rated shall be Vitalink 2-hour rated cable compliant to CAN/ULC-S139 and CSA 38-95. Cabling shall be low smoke halogen free.

2.4 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.

2.5 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.

2.6 NON-METALLIC SHEATHED CABLE

.1 Non-metallic sheathed copper cable type: NMD-90 size as indicated.

2.7 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).

2.8 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.

.2 Section 26 05 23 “Patient Care Wiring” includes Equipotential Grounding for Patient Care.

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 Provide “Fall of Potential” tests and the corresponding “Touch & Step” calculations for high voltage installations.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions. Measure ground grid resistance.

.3 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 Rod electrodes: Existing

.3 System and circuit, equipment, grounding conductors, bare stranded copper, soft annealed, sized as indicated. Insulation where specified or required to be green.

.4 Ground bus: Existing

.5 Non-corroding accessories necessary for grounding system, type, size material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.

.2 Protective type clamps.

.3 Bolted type conductor connectors.

.4 Thermit welded type conductor connectors.

.5 Bonding jumpers, straps.

.6 Pressure wire connectors.

2.3 STANDARDS OF ACCEPTANCE

.1 Acceptable manufacturers:

.1 Burndy Corp.

.2 Erico Inc

.3 Cadweld.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Extend existing grounding system to create a complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories.

.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 Connect building structural steel and metal siding to ground by welding copper to steel.

.10 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.11 Bond single conductor, metallic armoured cables to cabinet at supply end and provide non-metallic entry plate at load end.

.12 Provide a bonding conductor appropriately sized within each raceway routed within the building.

.13 All bonding and grounding connections to be compression type unless noted otherwise.

.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 Bond all structural steel, all concrete reinforcing steel and all metal systems with a #2 copper bonding conductor. Connect to closest ground bus or bonding point.

.19 All metallic conduits longer than 1m in length, containing a single grounding or bonding conductor, shall be bonded as per the Canadian Electrical Code.

3.2 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.

3.3 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 Measure ground grid resistance with earth test megohmmeter and install additional ground rods and conductors as required until resistance to ground complies with Code requirements and is less than 1Ω.

.4 Carry out all tests required by the Electrical Inspection Authority and provide all required reports and copied to the Consultant. Include all associated costs.

.5 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 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for cabinets in accordance with Section 26 05 00

Part 2 Products

2.1 SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Main and branch lugs, connection bars to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm [1”] minimum extension all around, for flush-mounted pull and junction boxes.

2.3 FINISHES

.1 Apply finishes in accordance with Section 26 05 00.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Install splitters as indicated and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES

.1 Install pull boxes in inconspicuous but accessible spaces.

.2 Only main junction and pull boxes are indicated. Provide pull boxes so as not to exceed 30 m of conduit run between pull boxes.

.3 Provide pull boxes and junction boxes in locations shown on the drawings and as required to suit job conditions.

.4 Locate pull boxes and junction boxes above removable ceilings, in electrical rooms, utility rooms or storage areas.

.5 Junction boxes, when used, to be installed in areas that are accessible through luminaire openings, and/or access panels.

.6 Where pull boxes are flush mounted, provide overlapping covers with flush head cover retaining screws, prime coated and painted to match wall or ceiling finish.

.7 Where cast corrosion resistant boxes are used, covers to be of matching type and gasketted.

.8 For special (not 100mm [4”] square or octagonal) pull boxes and/or junction boxes, paint identification for the system and provide lamicoid nametags to box covers with a size 2 nameplate 5mm [0.25”] lettering identifying system.

.9 Interior of all pull boxes and junction boxes for each system to be spray painted with colour as specified in Section 26 05 00

.10 All pull boxes, junction boxes and cabinets to be supported directly from building structure using one or a combination of galvanized screws, galvanized bolts, galvanized rods, and approved box clip.

.11 Support of pull boxes, junction boxes by conduit fittings or wire is not acceptable.

3.3 IDENTIFICATION

.1 Install size 2 identification labels indicating system name, voltage and phase in accordance with Section 26 05 00

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 Consultant 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.

.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 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi gang type MDB boxes for devices flush mounted in exposed block walls.

2.9 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.10 SURFACE CONDUIT BOXES

.1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.

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 of 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.

.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 flexible metal conduit for connection to recessed incandescent fixtures without a prewired outlet box and connection to recessed fluorescent fixtures.

.32 Use liquid tight flexible metal conduit for connection to motors, and other vibrating equipment and transformers.

.33 Use explosion proof flexible connection for connection to explosion proof motors.

.34 Install conduit-sealing fittings in hazardous areas, isolation rooms and clean rooms. Fill with compound.

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 SPARE CONDUITS

.1 Provide spare conduits as indicated.

.2 Provide 2x27 mm [1”] spare conduits up to ceiling space and 2x27 mm [1”] spare conduits down to ceiling space below from each flush panel. Terminate the conduits in 150x150x100 mm [6”x6”x4”] junction boxes in ceiling spaces or in case of an exposed concrete slab, terminate each conduit in a flush concrete box. Provide coverplates for all junction boxes.

3.4 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.

3.5 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 Existing Panel Boards are Square D.

.2 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.

.3 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.

.4 Provide circuit breakers with indicated trip ratings as shown in the panelboard schedules.

2.2 PANELBOARD IDENTIFICATION

.1 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.

.2 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.

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 In general the HVAC and the Plumbing/Fire Protection motors and drives will be respectively provided under the Mechanical Division and Plumbing/Fire Protection Divisions;. Refer to the related division of the specifications and drawings for exact locations and requirements.

.2 Provide the following components:

- .1 All disconnect switches required.
- .2 All starters, contactors, control transformers, except where supplied by the Mechanical or Plumbing/Fire Protection Divisions as noted in the equipment schedule.

.3 Thermostats, solenoid valves, pressure switches, aquastats, flow switches, timeclocks are generally provided by the Mechanical or Plumbing Divisions except as noted in the equipment schedule(s).

.4 Refer to equipment schedule(s) for details of motor controls and devices.

.5 Provide all power wiring from power distribution centre, through starter and control equipment to the motors.

.6 Conduit, wire and connections for all HVAC low voltage control wiring shall be the responsibility of Mechanical Division unless otherwise specified.

.7 Provide, connect and verify all Fire Alarm control wiring and devices.

1.3 CONTROLS - GENERAL

.1 Mechanical and Plumbing Divisions differ both in regard to the particulars of drives, motors, etc. specified. The Mechanical Division typically includes a major section on controls whereas the Plumbing Division typically includes more package equipment requiring power service connection only. Because of these variations the demarcation point between the work of the Electrical Division and the Mechanical and Plumbing Divisions typically differ.

.2 Generally for drives, equipment, etc. detailed in the Mechanical Division, the work of the Electrical Division finishes with the supply of a standard terminal block array for each starter. All further wiring, relays, timers, etc., together with control consoles, are provided under the Mechanical Division.

.3 Generally for the package equipment, drives and special controls detailed in the Plumbing Division, the work of the Electrical Division typically includes the provision of all wiring, devices, etc to complete each system and left ready for commissioning, set up, etc. by the Plumbing Division.

1.4 ELECTRICAL DIVISION RESPONSIBILITIES FOR MECHANICAL DIVISIONS

.1 Provide a ten point terminal block for each starter or contactor.

.2 Provide interwiring between starters or contacts and terminal blocks. Starter to be entirely factory-wired.

.3 Terminals to be as follows:

.1 120 V line from control transformer.
.2 Terminals for remote 3 wire stop/start.
.3 HOA or other control.
.4 120V neutral.
.5 Normally open dry contact.
.6 Common.
.7 Normally closed dry contact.
.8 Normally open dry contact.
.9 Common.
.10 Normally closed dry contact.

.4 Except where otherwise indicated, the work of the Electrical Division shall not extend beyond the control terminal blocks. The Mechanical Division shall provide all conduit, wire, wiring connections and components such as relays, timers, etc. as required to provide the interlocking functions and controls as outlined in the specifications. If the standard terminals supplied by the Electrical Division require supplementation in any way, e.g. by supplying additional N.O. or N.C. contacts, these facilities are included in the Mechanical Division Mech Div scope.

.5 Mechanical Division shall provide the mechanical control consoles complete with pilot controls, indicating lights, etc., as outlined in the specifications.

.6 When an item provided under the Mechanical Division is factory supplied with a starter or contactor and it is necessary to alter or add to the control wiring in order to achieve the method of operation specified in the Mechanical Division, this work shall be included in Mechanical Division.

.7 When control items such as thermostats, float controllers, etc., are connected to power wiring in series with the item being powered (e.g. unit heater motor, fractional HP fans, etc.) the supply and installation of the controller devices are included in Mechanical Division. Power wiring to and from the controllers is included in the Electrical Division. Install line voltage thermostats for single phase motors provided by the Mechanical Division where specifically indicated on the drawings and/or the “Equipment Schedule” of this specification.

.8 When the electrical characteristics of a controlled item exceed the capacity of a specified controller, provision of a contactor and the required wiring shall be included in the Mechanical Division.

1.5 ELECTRICAL DIVISION RESPONSIBILITIES FOR PLUMBING DIVISIONS

.1 When a drive, motor, etc. provided under the Plumbing Divisions is factory supplied with a starter, contactor, alternator, pressure switch, etc., the wiring and installation of these items and controls shall be included in the Electrical Division.

.2 The ten point terminal blocks similar to those specified under the Mechanical Division controls are not mandatory for the Plumbing Division equipment.

.3 The Electrical Division shall provide stop/start or HOA controls as specified for each item except where these stations are factory supplied with equipment.

.4 The Electrical Division shall leave each system fully functional and requiring only minor final adjustments (such as pressure or vacuum settings) by the Plumbing Divisions.

Part 2 Products

2.1 MATERIALS

.1 Refer to appropriate section of the Electrical Division(s).

2.2 CONTROL RELAYS

.1 Control relays to be rated minimum 10 A, 300V, with contacts as required and 120 V control coil unless otherwise noted. Relays to be typically mounted in CEMA1 enclosures located in control terminal cabinets and/or MCC.

.2 Provide required fire alarm relays and auxiliary contacts in motor control centres or at the related equipment cabinets to provide activation and deactivation of mechanical fan units as specified in the Mechanical Division.

.3 Relays for Fire Alarm shutdown system control to be approved for Fire Alarm use and powered from the Fire Alarm panel. Fire Alarm relay enclosures to be finished in red and identified “FIRE ALARM RELAY”

.4 Time delay relays to incorporate time delay feature to delay either opening or closing as specified. Time period to be adjustable from 0 to 5 minutes unless otherwise specified.

Part 3 Execution

3.1 INSTALLATION

.1 Provide all labour and materials required to complete power wiring for HVAC, Plumbing and Fire Protection equipment as called for in the project specifications and/or shown on the drawings.

.2 Provide all single and 3 phase motor protection switches, combination starters and disconnects contactors and relays as required for mechanical equipment unless otherwise specifically noted in these specifications or on the drawings.

.3 Terminate all line voltage wiring to the designated equipment terminals.

.4 Obtain a full set of HVAC control shop drawings and have a full understanding of the scope before commencing installation and including any fire alarm interface.

.5 Verify the recommended overcurrent protection and rating of Mechanical and Plumbing and Fire Protection equipment and equipment supplied by the Owner. Change feeder overcurrent protection as required to comply with equipment recommendations. Notify the Consultant of all revisions.

3.2 FIELD QUALITY CONTROL

.1 Cooperate with Mechanical Consultant and Contractor and check out the operation of all motor controls with all HVAC systems fully operational. Record all electrical loads. Replace any defective or wrongly sized starter overloads, heaters, fuses or circuit breakers.

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 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 26 05 00.

1.3 RELATED SECTIONS

.1 Section 26 09 24 Lighting Controls (Occupancy Sensors, Low Voltage Switching Devices, etc).

1.4 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA-C22.2 No.55, Special Use Switches.

.4 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.5 PHARMACY SUPPLEMENT

.1 Use “Hospital Grade” devices in all Pharmacy areas unless otherwise noted.

.2 Use “Heavy Duty Specification Grade” devices in all other areas.

Part 2 Products

2.1 RECEPTACLES – GENERAL

.1 Heavy duty specification grade.

.2 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:

.1 White nylon molded housing (red for emergency power circuits)

.2 Suitable for No.10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and non riveted grounding contacts.

.3 Use shuttered safety receptacles in Day Care or similar children play areas or as indicated.

.4 Receptacles of one manufacturer throughout project.

.5 Standard of acceptance:

.1 Hubbell 5252 heavy duty, construction series

.2 Leviton 5262 series

.3 Pass & Seymour 5262 series

2.2 RECEPTACLES – PARTICULAR APPLICATION

.1 Allow a maximum connection of six general use receptacles to one 15 amp circuit.

.2 Utilize NEMA 5-20R 15/20Amp style duplex receptacles for printers / and provide 20A rated dedicated circuits for each printer / copier unless special receptacle type configuration is required to suit the selected equipment.

.3 Utilize NEMA 5-20R 15/20Amp style receptacles for housekeeping spaced a maximum of 15 metres apart staggered along alternate sides of the corridor. Provide 20A rated dedicated conditional circuits for each area, to a maximum of 6 receptacles per circuit.

.4 Ground Fault Interrupter type to be 15 Amp, 125 volt duplex receptacles to be 2 pole, 3 wire hospital grade, white face, parallel blade, U ground, impact resistant nylon face, complete with breaker and reset button. Equal to:

.1 Hubbell GF8200A series

.2 Leviton 7599HG series

.3 Pass & Seymour HG1595 series (Décor)

.5 In the Campus Communications Hub (CCH) use L21-30R Industrial grade twist lock receptacles, two (2) per server cabinet and equipment rack are to be mounted on the underside the cable runner facing down above the vertical PDU location.

.6 All other single outlet and special purpose receptacles to be similar to the grade and series indicated above. Confirm ampacity, voltage and pin configuration prior to installation.

2.3 COVER PLATES

.1 Utilize thermoplastic nylon cover plates for receptacles and switches.

.2 In patient areas provide tamperproof fasteners, minimum two per cover plate, and install cover in a bed of tamperproof sealant.

.3 Grouped receptacles and switches will have a single cover plate for the whole group.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Mount wiring devices to height specified in Section 26 05 00 or as indicated.

.2 Upper edge of plates located on separate outlets immediately alongside one another to be at exactly the same height above finished floor.

.3 All plates to be installed parallel or perpendicular to building lines.

3.2 INSTALLATION PARTICULAR

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.2 Receptacles:

.1 Install all receptacles in the vertical plane unless otherwise noted.

.2 Generally install the 5-15/20R U ground pin down unless otherwise noted. Neutral up when receptacle in mounted horizontal.

.3 Install receptacles vertically in gang type outlet box when more than one receptacle is required in one location.

.4 Where split receptacles has one portion switched, mount vertically and switch the upper portion.

.5 Surge suppression duplex receptacles to be provided for all communication and computer terminal equipment backboards and cabinets including fire alarm, telephone, public address, door security, nurse call, central dictation, RF television, security television, etc. Provide dedicated neutral conductors for each surge suppression receptacle.

.6 Ground fault interrupter duplex receptacles to be used, adjacent sinks or water sources.

.3 Cover plates:

.1 Protect cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 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 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 Weatherproof as required.

2.2 CONTACTOR EQUIPMENT

.1 Contactors: to CSA C22.2 No.14.

.2 Half size contactors not accepted.

.3 Electrically operated, electrically or mechanically held, multi-pole full voltage type.

.4 Contactors to have 120V operating (and unlatching) coils unless otherwise noted.

.5 Controlled by pilot devices as indicated and rated for type of load controlled.

.6 Breaker or Fused switch combination contactor as indicated.

.7 Complete with 1 normally open and 1 normally closed auxiliary contacts unless indicated otherwise.

.8 Provide CEMA enclosure as required for location unless indicated otherwise.

2.3 EQUIPMENT IDENTIFICATION

.1 Indicate name of load controlled on size 4 name plates to Section 26 05 00.

2.4 STANDARD OF ACCEPTANCE

.1 Cutler Hammer – Heavy Duty xxxx

.2 Schneider - Heavy Duty xxxx

.3 Siemens - Heavy Duty xxxx

Part 3 Execution

3.1 DISCONNECT INSTALLATION

.1 Install disconnect switches complete with fuses where indicated or required.

.2 All disconnect switches for elevator machine rooms shall be fused in accordance with the equipment suppliers' requirements.

.3 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.

.4 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 Consultant has given a special pre-approved circumstance.

3.3 CONTACTOR INSTALLATION

.1 Install contactors and connect auxiliary control devices.

.2 Pilot lights to be illuminated when contactor is closed.

.3 Control wire to be minimum #14 AWG. Remote control wiring to be 5A fuse protected and the wiring shall be upsized to limit voltage drop to no more than 2%.

.4 Control circuits shall fail safe leaving the contactor in the open position if the power fails or where automatic reset could be a safety or operational concern. Provide a control circuit seal-in contact for all momentary contact control devices unless otherwise indicated.

.5 The contactor shall not automatically reset after a power failure unless otherwise indicated or for such items as automatic freeze protection, snow melting, light control etc.

.6 Electrically held contactors to be located in service rooms where practical.

End of Section

Part 1 General

1.1 RELATED SECTIONS

.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 26 05 00 Common Work Results.

.3 Complete and operational telecommunications system as required by the drawings and as herein specified.

.4 Provide all labour, materials, tools, and equipment required for the complete installation of work called for in all sections of the contract documents.

1.2 REFERENCES

.1 TIA/EIA-568-B.1 Commercial Building Telecommunications Cabling Standard – Part 1: General Requirements

.2 TIA/EIA-568-B.2 Commercial Building Telecommunications Cabling Standard – Part 2: Balanced Twisted Pair Cabling Components

.3 TIA/EIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces

.4 TIA/EIA-606-B Administration Standard for Commercial Telecommunications Infrastructure.

.5 J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

.6 TIA/EIA-758-A Customer Owned Outside Plant Telecommunications Cabling Standard

.7 TIA/EIA-942 Telecommunications Infrastructure Standard for Data Centers

.8 NECA/BICSI 568-2006 Standard for Installing Commercial Building Telecommunications Cabling

.9 ANSI/TIA 568-B.2-10 Augmented Category 6A Cabling

.10 BICSI Telecommunications Distribution Methods Manual (TDMM), latest edition

.11 Canadian Electrical Code (CEC)

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 SPECIFICATIONS AND DRAWINGS

.1 The General Conditions, Supplementary Conditions and Division 01 are part of this specification and shall apply to this Division.

.2 The intent of the specifications and drawings are to include all labour, products and services necessary for complete work, tested and ready for operation.

.3 Symbols used to represent various telecommunications devices often occupy more space on the drawing than the actual device does when installed. In such instances, do not scale locations of devices from telecommunications symbols. Install these devices with primary regard for usage of wall space, convenience of operation and grouping of devices.

.4 These specifications and the drawings and specifications of all other divisions shall be considered as an integral part of the accompanying drawings. Any item or subject omitted from either the specifications or the drawings but which is mentioned or reasonably specified in and by the others shall be considered as properly and sufficiently specified and shall be provided.

.5 Provide all minor items and work not shown or specified but which are reasonably necessary to complete the work.

1.5 SUBMITTALS

.1 Prior to delivery of any products to job site and sufficiently in advance of requirements to allow ample time to checking, submit shop drawings for review as specified in Division 01. Submit shop drawings for all equipment as required in each section of this specification.

.2 Prior to submitting the shop drawings to the Consultant, the contractor shall review the shop drawings to determine that the equipment complies with the requirements of the specifications and drawings.

.3 The term “shop drawing” means drawings, diagrams, illustrations, schedules, performance characteristics, brochures and other data which are to be provided by the contractor to illustrate details of a portion of the work.

.4 Manufacturer of products shall conform to revised shop drawings.

.5 Keep a complete set of shop drawings at job site during construction.

1.6 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 Health and Safety Requirements.

1.7 PRODUCT HANDLING

.1 Use all means necessary to protect the products of this Division before, during and after installation and to protect products and installed work of all other trades.

.2 Immediately make good any damage by repair or replacement at no additional cost to the Owner and to the approval of the Consultant.

.3 Remove advertising labels from all equipment. Do not remove identification or certification labels.

1.8 LABOUR

.1 The communications contractor must comply with all job-site requirements for the duration of the project.

.2 The communications contractor agrees to use only trade person who are fully trained, qualified and experienced on the installation, termination and testing of the structured cabling solution. The communications contractor must be an approved installer of the specific structured cabling solution.

Part 2 Products

2.1 SELECTED PRODUCTS & EQUIVALENTS

.1 Products and materials provided shall be new and free from all defects. Defective products or materials will be rejected, regardless of previous inspections. The contractor shall be responsible to remove and replace defective products at their expense, and shall be responsible for any resulting delays and associated expenses which result from defective products being rejected. Related materials shall be of the same manufacturer throughout the project.

.2 Products and materials referred to in the specifications by trade names, manufacturer's name and catalogue reference are those which shall be used as the basis for the Tender.

2.2 QUALITY OF PRODUCTS

.1 All products provided shall CSA approved, Canadian Underwriters' Laboratory approved where applicable, and new unless otherwise specified.

.2 If products specified are not CSA approved, obtain special approval fro the local regulatory authority. Pay all applicable charges levied and make all modifications required for approval.

.3 Products provided, if not specified, shall be new, of a quality best suited to the purpose required and their use subject to approval by the Consultant.

2.3 UNIFORMITY OF MANUFACTURE

.1 Unless otherwise specifically called for in the specifications, uniformly of manufacture shall be maintained for similar products throughout the work.

2.4 USE OF PRODUCTS DURING CONSTRUCTION

.1 Any equipment used for temporary or construction purposed shall be approved by the Construction Manager and in accordance with the General Conditions, "Use of Premises." Clean and restore to "as new" condition all equipment prior to the time of substantial completion.

.2 The warranty period shall begin when the date of substantial performance of work on each tranche.

Part 3 Execution

3.1 COORDINATION WITH OTHER DIVISIONS

.1 Examine the specifications and drawings of all divisions and become fully familiar with their work. Coordinate work with all trades and make changes to facilitate a satisfactory installation.

.2 Lay out the work and equipment with due regard to architectural, structural, mechanical, electrical and A/V features. Architectural and structural drawings take precedence over the telecommunications drawings regarding locations of wall, door, equipment and location and heights of outlets.

.3 Coordinate with all Divisions installing and services, and ensure that there are no conflicts.

.4 Install anchors, bolts, pipe sleeves, hanger inserts, etc. in ample time to prevent delays.

3.2 LOCATION OF OUTLETS

.1 Telecommunications drawings are, unless otherwise indicated, drawn to scale and approximate distances and dimensions may be obtained by scaling. Figured dimensions shall govern over scaled dimensions. Where exact dimensions and details are required, refer to Architectural and Structural drawings.

.2 Unless otherwise specified or shown, install products in accordance with recommendations and ratings of manufacturers.

3.3 SEPARATION OF SERVICES

.1 Maintain separation between electrical wiring system and building piping, ductwork, etc. so that wiring system is isolated (except at approved connections to such systems) to prevent galvanic corrosion.

.2 In particular, contact between dissimilar metals, such as copper and aluminum, in damp or wet locations is not permitted.

.3 Do not support wiring from pipes, ductwork, etc. Hangers for suspended ceilings may be used for the support of wiring only when approval is obtained from the Owner and the ceiling installer, and approved clips or hangers are used.

3.4 EQUIPMENT IDENTIFICATION

.1 Colour code exposed conduits (including conduits above t-bar ceilings), junction and pull boxes and metallic sheathed cables with paint or plastic tape (27mm wide band) at 15 metre intervals.

3.5 MOUNTING HEIGHTS

.1 Refer to section 26 05 00 Common Work Results for general mounting heights specification.

.2 Refer to all architectural drawings for telecommunications outlet mounting heights direction and requirements.

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

.1 The Contractor will supply, furnish, and install all material, labour, apparatus, tools, equipment and services required for construction and put into regular operation the complete structured cabling system as shown on the associated drawings, described in the specifications, and any attached appendices. System to be complete with all data/voice outlets, patch panels, equipment racks, cable management systems, 110 punch-down blocks, wire and cable to form a complete system.

1.3 APPLICABLE STANDARDS

.2 The cabling system described in this specification is derived in part from the recommendations made in industry standard documents. The documents below are incorporated by reference.

- .1 This Technical Specification and Associated Drawings
- .2 ANSI/TIA/EIA-568-B Commercial Building Telecommunications Cabling Standard – April, 2001
- .3 ANSI/TIA/EIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces - February, 2004
- .4 ANSI/TIA/EIA-606-A Administration Standard for the Telecommunications Infrastructure of Commercial Buildings – May, 2002
- .5 ANSI/J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications - October, 2002
- .6 Building Industries Consulting Services, International (BICSI) Telecommunications Distribution Methods Manual (TDMM) – 11th (or latest edition), 2006
- .7 National Fire Protection Agency (NFPA) - 70, National Electrical Code NEC) - 2002

.3 If a conflict exists between applicable documents, then the order in the list above shall dictate the order of precedence in resolving conflicts. This order of precedence shall be maintained unless a lesser order document has been adopted as code by a local, provincial or federal entity, and is therefore enforceable as law by a local, provincial or federal inspection agency.

.4 If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents; the vendor is responsible to determine and adhere to the most recent release when developing the proposal for installation.

1.2 SUBMITTALS

.1 Submittals as outlined herein and contain all items within one complete submission. Refer to Section 26 05 00 (Common Work Results) for submission details and the following:

.1 Shop Drawings

.1 Product data (including cut sheets and catalogue information)

.2 Samples required by the Contract Documents

.3 All above submittals must be forwarded promptly and in such sequence as to cause no delay in the work or in the activities of the other trades.

.4 Submitted shop drawings shall be signed by the Contractor, imprinted with the date submitted, and shall bear the Contractor's legitimate Company name.

.5 By submitting shop drawings, product data, and samples, the Contractor signifies that he, or she has carefully reviewed and verified materials, quantities, field measurements, and related field construction criteria. It also signifies the Contractor has checked, coordinated, and verified that all information contained with shop drawings, product data, and samples conforms to the requirements of the Work and of the Contract Documents.

.6 The Contractor shall perform no portion of the Work requiring submittal and review of shop drawings, product data, or samples until the Consultant has returned an approved submittal.

.7 The Contractor shall submit shop drawings, product data, and samples to the Consultant as a complete set in paper format within fifteen (15) days subsequent to Award of Contract and prior to start of Work.

.8 The Contractor shall make reproductions as required for his or her own use and distribution to subcontractors.

.9 The Contractor shall highlight relevant products on the shop drawings.

.10 The Consultant shall not accept illegible submittals.

1.3 GENERAL REQUIREMENTS

.1 System to be complete with all necessary components to provide functions required whether or not each and every item is necessarily mentioned. All components to be production proven models. Custom designed units will only be considered for those items that are not currently available on commercial market. System to be supplied and installed by an established communications contracting firm that is approved by Owner.

.2 Neither the drawings nor the specifications shall be used alone. Work omitted from the drawings but mentioned or reasonably implied in the specifications, or vice versa, shall be considered as properly and sufficiently specified and shall be provided.

.3 Misinterpretation of any requirements on drawings, or specifications shall not relieve the Contractor of his, or her responsibility of properly completing the Contract.

.4 Where conflict exists between drawings and specifications the Contractor shall, make allowance for provision of the component, system, or installation process in a manner which will provide the highest monetary cost components, systems, or installation process.

.5 Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of the Work. The Contractor shall obtain information from the Consultant where exact locations are not indicated.

.6 The Contractor shall not scale the drawings, but rather take field measurements in existing buildings particularly where equipment and material dimensions are dependent on building dimensions.

.7 The Consultant has the option of changing the location of Electrical and Communication outlets to within 2 m of designed location prior to rough-in stage at no extra cost.

.8 All wiring for systems to be PVC insulated, unshielded, twisted pair. All wiring to be installed in conduit and tray system unless otherwise specified.

.9 All conduit, pullboxes, junction boxes and terminal panels are to be installed to provide a complete conduit system for the Telephone/Data cabling system. All communication/data conduits to be minimum 27 mm [1 inch] diameter unless otherwise indicated. Horizontal pathway conduits may have no more than two 90 degree bends and are may be no longer than 30.5m [100 feet] in distance without a pullbox.

.10 The system shall be certified, by a Contractor designated and trained by the manufacturer of being capable to do so and shall provide written confirmation of this fact. Proof of certification must be provided prior to commencement of work.

.11 All data runs are to terminate on a universal patch panel system which will permit assignment from the data hardware by the use of labelled patch cords. All voice runs are to terminate on a universal patch panel system which will permit assignment from the voice hardware by the use of labelled patch cords.

.12 The “home run” device runs are to consist of Tyco/AMP 23-4P, (23 gauge, 4 pair) UTP-CMR SOL BC Category 6 PE/PVC Yellow Jacket 600MHz rated cable or equivalent based on jurisdictional/municipal codes. Specialized device runs or incidental voice lines requiring alternative design will be specified in accompanying documentation. Each communication outlet will have a minimum of two permanent links as defined in EIA/TIA 568-B, unless specified otherwise.

.13 The cabling system must meet or exceed Category 6 permanent link performance as defined in EIA/TIA 568-B and provide a 25 year system performance certification from a single channel source manufacturer. Multi or mixed vendor solutions will NOT be considered.

Part 2 Execution

2.1 INSTALLATION

.1 Horizontal Cabling Installation

.1 Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.

.2 Cable raceways shall not be filled greater than the CSA/NEC maximum fill for the particular raceway type.

.3 Cables shall be installed in continuous lengths from origin to destination (no splices) unless specifically addressed in this document.

.4 Consolidation points are not permitted except by written authority.

.5 The cable's minimum bend radius and maximum pulling tension shall not be exceeded.

.6 When a cable enters or exits a junction or pull box or other such enclosure the appropriate connector, grommet, or bushing shall be used.

.7 If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of four-foot intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.

.8 Horizontal distribution cables shall be bundled in groups of no greater than 40 cables. Cable bundle quantities in excess of 40 cables may cause deformation of the bottom cables within the bundle.

.9 Cable shall be installed above fire-sprinkler and systems and shall not be attached to the system or any ancillary equipment or hardware.

.10 Cables shall not be attached to ceiling grid or lighting support wires. Where light supports for drop cable legs are required, the contractor shall install clips to support the cabling.

.11 Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

.12 Cables shall be identified by a self-adhesive label.

.13 4-pair UTP cable shall be installed so that there are no bends less than four times the cables outside diameter (4 X cable O.D.) at any point in the run as outlined in EIA/TIA 568-B.

.14 Pulling tension on 4-pair UTP cables shall not exceed 25-pounds for a single cable or cable bundle as outlined in EIA/TIA 568-B.

.15 Cables will not pass through anymore than two 90 degree angles from end to end as outlined in EIA/TIA 568-B.

.16 If cable needs to go through a wall and an existing pathway does not exist, the created pathway must use electrical conduit as a sleeve with EMT connectors with nylon throats at each end of the conduit. Poking a hole in the wall and running the cable through is not acceptable. All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system

.17 If cable is to be terminated in an open office location with modular furniture and termination within a wall is not a viable option then the cables are to terminate within pac poles, not the modular furniture.

.2 Copper Termination

.1 Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-B document, manufacturer's

recommendations and/or best industry practices.

.2 Pair untwist at the termination shall not exceed one-half an inch for Category 6 connecting hardware.

.3 Maximum bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

.4 Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

.5 The cable jacket shall be maintained as close as possible to the termination point.

.6 Each cable shall be clearly labelled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labelled within the bundle, where the label is obscured from view shall not be acceptable.

.3 Labeling:

.1 All documentation and labelling must follow the TIA/EIA 606A Standard. Specifically, all labels must be machine-printed. They must be smudge-resistant and water-resistant. Laser printed labels are acceptable. Ink-jet printed labels may be used provided some mechanical protection is used (such as cellophane tape or a plastic strip). For labels on faceplates, patch panels, walls, or equipment, a device such as the Brother P-Touch labeller is acceptable. For labels identifying cable, the labels must be wrapped around the cable within 30 cm of the cable termination and must be protected with a plastic coating. Laser-printed labels may be printed on sheets such as Panduit PLL-12-Y3 self-laminating sheets or equivalent. Also, a device such as the Panduit LS3E can be used to print self-laminating labels as needed.

.2 In addition to other labels, network equipment must be labelled to identify the equipment within the room. Hubs will be labelled top-to-bottom, left-to-right, starting at “Hub 1”. For labelling purposes, the term “hub” refers to switches and terminal servers as well.

.3 Horizontal cables are labelled sequentially from each communications room. Patch panels will be labelled in a left-to-right, top-to-bottom fashion. With all new builds the cables must be terminated in a logical fashion so that all data drops from a room or area in the building are sequentially located on the patch panel(s). In order to identify the installer of the horizontal cable, the label on the cable also includes the company’s initials or logo where possible. Self-laminating labels must be wrapped around the ends of horizontal cable runs 10 cm from the end of the sheath, with the communications room and closet and the wire number marked on it. For example, a cable coming from patch panel B, location 17, in TR A1A would have this label at both ends XX A1A-B17. (XX being the company’s initial or logo)

.4 The colour coding for jacks to identify system usage is as follows: Orange - PACS Diagnostic Imaging; Green - Wireless Connection Outlet (POE enabled); Black- Data Applications; White-Voice Applications; Purple - Dictation; Yellow-Nurse Call; Red - Patient Monitoring

.5 Patch cables used at the workstation or within a communications room or closet do not need to be labelled.

2.2 ACCEPTANCE

.1 A Technical Representative will make periodic inspection of the project in progress. One inspection will be performed at the conclusion of cable pulling,

prior to closing of the false ceiling, to inspect the method of cable routing and support, and the fire stopping of penetrations. A second inspection will be performed at completion of cable termination to validate that cables were dressed and terminated in accordance with TIA/EIA 568-B specifications for jacket removal and pair untwist, compliance with manufacturer's minimum bend radius, and that cable ends are dressed neatly and orderly.

.2 Upon completion of the project, the Technical Representative will perform a final inspection of the installed cabling system with the Contractor's Project Foreman. The final inspection will be performed to validate that all horizontal cables were installed as defined in the drawing package, and that the installation meets the aesthetic expectations of the Owner.

.3 Upon receipt of the test documentation, the Owner reserves the right to perform spot testing of a representative sample of the cabling system to validate test results provided in the test document. Owner testing will use the same method employed by the contractor, and minor variations will be allowed to account for differences in test equipment. If any significant discrepancies are found, the Contractor will be notified for resolution.

.4 During the three week period between final inspection and delivery of the test and as-built documentation, the Owner will activate the cabling system. The Owner will validate operation of the cabling system during this period.

.5 Completion of the installation; in-progress and final inspections; receipt of the test and as-built documentation; receipt of the installation permit number with an accompanying summary of the work performed within three weeks of completion and successful performance of the system for a two week period will constitute acceptance of the system and/or written approval by the Consultant.

2.3 WARRANTY AND SERVICES

.1 The contractor shall provide a system warranty covering the installed cabling system against defects in workmanship, components, and performance, and follow-on support after project completion.

.2 The contractor shall warrant the cabling system against defects in workmanship for a period of one year from the date of system acceptance. The warranty shall cover all labour and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. This warranty shall be provided at no additional cost to the Owner.

.3 The contractor shall facilitate a 25 year performance warranty between the manufacturer and the Owner. The performance warranty shall warrant the installed 250 MHz horizontal CAT 6 copper cabling system. Copper links shall be warranted against the link performance minimum expected results defined in TIA/EIA-568-B.

2.4 TESTING

.1 Test documentation shall be provided electronically in PDF format to the Information Systems Department within three weeks after the completion of the project. The test document should not exceed 8-1/2" x 11" There shall be only one cable test result per page, and the document must include the cable designation that matches the machine printed label that can be found within 10cm of each cable end. Test documentation must include site code.

.2 The test equipment by name, manufacturer, model number and last calibration date will also be provided at the end of the document. Unless a more frequent calibration cycle is specified by the manufacturer, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment

during the test.

.3 When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be provided electronically in PDF format to the Information Systems Department.

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

.1 The Contractor will supply, furnish, and install all material, labour, apparatus, tools, equipment and services required for construction and put into regular operation the complete CCTV system as shown on the associated drawings, described in the specifications, and any attached appendices. System to be complete with all servers, management software, cameras, enclosures and cable management systems form a complete video surveillance system.

1.3 General Requirements

.1 System to be complete with all necessary components to provide functions required whether or not each and every item is necessarily mentioned. All components to be production proven models. Custom designed units will only be considered for those items that are not currently available on commercial market. System to be supplied and installed by an established communications contracting firm that is approved by Owner.

.2 Neither the drawings nor the specifications shall be used alone. Work omitted from the drawings but mentioned or reasonably implied in the specifications, or vice versa, shall be considered as properly and sufficiently specified and shall be provided.

.3 Misinterpretation of any requirements on drawings, or specifications shall not relieve the Contractor of his, or her responsibility of properly completing the Contract.

.4 Where conflict exists between drawings and specifications the Contractor shall, make allowance for provision of the component, system, or installation process in a manner which will provide the highest monetary cost components, systems, or installation process.

.5 Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of the Work. The Contractor shall obtain information from the Consultant where exact locations are not indicated.

.6 The Contractor shall not scale the drawings, but rather take field measurements in existing buildings particularly where equipment and material dimensions are dependent on building dimensions.

.7 The Consultant has the option of changing the location of cameras within 2 m of designed location prior to rough-in stage at no extra cost.

.8 All wiring for systems to be PVC insulated, unshielded, twisted pair. All wiring to be installed in conduit and tray system unless otherwise specified.

1.4 Training

.1 System installer to conduct training program for designated maintenance and operating personnel. This program to include but not be limited to the following:

.1 Operation: designated personnel to be trained to accomplish and understand all aspects of system operation.

.2 Maintenance: designated personnel to be trained to perform routine maintenance on the system.

.3 Training period schedule to be established by Owner. Training periods to take place after building completion and prior to system use.

1.5 Summary

.1 This Section specifies the minimum requirements for the VGH MRI expansion. This Security Video Surveillance System shall include but is not limited to the following:

- Network Video Management Software (NVMS)
- Network Video Recording Hardware (NVR)

.2 The installation is intended to be and extension of the existing CCTV system in the area.

1.6 Quality assurance

.1 Qualifications

.1 Manufacturer

.1 Manufacturer shall have been in business for more than 5 years.

.2 Installers

.1 All camera installation, configuration, setup, program and related work shall be performed by authorized integrators/electronic technicians certified by the manufacturer.

.2 Certification for authorized integrators/electronic technicians shall include at a minimum the installation and service of the equipment provided.

1.7 Warranty

.1 The Contractor shall provide a single written document outlining the warranty of the manufacturer(s) product and the contractor's installation, on a single document. The document shall warrant complete installation of all services and equipment to be free from defects in materials and workmanship for a period of no less than [2 years], starting with the date of Final System Acceptance.

.2 Contractor shall provide any software maintenance patches and version updates or upgrades at no-additional cost to Owner for a period of at least 2 years.

.3 The Contractor will provide a cost budget for up to five (5) years for the maintenance and upgrades to the system. The budget must clearly define all contractor and manufacturer costs expected.

Part 2 Products

2.1 NETWORK VIDEO MANAGEMENT SERVER

.1 No new server required for this project – existing software to be updated to include new cameras.

2.2 NETWORK VIDEO MANAGEMENT WORKSTATION(S)

.1 No new workstations required for this project.

2.3 CAMERAS

.1 Network

.1 The camera shall support both fixed (static) IP addresses and dynamically assigned IP addresses provided by a Dynamic Host Control Protocol (DHCP) server.

.2 The camera shall support user configuration of network parameters including:

.1 Fixed (static) IP address

.2 Subnet mask

.3 Gateway

.4 Control port

.3 The camera shall be automatically detected when using a Video Management Application (VMA) or Network Video Recorder (NVR) supporting this feature.

.4 The camera shall provide support for both IPv4 and IPv6 Networks.

.2 Installation and Maintenance

.1 The camera shall:

.1 Allow firmware updates over the network.

.2 All customer-specific settings shall be stored in a non-volatile memory and shall not be lost during power cuts or soft reset.

.3 The camera enclosure shall include the following:

.1 Be equipped as a surface mount

.2 The camera shall be capable of being powered by the following power sources:

.1 PoE: IEEE 802.3af Class 3 PoE Plus Compliant

.3 The camera shall be connected to power through:

.1 Ethernet connection with IEEE 802.3af Class 3 PoE power

2.4 NETWORK VIDEO MANAGEMENT SOFTWARE (NVMS)

.1 Existing NVMS for facility to be utilized, provide licensing for new cameras as required.

Part 3 Execution

3.1 PREPARATION

.1 Prior to installation, the Network Video Management System shall be configured and tested in accordance with the manufacturer's instructions.

3.2 INSTALLATION

.1 Install system in accordance with manufacturer's instructions.

.2 Perform all work in accordance with acknowledged industry and professional standards.

3.3 SYSTEM SOFTWARE

.1 Update and test software and databases for the complete and proper operation of systems involved.

.2 The Contractor is responsible for the entire programming and setup of the system such that no additional programming is required. Programming shall include the setup of all available features of the software.

.3 Perform a full system back-up at completion of initial programming and deliver the configuration to the Owner.

.4 Perform field software changes after the initial programming session to “fine tune” operating parameters and sequence of operations based on any revisions to the Owner’s operating requirements.

END OF SECTION

TABLE OF CONTENTS

1.1 EF 100 Check List – Submissions to Consultant

ITEM	CHECKED BY	DATE
5 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 (EF 110) – Detailed price breakdown (EF 112)		
A.S.A.P. – Shop drawings and Product Samples (EF 111)		
WITH EACH APPLICATION FOR PROGRESS PAYMENT – Price breakdown (EF 112)		
PRIOR TO DEMONSTRATION OF SYSTEMS – Demonstration agenda		
DEMONSTRATION OF SYSTEMS – Checklists for sign off of Demonstrations (EF 141)		
10 DAYS PRIOR TO SUBSTANTIAL PERFORMANCE – Submission of items listed on Form EF-142		
WHEN REQUESTING REVIEW OF OUTSTANDING WORK – Checklist of work remaining (EF 144) – Certificate of total completion (EF 145)		

1.2 EF 110 Equipment/Sub-Trade List

ITEM	COMPANY/SUPPLIER
Security System Equipment	
Security Sub-trade	
Seismic Engineer	
Testing and Commission Agency	

Modify/Add to suit project and equipment responsibility splits

1.3 EF 111 Check List –Shop drawings and Product and Samples

		REVIEW	
ITEM	**DATE SUBMITTED**	**ACTION**	**DATE**
Wiring Devices			
Security System			

NOTES:

.1 Modify list to suit project.

.2 Submit samples where indicated to the consultant for review prior to installation.

1.4 EF 112 Progress Claim Summary – Division26, 27, 28, 33

PROJECT: **CLAIM NO:** _____

FOR MONTH OF: _____

ITEM		PRICE	WORK TO DATE		PREVIOUS WORK		THIS MONTH	
		$	%	$	%	$	%	$
Base Contract:								
General Conditions								
Mobilization (not to exceed 2%)								
Demolition								
Conduit, Boxes & Wire	Mat Lab.							
Wiring Devices & Plates	Mat Lab.							
Voice/Data Systems	Mat Lab.							
Security Systems	Mat Lab.							
O & M								
Testing &								
Other								
Cash Allowances								
Total Base Contract								
Change Order								
Total Change Orders								
Total Contract:								
Amount due less 10% mechanics lien holdback								

Submit this form as called for on **EF 100** for tender price breakdown and for each progress claim

1.5 EF 120 Check List –Colour Coding

Obtain sign off from Building Owners representative prior to colour coding systems.

Project Identification:

	SYSTEM	MAJOR BAND	MINOR BAND	CHARACTERS
1	120/208 volt Non Essential	*Light Blue*		
2	347/600 volt Non Essential	*Dark Blue*		
3	120/208 volt Essential	*Light Blue*	*Black*	
4	347/600 volt Essential	*Dark Blue*	*White*	
5	277/480 volt	*Gold*		
6	Up to 5 kV			
7	Up to 25 kV	*Yellow*	*Purple*	*Nominal Voltage*
8	Fire Alarm	*Red*		*FA*
9	Television	*Dark Brown*		*TV*
10	AV or RF	*Light Brown*		*AV/TV*
11	Clock System	*Yellow*		*CS*
12	Communications	*White*		*COM*
13	Nurse Call/Cardiac Arrest/Emerg Call	*Orange*		*NC/CA/EC*
14	Security/Personal Alarm	*Dark Green*		*SEC/PA*
15	Central Intercom	*Purple*	*Green*	*IC*
16	Other			

Prepared By _____

Owners Sign Off _____ DATE _____

1.6 EF 131 Certificate of Seismic Restraint Installation

Project Identification: _____

I hereby declare that I _____

am an employee/a principal of _____

Certify that the seismic restraint of all electrical equipment and wiring system installation meets the requirements of the B.C. Building Code as it relates to seismic restraint and the Schedules B, B1 & CB have been submitted and signed and to the Consultant.

SIGNED _____ DATE _____

NOTES:

.1 This certificate shall be submitted to the Consultant prior to Substantial Performance

EF 140 Check List & Record – Items to be Handed to Owner

ITEM	QUANTITY	RECEIVED	DATE

NOTES:

.1 Copies of this form shall be submitted to the consultant and the owner with all items signed off prior to substantial performance.

Prepared By _____

Owners Sign Off _____ DATE _____

1.7 EF 141 Check List – Owners Demonstration

	CONTRACTOR		OWNER	
SYSTEM/ITEM	**SIGNED**	**DATE**	**SIGNED**	**DATE**
Security Systems				
Data/Voice Systems				
Access to Equipment				
Review of Maintenance Manual				
Points of required Maintenance				

NOTES:

.1 Contractor shall submit copies of this form with each appropriate item signed and dated by the person having overall charge of commissioning prior to substantial performance. (See **EF 143**).

.2 Owners representative shall sign off each item during or after 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 the Owners representative may elect to only witness sample items, but the person having charge of commissioning is expected to have checked them all.

1.8 EF 142 Check List – Substantial Performance Submissions - Electrical

SECTION	ITEM	DATE	STATUS
260500	Final Electrical Inspector Certificate		
260500	Items handed to Owner Checklist (**EF 140**)		
260500	Identification		
260500	Record Drawings		
260500	Operating & Maintenance Manuals		
260505	Seismic Engineer Report and Schedules (**EF131**)		
280000	Security System Commissioning		
	Contractors Letter of Guarantee		
	Demonstration to Operating Staff agenda		
	Demonstrations Checklists (**EF 141**)		
	Substantial Performance Certificate (**EF143**)		
	Checklist of work remaining after Substantial (**EF 144**).		

NOTES:

.1 This list is provided as a checklist and may not include all Substantial Performance requirements.

1.9 EF 143 Certificate of Substantial Performance - Electrical

I hereby certify that I _____
am an employee / a principal /an agent

of _____

and have personally witnessed the following with regard to the electrical systems work specified for the above project and that to the best of my knowledge except as noted on **EF 144** (attached);

- The installation is complete and as specified.
- The systems have been commissioned and operate satisfactorily.
- Every control sequence and every control performs as specified.
- The systems are clean.
- All of the required submissions have been made to the consultant.

SIGNED _____ DATE _____

NOTES:

.1 This certificate must be completed and submitted to the consultant prior to substantial performance.

.2 If it is apparent that the systems or their operation are seriously deficient then all reasonable costs and consultant time charges relating to any subsequent site reviews shall be deducted from the contract sum.

1.10 EF 144 Check List – Work Remaining After Substantial Performance

		COMPLETION		
ITEM NO.	**DESCRIPTION**	**CLAIMED BY**	**DATE**	**VERIFIED DATE**

NOTES:

.1 This form must be filled in and submitted to the Consultant prior to substantial performance.

.2 Any discovered outstanding items will be added to the list by the Consultant. Copies of the complete list will be circulated to the Owner, the Architect and the Contractor.

.3 The Contractor may include estimated values against the outstanding work but determination of the actual amounts to be held will be made by the Consultant.

.4 The Contractor shall sign off each item as it is completed and submit the list monthly to the Consultant. When all items are signed off the completed list shall be submitted with the certificate of total performance **EF 145**.

1.11 EF 145 Certificate of Total Performance – Electrical

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 EF 144 (attached) has been satisfactorily completed and I hereby certify that the Electrical systems work specified on the above project is complete.

SIGNED _____ DATE _____

NOTES:

.1 This certificate must be completed and submitted to the Consultant when requesting total performance.

.2 If it is apparent during the final review that the systems or their operation are seriously deficient then all reasonable costs and consultant time charges relating to any subsequent site reviews shall be deducted from the contract sum.

End of Section