SPECIFICATION

for

Victoria SAR Station
25 Huron St Victoria B.C.

Project No. 2017567

prepared for: Fisheries and Oceans, Real Property

December 14, 2018

SPECIFICATION

Division 07 – Thermal and Moisture Protection

Division 8 – Openings

Division 9 – Finishes

Division 10 – Specialties

Division 11 – Equipment

Division 12 – Furnishings

Division 21 – Fire Protection

DIVISION 22 - Plumbing

DIVISION 23 – Heating Ventilation and Air Conditioning

DIVISION 25 – Integrated Automation

DIVISION 48 – SOLAR

APPENDICIES

DRAWINGS

ARCHITECTURAL

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

Work of this Contract is comprised of the construction of the Victoria Search and Rescue station. The station is of wood frame construction. The station is to be constructed on a concrete foundation.

The contractor will be responsible for erecting the wood frame structure. The contractor will also supply and install all windows and doors, roofing, exterior rainscreen and cladding. All interior construction and electrical and mechanical components to be supplied and installed by the contractor under this contract. Interior finishes including but not limited to flooring, interior wall framing, finishes and painting, millwork and fixtures are to be supplied and installed by the contractor. Refer to individual specification sections and drawings.

1.2 CONTRACT METHOD

.1 Construct Work under a stipulated price contract.

1.3 CONTRACT DOCUMENTS

.1 The Contract documents, drawings and specifications are intended to complement each other, and to provide for and include everything necessary for the completion of the work.

.2 Drawings are, in general, diagrammatic and are intended to indicate the scope and general arrangement of the work.

1.4 DIVISION OF SPECIFICATIONS

.1 The specifications are subdivided in accordance with the current 6-digit National Master Specifications System.

.2 A division may consist of the work of more than 1 subcontractor. Responsibility for determining which subcontractor provides the labour, material, equipment and services required to complete the work rests solely with the Contractor.

.3 In the event of discrepancies or conflicts when interpreting the drawings and specifications, the specifications govern.

1.5 DOCUMENTS REQUIRED

.1 Maintain at job site, one copy of each document as follows:

- .1 Contract Drawings.
- .2 Specifications.
- .3 Addenda.
- .4 Reviewed Shop Drawings.
- .5 Change Orders.

.6 Other Modifications to Contract.

.7 Copy of Approved Work Schedule.

.8 Health and Safety Plan and Other Safety Related Documents.

.9 Other documents as specified.

1.6 WORK SCHEDULE

.1 Provide a schedule of work within 5 days of contract award and observe the following requirements

.1 Work must be completed by January 1, 2020

.2 Whenever variation from the schedule in excess of 3 working days occurs or is expected to occur, notify the Departmental Representative and provide a revised schedule

.3 Hours of work will be restricted to conform with municipal noise bylaws when work generates noise.

1.7 COST BREAKDOWN

.1 Before submitting the first progress claim, submit a breakdown of the Contract lump sum prices in detail as directed by the Departmental Representative and aggregating Contract price.

1.8 SITE CONDITIONS

.1 It will be the responsibility of the contractor to visit the site prior to the Submission of Tenders and make themselves thoroughly acquainted with the conditions at the site and to make whatever inquiries that are necessary to familiarize themselves with all conditions likely to affect the work.

1.9 CONTRACTOR USE OF PREMISES

.1 The contractor's use of site will be limited to the immediate area of the work and areas assigned by the Departmental Representative for site office placement, equipment, material stock piles, sanitary facilities, etc.

.1 Work to be performed inside a functioning Coast Guard Facility.

.2 Co-ordinate use of premises under direction of Departmental Representative.

.3 The contractor will provide sanitary facilities for the work force in accordance with governing regulations and ordinances.

.4 Departmental Representative will designate areas for parking, material storage, recycling storage and a site office. Maintain these areas clean and free of construction related debris. Make good damages resulting from contractors use of these areas at no cost to the contract.

1.10 REFERENCES AND CODES

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

.3 All work is to be performed in accordance with Worksafe B.C. regulations, Labour Canada regulations, and all applicable municipal statutes and authorities having jurisdiction. In the event of conflict between any provisions the most stringent provision will apply.

.4 Ensure that all employees have received appropriate WHIMIS training and that all necessary MSDS information is available on site.

1.11 PERMITS, FEES AND NOTIFICATIONS

.1 Obtain and pay for electrical permits and fees.

1.12 SUBMITTALS

.1 Submit to Departmental Representative 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 Where specified, submit drawings stamped and signed by professional engineer registered or licensed in British Columbia.

.3 Submit shop drawings in .PDF format.

.4 Allow 5 working days for Consultant review of shop drawings.

1.13 ADDITIONAL DRAWINGS

.1 The Departmental representative may furnish additional drawings for clarification. These additional drawings have the same meaning and intent as if they were included with plans referred to in the contract documents.

1.14 RECORD DRAWINGS

.1 As work progresses, maintain accurate records to show all deviations from the contract documents. Record these changes on a clean set of drawings used only for this purpose. Record changes in red ink. At completion, supply the Departmental Representative with one set of drawings and specifications with all changes clearly marked

1.15 EXECUTION

.1 Execute cutting, fitting, and patching to complete Work.

.2 Fit several parts together, to integrate with other Work.

.3 Uncover Work to install ill-timed Work.

.4 Remove and replace defective and non-conforming Work.

.5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

.6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.7 Fit Work to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

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

1.16 MATERIALS AND EQUIPMENT

.1 Use new materials unless otherwise specified

1.17 OWNER OCCUPANCY

.1 Owner will occupy premises adjacent to the work site during entire construction period for execution of normal operations.

.2 Co-operate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

.3 Maintain access to adjacent facilities during the duration of construction.

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

.1 Submit to Departmental Representative 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 SI Metric units.

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

.5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

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

.7 Verify field measurements and affected adjacent Work are co-ordinated.

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

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

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

1.2 HEALTH AND SAFETY PLAN

.1 Submit site specific Health and Safety Plan, MSDS and WHMIS documents requested in Section 01 35 30 - Health and Safety

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.3 Allow 5 days for Departmental Representative's review of each submission.

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

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

.6 Accompany submissions with electronic transmittal, containing:

- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Indicate the specification section and paragraph number that applies to the shop drawing that is being submitted.
  - .1 Ensure that each shop drawing clearly refers to the requirements of the stated specification section.
- .5 Identification and quantity of each shop drawing, product data and sample.
- .6 Other pertinent data.

.7 Submissions include:

- .1 Date and revision dates.
- .2 Project title, number and applicable specification section.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Setting or erection details.
  - .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.
  - .7 Operating weight.
  - .8 Wiring diagrams.
  - .9 Single line and schematic diagrams.
  - .10 Relationship to adjacent work.
- .6 Submit shop drawings under the seal of an engineer licenced in the Province of British Columbia when indicated in individual specification sections.

.8 After Departmental Representative's review, distribute copies.

.9 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

.10 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.

.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.

.11 Submit electronic copies of manufacturers instructions for requirements requested in Specification Sections and as requested by Departmental Representative.

.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.

.12 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative

.13 Submit 2 hard copies and electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.

.14 Delete information not applicable to project.

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

.16 If upon review by Departmental Representative 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.

.17 The review of shop drawings by the Departmental Representative is for sole purpose of ascertaining conformance with general concept.

.1 This review shall not mean that the Departmental Representative 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.

1.4 SAMPLES

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

.2 Deliver samples prepaid, one of each sample to Departmental Representatives office and Prime Consultant’s office.

.3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.4 Where colour, pattern or texture is criterion, submit full range of samples.

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

.6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.

.7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.5 PHOTOGRAPHIC DOCUMENTATION

.1 Submit electronic copy of digital photography in jpg format, standard resolution as directed by Departmental Representative.

.2 Project identification: name and number of project and date of exposure indicated.

.3 Number of viewpoints: 4 locations.

.1 Viewpoints and their location as determined by Departmental Representative.

.4 Frequency of photographic documentation: weekly and as follows

.1 Upon completion of: Framing and services before concealment.

1.6 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, and with each progress draw, submit Workers' Compensation Board status.

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 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations

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

.1 Material Safety Data Sheets (MSDS).

.3 Province of British Columbia

.1 Workers Compensation Act, RSBC 1996 - Updated 2006.

.2 Occupational Health and Safety Regulation.

.4 National Building Code of Canada (NBC)

.1 Part 8, Safety Measures at Construction and Demolition Sites.

1.2 WORKERS COMPENSATION BOARD COVERAGE

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

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

1.3 COMPLIANCE WITH REGULATIONS

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

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

1.4 SUBMITTALS

.1 Submit to Department Representative submittals listed for review.

.2 Work effected by submittal will not proceed until review is completed.

.3 Submit the following:

.1 Health and Safety Plan.

.2 Copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.

.3 Copies of incident and accident reports.

.4 Copies of Material Safety Data Sheets and all other documents required by Workplace Hazardous Materials Information System (WHMIS) requirements.

.5 Emergency procedures

.4 Submission of Health and Safety Plan and any revised version to the Departmental Representative is for information and reference purpose only. It will not:

.1 Be construed to imply as approval by Department Representative

.2 Be interpreted as warranty of being complete, accurate, and compliant.

.3 Relieve the Contractor of his legal obligations for provision of health and safety for the project.

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

1.5 WORK PERMITS

.1 Obtain speciality permit(s) related to the project before start of work.

1.6 FILING OF NOTICE

.1 Complete and submit Notice of Project as required by Provincial authorities.

.2 Provide copies of all notices to Department Representative.

1.7 SAFETY ASSESSMENT

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

1.8 MEETINGS

.1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

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

1.10 GENERAL CONDITIONS

.1 Provide safety barricades and lights at work site as required to provide safe working environment for workers.

.2 Ensure that non-authorized persons are not allowed in designated construction areas and work site.

.1 Provide appropriate means by use of barricades, fences, and warning signs.

1.11 REGULATORY REQUIREMENTS

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

.2 In the event of conflict between any provision of above authorities, the most stringent provision will apply.

1.12 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, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.13 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 having jurisdiction and advise Departmental Representative verbally and in writing.

1.14 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 associated with the work outlined in the Contract.

.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.

1.15 HAZARDOUS PRODUCTS

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

1.16 POSTING OF DOCUMENTS

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

1.17 CORRECTION OF NON-COMPLIANCE

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

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

.3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected. The Contractor will be responsible for costs arising from such "stop work order".

1.18 CONFINED SPACES

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

1.19 OVERLOADING

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

1.20 SCAFFOLDING

.1 Design, construct, and maintain scaffolding in a rigid, secure, and safe manner, in accordance with CSA Z797 and BC Occupational Health and Safety Regulations.

1.21 FIRE SAFETY REQUIREMENTS

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

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

1.22 FIRE PROTECTION

.1 Do not use fire hydrants, standpipes, and hose systems for purposes other than firefighting

.2 Be responsible/liable for cost incurred from fire department, building owner, and tenants, resulting from false alarms

1.23 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.

END OF SECTION

Part 1 General

1.1 CONSTRUCTION FIRE SAFETY

.1 The Contractor shall provide construction fire safety in accordance with the National Fire Code of Canada.

1.2 REPORTING FIRES

.1 The Contractor shall inform the Departmental Representative of all fire incidents at the construction site, regardless of size.

.2 Know location of nearest fire alarm pull station and telephone, including emergency phone number.

.3 Report immediately fire incidents to Fire Department as follows:

.1 Activate nearest fire alarm pull station.

.2 Telephone, by calling **911.**

.4 Person activating fire alarm pull station will remain at the front entrance to direct Fire Department to scene of fire.

.5 When reporting fire by telephone, give location of fire, name or number of building and be prepared to verify location.

1.3 FIRE SAFETY PLAN

.1 Submit a fire safety plan for the construction site prior to commencement of construction work. The fire safety plan shall conform to the National Fire Code of Canada.

.2 The fire safety plan shall be submitted to the Departmental Representative for review by local fire department. Any comments by local fire department shall be implemented by the Contractor.

.3 The fire safety plan shall be limited to the area of construction only. Contractor is not responsible for amending fire safety plans in existing buildings.

.4 Post the fire safety plan at the entrance to the construction site or near the construction site's health and safety board.

.5 The fire safety plan shall conform to the National Fire Code of Canada, and shall contain, at minimum:

.1 Emergency procedures to be used in case of fire, including

.1 Sounding the fire alarm;

.2 Notifying the fire department;

.3 Instructing occupants on procedures to be followed when the fire alarm sounds;

.4 Evacuating occupants, including special provisions for persons requiring assistance; and

.5 Confining, controlling and extinguishing fires.

.2 The appointment and organization of designated supervisory staff to carry out fire safety duties.

.3 The training of supervisory staff and other occupants in their responsibilities for fire safety.

.4 Documents including diagrams, showing the type, location and operation of building fire emergency systems.

.5 The holding of fire drills (where applicable).

.6 The control of fire hazards in the building.

.7 The inspection and maintenance of building facilities provided for the safety of occupants.

1.4 FIRE WARNING SYSTEM

.1 A fire warning shall be provided to notify construction personnel of a fire emergency in the construction area.

.2 The system used shall be capable of being heard throughout the construction site.

1.5 EXTERIOR FIRE PROTECTION SYSTEMS

.1 Do not use Fire hydrants, standpipes or hose systems for other than fire-fighting purposes unless authorized by the Departmental Representative.

1.6 FIRE EXTINGUISHERS

.1 In addition to other requirements of this specification, supply fire extinguishers necessary to protect work in progress and contractor's physical plant on site.

.2 Fire extinguishers may be required in the following areas:

.1 Adjacent to hot works;

.2 In areas where combustibles are stored;

.3 Near or on any internal combustion engines;

.4 Adjacent to areas where flammable liquids or gases are stored or handled;

.5 Adjacent to temporary oil fired or gas fired equipment; and

.6 Adjacent to bitumen heating equipment.

.3 Extinguishers shall be sized as 4-A:40-B:C (20 lbs) unless otherwise directed by the Departmental Representative.

.4 Extinguishers shall be of the dry chemical type unless otherwise required by the hazard being protected.

.5 The Contractor may assume the quantity of extinguishers based on a maximum travel distance between extinguishers of 75 feet.

1.7 ACCESS FOR FIRE FIGHTING

.1 Access for firefighting shall be provided in accordance with the National Fire Code of Canada.

1.8 SMOKING PRECAUTIONS

.1 Smoking is prohibited in all buildings. Observe posted smoking restrictions on entire site. Smoking only in designated areas. Contractor to provide designated area for job.

1.9 RUBBISH AND WASTE MATERIALS

.1 Keep rubbish and waste materials at minimum quantities.

.2 Burning of rubbish is prohibited.

.3 Remove rubbish from work site at end of work day or shift or as directed.

.4 Storage:

.1 Store oily waste in approved receptacles to ensure maximum cleanliness and safety.

.2 Deposit greasy or oily rags and materials subject to spontaneous combustion in approved receptacles and remove specified.

1.10 FLAMMABLE AND COMBUSTIBLE LIQUIDS

.1 Handle, store and use of flammable and combustible liquids in accordance with the National Fire Code of Canada.

.2 Keep flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use in quantities not exceeding 45 litres provided they are stored in approved safety cans bearing Underwriters' Laboratory of Canada or Factory Mutual seal of approval. Obtain written authorization from Port Hardy Fire Chief for storage of quantities of flammable and combustible liquids exceeding 45 litres.

.3 Do not transfer flammable or combustible liquids inside buildings.

.4 Do not transfer flammable or combustible liquids in vicinity of open flames or any type of heat-producing devices.

.5 Do not use flammable liquids having flash point below 38 degrees C such as naphtha or gasoline as solvents or cleaning agents.

.6 Store flammable and combustible waste liquids, for disposal, in approved containers located in safe ventilated area. Keep quantities to a minimum and notify Departmental Representative when disposal is required.

1.11 HOT WORKS

.1 The Contractor shall implement a hot works program in accordance with the National Fire Code of Canada and NFPA 51 Standard for Fire Prevention during Welding, Cutting and Other Hot Work.

.2 Area of hot works:

.1 Hot works shall be carried out in an area free of combustible and flammable content.

.1 All flammable and combustible materials within 15m of the hot works shall be protected in accordance with the National Fire Code of Canada;

.2 A fire watch shall be provided during the hot work and for a period of not less than 60 minutes afterwards.

.2 Where there is a possibility of sparks leaking onto combustible materials in areas adjacent to the areas where the hot work is carried out.

.1 Openings in walls, floors or ceilings shall be covered or closed to prevent the passage of sparks to such adjacent areas, or

.3 Protection of flammable and combustible materials.

.1 Any combustible or flammable material, dust or residue shall be:

.1 Removed from the area where hot works is carried out; or

.2 Protected from ignition by non combustible materials.

.4 Fire extinguisher:

.1 A fire extinguisher shall be provided within 3 m of all hot works. Minimum size shall be 20lbs.

1.12 HAZARDOUS SUBSTANCES

.1 Work entailing use of toxic or hazardous materials, chemicals and/or explosives, or otherwise creating hazard to life, safety or health, shall be in accordance with National Fire Code of Canada.

.2 Provide ventilation where flammable liquids, such as lacquers or urethanes are used. Eliminate all sources of ignition. Inform the North Saanich Fire Chief prior to and at completion of such work.

1.13 QUESTIONS AND/OR CLARIFICATION

.1 Direct questions or clarification on Fire Safety in addition to above requirements to the Departmental Representative.

1.14 FIRE INSPECTION

.1 Co-ordinate site inspections by the Fire Chief through Departmental Representative.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 74 11 – Cleaning

.3 Section 01 74 19 – Construction Waste Management

.4 Section 03 10 00 – Concrete Forming and Accessories

.5 Section 03 30 00 – Cast-In-Place Concrete

.6 Section 31 23 33.01 – Excavating, Trenching and Backfilling

.7 Appendix A – Evaluation of Soil Vapours for a Proposed New Search and Rescue Station at the Victoria Coast Guard Base, Victoria B.C. Golder, Sept 10 2018.

.8 Appendix B – Environmental Effects Determination and Archaeological Assessment, Golder, Sept 10 2018.

.9 Appendix C - Geotechnical Summary Report WSP Oct 16 2018.

1.2 REFERENCES

.1 Canadian Environmental Protection Act (CEPA), 1999

.2 British Columbia Environmental Management Act (EMA), 2004

.3 Canadian Council of Ministers of the Environment (CCME) – Canadian Environmental Quality Guidelines

1.3 DEFINITIONS

.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade environment aesthetically, culturally and/or historically.

.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

.3 Deleterious Substance: any substance that, if added to water, makes the water deleterious to fish or fish habitat or any water containing a substance in such quantity or

concentration or has been changed by heat or other means, that if added to water makes that water deleterious to fish or fish habitat.

1.4 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 a site-specific Environmental Protection Plan, a site-specific Erosion and Sediment Control Plan, and a site-specific Soil Management Plan for review by the Departmental Representative.

.3 The Departmental Representative will review the Contractor's Environmental Protection Plan, Erosion and Sediment Control Plan, and Soil Management Plan and provide comments to the Contractor within 14 days of receipt of each plan. Revise plans as appropriate and resubmit plans to Departmental Representative within 7 days after receipt of comments from Departmental Representative.

.4 Departmental Representative's review of Contractor's Environmental Protection Plan, Erosion and Sediment Control Plan, and Soil Management Plan shall not be construed as approval and does not reduce the Contractor's overall responsibility for construction environmental protection.

.5 The Environmental Protection Plan is to present comprehensive overview of known or potential environmental issues which must be addressed during construction. Address topics at level of detail commensurate with environmental issue and required construction tasks.

.6 Project-specific **Environmental Protection Plan (EPP)**. 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 Descriptions of environmental protection personnel training program.
- .5 Drawings showing locations of proposed 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 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.
- .7 Spill Prevention and Emergency Response Plan: including procedures, instructions, reports and equipment to be used in event of unforeseen spill of regulated substance. Refer to section on Spills or Releases of Deleterious Substances.
- .8 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
- .9 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off project site.

.10 Contaminant prevention plan that: identifies potentially hazardous substances to be used on job site; identifies intended actions to prevent introduction of such materials into air, water, or ground; and details provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage, handling, transportation and disposal of these materials.

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

.7 The Contractor shall engage a Qualified Environmental Practitioner (QEP) to prepare an Erosion and Sediment Control Plan for this project. The plan shall be developed prior to site preparation and construction activities.

.8 The **Erosion and Sediment Control Plan (ESCP)** shall identify the type and location of erosion and sediment controls to be provided and include monitoring and reporting requirements to ensure that control measures are in compliance with the ESCP, Federal, Provincial and Municipal laws and regulations. The Erosion and Sediment Control Plan should address (but is not limited to):

.1 Management of runoff from excavations, pits, trenches, stockpiled materials, roadways;

.2 Protection of marine environment and catchbasins from deleterious substances;

.3 Considerations for leave strips, vegetative buffers and phased excavation approaches;

.4 Temporary drainage ditches, if applicable;

.5 Dewatering procedures;

.6 Treatment facilities (e.g. flocculation tanks, settling basins, or other treatment facilities as required) and procedures to ensure that waste water (including potentially contaminated groundwater seepage from excavations) meets federal, provincial and municipal guidelines applicable to the method of disposal.

.7 Truck/equipment wash station, if applicable; and

.8 Cleaning of roadways.

.9 A **Soil Management Plan (SMP)** shall be developed for the Project to address how all soils will be handled, stockpiled and disposed of. Refer to section on Soil Management for additional requirements. The Soil Management Plan shall include the following information:

.1 work title;
.2 work number;
.3 contact information;
.4 location of the excavation / soil storage area including site plan;
.5 approximate volume of soil;
.6 a brief description of the contaminants (hydrocarbon, heavy metals, etc.)
  .1 Refer to Appendix A and Appendix B for identified contaminated soils.
.9 plan for soil storage, and disposal;
.10 all manifests/weight tickets/disposal certificates; and
.11 signature of person responsible for plan.

1.5 FIRES

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

1.6 NOISE CONTROL

.1 Work activities shall be limited to normal business hours to minimize noise disturbance to wildlife and humans.

.2 Equipment and machinery shall be properly maintained to minimize unnecessary noise pollution. Where possible, noise control technology shall be applied on heavy machinery and equipment.

.3 Work shall be completed in accordance with local municipal noise bylaws.

1.7 DISPOSAL OF WASTES

.1 Do not discard or dispose of rubbish and waste materials on site unless approved by Departmental Representative.

.2 Construction wastes must be stored securely and disposed of properly at an approved off-site location. Contractor is not permitted to use the waste collection system at Victoria Coast Guard Base.

.3 Maintain Work in tidy condition, free from accumulation of waste products and debris.

.4 Provide on-site containers for collection of waste and recyclable materials. Divert recyclable materials from landfill. Departmental may request documented proof of proper disposal and recycling.

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

.6 Handle and transport hazardous and toxic waste in accordance with Transportation and Dangerous Goods Act, 1999.

.7 Dispose of hazardous and toxic waste using facilities licensed to receive hazardous and toxic waste. Do not co-mingle hazardous and toxic waste with regular wastes or recyclable materials.

.8 Provide the Departmental Representative with the name and certification of such facilities.

.9 Provide the Departmental Representative with shipping manifests and bills of lading to verify legal disposal of hazardous and toxic waste materials.

1.8 DRAINAGE, EROSION AND SEDIMENTATION

.1 Provide Erosion and Sediment Control Plan as per above noted submittal requirements.

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

.3 Do not pump water containing deleterious substances into waterways, sewer or drainage systems.

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

.5 Provide flocculation tanks, settling basins, or other treatment facilities as required to ensure that waste water (including potentially contaminated groundwater seepage from excavations) meets Federal, Provincial and Municipal criteria applicable to the method of disposal.

.6 All water to be removed from the site must be characterized through representative sampling and analysis prior to removal and disposal. Contractor shall engage a QEP to complete the required sampling and analysis. All analytical results will be reviewed by the Departmental Representative prior to removal from the site. Departmental requires a minimum 48 hour notice prior to any discharges to the sanitary system. Where applicable, water shall be disposed in permitted facilities in accordance with applicable legislation.

.7 Sample analysis must be done by an independent testing agency accredited according to the Standards Council of Canada, the Canadian Association of Laboratory Accreditation Inc. (ISO/IEC 17025) and British Columbia Ministry of Environment.

.8 All samples are to be tested at a minimum for Polycyclic Aromatic Hydrocarbons (PAH), Total Metals, pH, Salinity and Total Suspended Solids (TSS) and any other identified contaminants of concern.

.9 The Contractor shall arrange and pay for sampling and testing of the water.

.10 Water test results shall be compared to:

- .1 CRD Sewer Use Bylaw No. 2922;
- .2 CCME Canadian Environmental Quality Guidelines;
- .3 BC Approved Water Quality Guidelines (BCAWQG); and
- .4 Any other applicable guidelines and standards.

.11 Contractor is to submit to Departmental Representative a professional report, for review, with laboratory results, analysis and recommendations for disposal/removal. Results shall be tabulated in an easy to read format with exceedances highlighted.

1.9 WORK ADJACENT TO WATERWAYS

.1 Do not operate construction equipment in waterways.

.2 Do not dump excavated fill, waste material or debris in waterways.

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

.4 Protect the roadways from tracking mud, soil and debris throughout the work.

1.11 SPILLS OR RELEASE OF DELETERIOUS SUBSTANCES

.1 Spills can happen at any time during construction, and there are specific times when the risk is higher such as during the use of paints, corrosive protective coatings, wood preservatives and while working with concrete. Sawdust and wood shavings can potentially enter the marine environment from cutting and drilling during repairs. Potential spills of deleterious substances could result in contamination of the local marine environment, which is a potential violation under the Canadian Environmental Protection Act (CEPA) and the Fisheries Act.

.2 Measures to be implemented to prevent, control, or mitigate spills or release of deleterious substances:

.1 Emergency response procedure for spills of deleterious substances must be in place. In the event of a Level I spill (easily contained and cleaned) the contractor will provide spill response and notify the Departmental Representative that a spill has occurred. In the event that there is a Level II spill (spill that cannot be easily contained or cleaned up), the Contractor shall call the BCEO Trouble Desk (250-363-2009) and 911, where HERT will respond to the spill.

.2 Notify Departmental Representative of all spills, regardless of severity. Submit within 24 hours of the spill, a written spill report containing the following minimum information:

.1 Date, time, location of spill;
.2 Substance spilled;
.3 Approximate volume spilled;
.4 Approximate area of spill;
.5 Type of surface at spill site;
.6 Circumstances resulting in the spill;
.7 Actions taken;
.8 Affected receptors; and
.9 Weather conditions at the time of the spill.

.3 Response equipment is to be on site at all times (i.e. spill kits) and workers trained in their location and use. The resources on hand must be sufficient to respond effectively and expediently to any spill that could occur onsite.

.4 All construction equipment brought onto the site will be clean and properly maintained.

.5 Equipment refueling or lubricating shall occur in a designated area > 30m from the marine environment with proper controls to prevent the release of deleterious substances and shall be conducted away from any surface water drains or collection points.

.6 Any equipment remaining on site overnight shall have appropriately placed drip pans.

.7 The Contractor shall take due care to ensure no deleterious materials including sediment-laden runoff leave the worksite, or enter any surface water or storm water or sanitary sewer at or near the worksite.

.8 Concrete wash water from cast-in-place concrete works (within the first 72 hours) shall not enter any surface water or storm water or sanitary sewer at or near the worksite. Concrete pouring should not be performed if significant precipitation events are expected within 72 hours.

.9 The Contractor shall ensure that no sawdust or shavings enter the marine environment. In the event that sawdust and shavings enter the marine environment, they shall be collected promptly and disposed of appropriately.

.10 The rinse, cleaning water or solvents for glues, paints, wood preservatives and other potentially harmful or toxic substances shall be controlled so as to prevent leakage, loss of discharge into the storm drain system or into the marine environment.

.11 Prevent discharges containing asphalt, grout, concrete or other waste materials from reaching storm drains or the marine environment. This includes, but is not limited to:

.1 Minimizing the washing of sand or gravel from new asphalt, debris from drilling or cutting or other materials into storm drains and the marine environment by sweeping.

.2 Application of fog seals, tack coats or other coatings, if required, during periods when rainfall is unlikely to occur during application.

.3 Cleaning equipment off site.

.4 Protection of drainage structures with sediment controls as required.

1.12 HAZARDOUS MATERIALS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada

.2 Store hazardous or toxic substances in a designated area.

.3 Manage transport and dispose of hazardous materials in an approved legal manner in accordance with hazardous waste regulations.

.4 Provide Departmental Representative with waste manifest for disposal of hazardous materials.

1.13 SITE CLEARING, PLANT PROTECTION AND RESTORATION

.1 All disturbed areas are to be restored to their original condition or better after construction.

.2 Disturbance of vegetated areas is to be minimized as much as possible.

.3 Disturbed areas of bare soil are to be re-seeded as soon as possible post-construction.

.4 For trees that are to remain onsite, protect roots to drip line during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.

.5 Delineate exclusion zones around the bases of trees to remain. Erect temporary fencing, use flagging tape or employ other protective measures as appropriate.

.6 Advise Departmental Representative prior to completing any alteration of existing trees and/or working within the drip line of trees to remain. If tree alteration and/or work within

the drip line is unavoidable, Contractor shall engage a certified arborist to provide guidance for minimizing damage to the tree.

.7 When excavating through roots, excavate by hand and make clean cuts through roots using a sharp axe or saw. Cuts shall be sealed with appropriate wound dressing.

.9 Tree felling shall be completed by someone qualified to do so as per the Canada Occupational Health and Safety Regulations (SOR/86-304, Canada Labour Code) and under the direction of a certified arborist or Departmental approved equivalent.

1.14 SOIL MANAGEMENT

.1 Provide Soil Management Plan in accordance with submittal requirements above.

.2 Refer to Appendix A and Appendix B for soil sampling data and areas that have been identified as containing contaminated soils.

.3 All soils that are to be removed from site are to be considered contaminated and shall be disposed in permitted facilities in accordance with applicable legislation.

.1 Volume of contaminated soils to be removed from site is anticipated to be 850 cubic meters.

.4 Contaminated soil removed from the site shall be transported and disposed in accordance with all applicable legislation. All materials shall be securely covered while in transport.

.5 All stockpiled materials shall be:

.1 Placed on an impermeable surface (i.e. use 6 mil poly under the stockpiles to prevent direct contact with the ground surface);
.2 Covered and secured with 6-mil poly during precipitation events;
.3 Covered and secured with 6 mil poly at the end of each work day; and
.4 Covered and secured with 6 mil poly when not in use.

.6 The Contractor shall minimize cross-contamination and mixing of individual stockpiles. Individual stockpiles are to be no larger than $50m^3$ in size.

.7 Contractor shall provide suitable equipment at the stockpile site to pile soil into individual stockpiles and for site maintenance.

.8 All stockpiled areas shall be reinstated to original condition or better.

1.15 EXCAVATION

.1 All utilities must be located prior to excavation through a BC One call and a private utility location company to ensure all underground utilities are properly located.

1.16 IMPORT OF FILL MATERIAL

.1 Definitions

.1 Soil includes:

(a) unconsolidated mineral or organic material;

(b) fill; and

(c) sediment deposited on land.

.1 Fill Characterisation and Documentation:

.2 All imported fill material, regardless of type, shall be tested for the level of contamination prior to arrival on-site.

.3 Contractor is responsible to arrange and pay for testing of import fill material.

.4 Environmental characterization of fill material must be conducted in accordance with the British Columbia, Ministry of Environment, Technical Guidance Document #1 – Site Characterization and Confirmation Testing.

.5 Only fill material meeting the CCME Canadian Soil Quality Guidelines for Residential/Parkland (RL/PL) Land Use may be used onsite.

.6 Samples shall be tested at a minimum for Metals, PAH and Hydrocarbons.

.7 The Contractor shall submit documented proof to the Departmental Representative that all imported fill material for this project meets the applicable guidelines prior to being brought onsite.

.8 Documented proof shall be in the form of a signed cover letter and signed test analysis results, from an independent testing firm accredited according to the Standards Council of Canada, the Canadian Association of Laboratory Accreditation Inc. (ISO/IEC 17025), and British Columbia Ministry of Environment.

.9 The cover letter shall:

.1 Clearly state that all imported material meets the stated guidelines,

.2 Include the name and location of all material sources,

.3 Identify the nature of current and historic activities conducted at the source.

.10 The test analysis reports shall:

.1 Clearly show the test results for each type of material tested and compared against the applicable CCME Guidelines, as per the above-noted requirements, in an easily-read tabular format.

.2 Include tests results conducted within 3 months of the date of submittal.

.3 Include the name and location of all material sources.

.11 All material brought to the site that does not meet the above-noted CCME Guidelines will be removed from the property immediately at the Contractor's cost.

1.17 ARCHAEOLOGICAL RESOURCES

.1 Archaeological features may potentially be discovered and disturbed at the site during excavation and/or building deconstruction/construction.

.2 The contractor must notify Departmental Representative 7 days prior to any in ground work.

.3 DFO will engage archaeological consultants to monitor the site during excavation activities.

.1 Contractor to accommodate on site monitoring during excavation.

.4 If archaeological deposits waste are discovered, stop work immediately and notify Departmental Representative.

.5 Archaeologically significant material, if found on the property, remains the property of the Crown and shall not be removed from the site.

.6 Management of the archaeological materials will be coordinated through Departmental Representative.

1.18 NOTIFICATION

.1 Departmental Representative 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, Erosion and Sediment Control Plan or Soil Management Plan.

.2 Contractor: After receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.

.3 Departmental Representative 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 National Building Code of Canada (NBC) 2015 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 Comply with applicable local bylaws rules and regulations enforced at the location concerned.

.3 Provide inspection authorities having jurisdiction with plans and information required for issue of acceptance certificates.

.4 Pay fees and obtain certificates and permits required.

.5 Furnish inspection certificates in evidence that the work installed conforms to the requirements of the authority having jurisdiction.

.6 Conform to the Canada Labour Code II, Canada Occupational Safety and Health regulations.

.7 FCC, Fire Commissioner of Canada.

.1 Standard No. 301, "Construction Operations, June 1982.

.8 WCB, Worker's Compensation Act, B.C., Reg. 185/99.

.9 Meet or exceed requirements of:

.1 Contract documents.

.2 Specified standards, codes and referenced documents.

1.2 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions and municipal by-laws.

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 Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative 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.

1.2 PROCEDURES

.1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in 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.

1.3 REJECTED WORK

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 Make good other Contractor's work damaged by such removals or replacements promptly.

.3 If ,in opinion of Departmental Representative, it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents the Departmental Representative will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents.

.4 In case of dispute, decisions as to standard or quality of work rests solely with the Departmental Representative.

1.4 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies are to be engaged by the contractor to inspect portions of the work, as indicated in individual specification sections.

.2 Contractor is to allow for the costs of these inspections.

.3 Provide equipment required for executing inspection and testing by appointed agencies.

.4 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.5 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and reinspection.

1.5 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

1.6 MOCK-UPS

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

.2 Construct in locations acceptable to Departmental Representative, as specified in specific Section.

.3 Prepare mock-ups for Departmental Representative review with reasonable promptness and in orderly sequence, to not cause delays in Work.

.4 Failure to prepare mock-ups 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.

.5 Departmental Representative may allow Mock-ups to remain as part of the work.

1.7 EQUIPMENT AND SYSTEMS

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

.2 Refer to individual specification sections for definitive requirements.

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 utilities controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.2 WATER SUPPLY

.1 Departmental Representative will provide continuous supply of potable water for construction use.

.2 Exercise conservation. Turn off water when not in use.

.3 Provide all equipment and temporary hoses to bring water supply to site, at no additional cost to the contract.

1.3 TEMPORARY POWER AND LIGHT

.1 Electrical power is available for construction purposes at no cost once new power pole has been installed and BC Hydro connection has been made.

.1 Prior to B.C. Hydro connection, Contractor will be responsible for provision of power through the use of portable generators.

.1 Contractor to pay for provision of generators and fuel under this contract.

.2 Contractor to install provisions for temporary power once new power pole is installed.

.2 Departmental Representative will determine delivery points and quantitative limits. Departmental Representative written permission is required before any connection is made. Connect to existing power supply in accordance with Canadian Electrical Code.

.3 Provide all equipment and temporary lines to bring these services to the work, at no additional cost to the contract.

.4 Exercise conservation whenever using temporary electrical power supply.

1.4 FIRE PROTECTION

.1 Burning rubbish and construction waste materials is not permitted on site.

Part 2 Products

2.1 NOT USED

Part 3 EXECUTION

.1 NOT USED

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.2 SCAFFOLDING

.1 Scaffolding in accordance with CAN/CSA-S269.2.

.2 Provide and maintain scaffolding, ladders, shoring and platforms necessary for the performance of the work.

.3 Provide scaffolding and support structures as detailed in individual specification sections.

1.3 HOISTING

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

.2 Hoists to be operated by B.C. certified personnel.

.3 Notify Departmental Representative not less than 5 working days prior to any cranes or lifting devices coming on site. PCO indicates that maximum height is 5 meters. Seek permission from the Port Hardy Airport Authority and Departmental representative for any equipment that exceeds 5 meters.

1.4 SITE STORAGE/LOADING

.1 Confine work and operations of employees to areas as directed by Departmental Representative unless otherwise identified in 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.

1.5 Site Office

.1 Contractor to provide temporary office of sufficient size to accommodate site meetings and store documents required on site. Furnish with a drawing laydown table.

1.6 CONSTRUCTION PARKING

.1 Parking is permitted on site in areas directed by Departmental Representative.

.2 Existing roads may be used for access to project site. Maintain construction parking area clean and free of construction-related debris, spillage and soiling.

.3 Make good damage resulting from Contractor use of parking areas and roads, at no additional cost to the Contract.

1.7 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 where directed by Departmental Representative.

1.8 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.

1.9 CONSTRUCTION SIGNAGE

.1 No project identification signage allowed.

.2 No other signs or advertisements, other than warning signs, are permitted on site.

.3 Signs and notices for safety and instruction in both official languages Graphic symbols to CAN/CSA-Z321.

.4 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Departmental Representative.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 Not Used

END OF SECTION

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 and BARRIERS

.1 Provide minimum 1,828.8mm high construction fencing around perimeter of the area of work.

.1 Extent of fencing is indicated on drawings.

.2 Provide visual /dust screening for portions of construction area fencing.

.1 Extent of screening indicated on drawings

.2 Knit polyethylene screen

.3 90% density, visual screening.

.4 Complete with reinforced edges and grommets for secure attachment to construction fencing

1.3 DUST TIGHT SCREENS

.1 Provide dust tight screens or partitions to localize dust generating activities, and for protection of workers and public.

.2 Maintain and relocate protection until such work is complete.

1.4 ACCESS TO SITE

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

1.5 FIRE ROUTES

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

1.6 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

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

.2 Be responsible for damage incurred.

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

END OF SECTION

Part 1 General

1.1 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 inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.4 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative 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.

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

.6 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.

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

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

1.3 TRANSPORTATION

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

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

1.4 MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions.

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

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

1.5 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.

.2 Do not employ anyone unskilled in their required duties.

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

1.6 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.

1.7 CONCEALMENT

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

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

1.8 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.

1.9 LOCATION OF FIXTURES

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

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

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

1.10 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.

1.11 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.

1.12 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 Departmental Representative.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Coast Guard personnel and by Other Contractors.

.2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative.

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

.4 Provide on-site containers for collection of waste materials and debris. Locate where directed by Departmental Representative.

.5 Provide and use clearly marked separate bins for recycling wherever facilities are available. Refer to Section 01 74 19 - Waste Management and Disposal for additional requirements.

.6 Remove waste material and debris from site and deposit in waste containers at end of each working day. Dispose of waste materials and debris off site.

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

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

.9 Provide adequate ventilation during use of volatile or noxious substances. Do not use building ventilation system for this purpose.

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

.11 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

2 FINAL CLEANING

.1 When Work is substantially completed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

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

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

.4 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate and mechanical/electrical fixtures. Replace broken, scratched and disfigured glass.

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

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

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

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

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

.10 Remove dirt and other disfiguration from exterior surfaces.

.11 Clean and sweep roofs, gutters, areaways and sunken wells.

.12 Sweep and wash clean paved areas and all pavement parking/storage areas used by Contractor to remove all traces of construction spillage, stains and residue. Do not blast dirty water onto adjacent buildings and site features.

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

.14 Clean roofs, downspouts and drainage systems.

.15 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for re-use and for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Waste goals.

.2 Waste management plan.

.3 Waste management plan implementation.

.4 Disposal of waste.

1.2 DEFINITIONS

.1 Clean Waste: Untreated and unpainted; not contaminated with oils, solvents, sealants or similar materials.

.2 Construction and Demolition Waste: Solid wastes typically including but not limited to, building materials, packaging, trash, debris, and rubble resulting from construction, re-modelling, repair and demolition operations.

.3 Hazardous: Exhibiting the characteristics of hazardous substances including, but not limited to, ignitability, corrosiveness, toxicity or reactivity.

.4 Non-hazardous: Exhibiting none of the characteristics of hazardous substances, including, but not limited to, ignitability, corrosiveness, toxicity, or reactivity.

.5 Non-toxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

.6 Recyclable: The ability of a product or material to be recovered at the end of its life cycle and re-manufactured into a new product for reuse by others.

.7 Recycle: To remove a waste material from the Project site to another site for re-manufacture into a new product for reuse by others.

.8 Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

.9 Return: To give back reusable items or unused products to vendors for credit.

.10 Reuse: To reuse a construction waste material in some manner on the Project site.

.11 Salvage: To remove a waste material from the Project site to another site for resale or reuse by others.

.12 Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

.13 Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

.14 Toxic: Poisonous to humans either immediately or after a long period of exposure.

.15 Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

.16 Volatile Organic Compounds (VOC): Chemical compounds common in and emitted by many building products over time through outgassing:

.1 Solvents in paints and other coatings,

.2 Wood preservatives; strippers and household cleaners,

.3 Adhesives in particle board, fibreboard, and some plywood; and foam insulation,

.4 When released, VOC's can contribute to the formation of smog and can cause respiratory tract problems, headaches, eye irritations, nausea, damage to the liver, kidneys, and central nervous system, and possibly cancer.

.17 Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.3 WASTE MANAGEMENT GOALS

.1 Owner has established that this Project shall generate the least amount of waste possible and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors shall be employed. The owners goal is to divert 75% of waste materials from the landfill.

.2 Owner recognizes that waste in any project is inevitable, but indicates that as much of the waste materials as economically feasible shall be reused, salvaged, or recycled.

.3 Waste disposal in landfills shall be minimized.

1.4 MATERIAL SOURCE SEPARATION PLAN

.1 Before project start-up, prepare Materials Source Separation Program. Provide separate containers for re-usable and/or recyclable materials of following:

.1 Construction waste: including but not limited to following types.

.1 Uncontaminated packaging (wood, metal banding, cardboard, paper, plastic wrappings, polystyrene).

.2 Wood pallets (recycle or return to shipper).

.3 Batt insulation.

.4 Metals (pipe, conduit, ducting, wiring, miscellaneous cuttings)

.5 Wood (uncontaminated).

.6 Gypsum board (uncontaminated).

.7 Paint, solvent, oil.

.8 Other materials as indicated in technical sections.

.2 Administration/worker waste (uncontaminated): including but not limited to following types.

.1 Paper, cardboard.

.2 Plastic containers and lids marked types 1 through 6.

.3 Glass and aluminum drink containers (recycle or return to vendor).

.2 Implement MSSP for waste generated on project in compliance with approved methods and as approved by Departmental Representative.

.3 Locate containers in locations, to facilitate deposit of materials without hindering daily operations and as directed by Departmental Representative.

.4 Locate separated materials in areas which minimize material damage.

1.5 STORAGE, HANDLING AND PROTECTION

.1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.

.2 Unless specified otherwise, materials for removal becomes Contractor's property.

.3 All materials for recycling must be source separated into separate bins to be accepted by the local processing authority.

.4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.

.5 Protect surface drainage, storm sewers, sanitary sewers, and utility services from damage and blockage.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 PREPARATION

.1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.2 USE OF SITE AND FACILITIES

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

3.3 WASTE MANAGEMENT IMPLEMENTATION

.1 Manager: Contractor to designate an on-site party responsible for instructing workers and overseeing the results of the Waste Management Plan the Project.

.2 Instruction: Contractor shall provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the Project.

.3 Separation facilities: Contractor shall lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.

.4 Hazardous wastes: Hazardous wastes shall be separated, stored, and disposed of according to local regulations.

.1 Dispose or recycle demolished asphalt paving in accordance with local bylaws.

3.4 DISPOSAL OF WASTE

.1 Burying of rubbish and waste materials is prohibited.

.2 Disposal of waste into waterways, storm, or sanitary sewers is prohibited.

3.5 COORDINATION

.1 Coordinate disposal of demolished concrete slab with Municipality. Contractor to load demolished material onto trucks provided by the Municipality. Municipality to haul debris to disposal site. Contractor responsible for arranging for disposal site and payment of tipping fees.

3.6 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

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

.1 Acceptance of Work Procedures:

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

.1 Notify Departmental Representative in writing of satisfactory completion of inspection and submit verification that corrections have been made.

.2 Request Departmental Representative's inspection.

.2 Departmental Representative's Inspection:

.1 Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.

.2 Contractor to correct Work as directed.

.3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:

.1 Work: completed and inspected for compliance with Contract Documents.

.2 Defects: corrected and deficiencies completed.

.3 Certificates required by authorities having jurisdiction have been submitted.

.4 Operation of systems have been demonstrated to the owner’s personnel

.5 Work is complete and ready for final inspection.

.4 Declaration of Substantial Performance: When Departmental Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.

.5 Commencement of warranty period: Date of Departmental Representatives acceptance of substantial performance to be the date for commencement for warranty period.

.6 Payment of Holdback: after issuance of Substantial Performance of work, submit application for payment of holdback amount in accordance with contractual agreement.

.7 Final Inspection:

.1 When completion tasks are done, request final inspection of Work by Departmental Representative.

.2 If work is deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.

.8 Final Payment

.1 When Departmental Representative considers final deficiencies and defects corrected and requirements of contract met, make application for final payment.

.2 When work deemed incomplete by Departmental Representative complete outstanding items and request re-inspection.

1.2 FINAL CLEANING

.1 Remove surplus materials, excess materials, rubbish tools and equipment.

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 Closeout submittals.

.2 Operation and maintenance manual format.

.3 Contents each volume.

.4 Recording actual site conditions.

.5 Record (as-built) documents and samples.

.6 Record documents.

.7 Warranties and bonds.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.3 CLOSEOUT SUBMITTALS

.1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.2 Submit preliminary copy for consultant review.

.3 Copy will be returned with Consultant's comments.

.4 Revise content of documents as required prior to final submittal.

.5 Two weeks prior to Substantial Performance of the Work, submit to the Consultant, four final copies of operating and maintenance manuals in Canadian English.

.1 One copy of the manual to be provided in digital form on CD rom, in Canadian English.

.6 Ensure spare parts, maintenance materials and special tools required in individual specification sections are new, undamaged or defective, and of same quality and manufacture as products provided in Work.

.7 If requested, furnish evidence as to type, source and quality of products provided.

.8 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.9 Pay costs of transportation.

1.4 OPERATION AND MAINTENANCE MANUAL FORMAT

.1 Organize data in the form of an instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

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

.4 Cover: Identify each binder with type or printed title “MAINTENANCE MANUAL”'; list title of project and identify subject matter of contents.

.5 Arrange content by systems, under Section numbers and sequence of Table of Contents.

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

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

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

.9 Provide both .PDF electronic copy and hard copy submissions

.10 Coordinate with commissioning specification to include all related close out documentation, warranty and test reports.

1.5 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project;

.1 date of submission;

.2 names, addresses, and telephone numbers of Consultant and Contractor with name of responsible parties; and

.3 schedule of products and systems, indexed to content of volume.

.2 For each product or system, list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

.4 Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

1.6 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of black line opaque drawings, and within the Project Manual.

.2 Annotate with coloured felt tip marking pens, maintaining separate colours for each major system, for recording changed information.

.3 Record information concurrently with construction progress. Do not conceal Work of the Project until required information is accurately recorded.

.4 Contract drawings and shop drawings: legibly mark each item to record actual construction, including:

.1 Measured depths of elements of foundation in relation to finish first floor datum.

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

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

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 References to related shop drawings and modifications.

.5 Specifications: legibly mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

.6 Other Documents: maintain inspection certifications, field test records, required by individual specifications sections.

.7 Submit copy of record drawings and specifications to the Departmental Representative.

1.7 WARRANTIES AND BONDS

.1 Separate warranties and bonds with individual tab sheets keyed to the table of contents listing in the maintenance manual.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 20 00 – Concrete Reinforcing

.2 Section 03 30 00 – Cast-in-Place Concrete

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA)

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

.2 CAN/CSA O86-14, Engineering Design in Wood.

.3 CSA O121-08 (R2013), Douglas Fir Plywood.

.4 CAN/CSA O325.0-16, Construction Sheathing.

.5 CSA S269.1-16, Falsework and Formwork.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings: convene pre-installation meeting one week prior to beginning concrete works.

.1 Ensure key personnel, site supervisor, Departmental Representative, concrete producer speciality contractor - finishing, forming attend.

.1 Verify project requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit copy of WHMIS SDS in accordance with Section 01 35 43 - Environmental Procedures and 01 35 30 - Health and Safety Requirements.

.3 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan and Waste Reduction Workplan highlighting recycling and salvage requirements.

1.5 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer s name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground and in accordance with manufacturer s recommendations in clean, dry, well-ventilated area.

.2 Store and protect formwork from damages.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Formwork materials:

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

.2 For concrete with special architectural features, use formwork materials to CSA A23.1/A23.2.

.2 Tubular column forms: spirally wound, polyethylene impregnated virgin kraft interior layer and a waxed exterior, internally treated with release material.

.3 Form ties:

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

.2 For Architectural concrete; snap ties complete with plastic cones and light grey concrete plugs.

.4 Form liner:

.1 Plywood: Douglas Fir to CSA O121

.5 Form release agent: Proprietary, non- volatile material not to stain concrete or impair subsequent application of finishes or coatings to surface of concrete, derived from agricultural sources, non- petroleum containing, non-toxic, biodegradable and low VOC.

.6 Falsework materials: to CSA S269.1.

.7 Sealant: to Section 07 92 00 - Joint Sealants.

Part 3 Execution

3.1 FABRICATION AND ERECTION

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

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

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

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

.5 Align form joints and make watertight.

.1 Keep form joints to minimum.

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

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

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

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

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

3.2 REMOVAL AND RESHORING

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

.1 2 days for walls and sides of beams.

.2 2 days for footings.

.2 Remove formwork when concrete has reached 70 % of its 28 day design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.

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

3.3 CLEANING

.1 Progress Cleaning:

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 10 00 – Concrete Forming and Accessories

.2 Section 03 30 00 – Cast-in-Place Concrete

1.2 PRICE AND PAYMENT PROCEDURES

.1 Measurement and Payment:

.1 No measurement made under this Section.

.1 Include reinforcement costs in items of concrete work in Section 03 30 00 - Cast-In-Place Concrete.

1.3 REFERENCE STANDARDS

.1 American Concrete Institute (ACI)

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

.2 ASTM International (ASTM)

.1 ASTM A123/A123M — 17 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A143/A143M-07 (2014), Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

.3 ASTM A641/A641M-09a(2014), Standard Specification for Zinc–Coated (Galvanized) Carbon Steel Wire.

.4 ASTM A1064/A1064M-17, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

.3 CSA Group (CSA)

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

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

.3 CSA G30.18-09 (R2014), Carbon Steel Bars for Concrete Reinforcement.

.4 CSA G40.20/G40.21-13 (R2014), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.5 CSA W186-M1990 (R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.4 Reinforcing Steel Institute of Canada (RSIC)

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

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings: convene pre-installation meeting one week prior to beginning concrete works.

.1 Ensure site supervisor, departmental representative, concrete producer and speciality contractor - finishing, forming attend.

.1 Verify project requirements.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for proprietary materials used in Cast-In-Place Concrete and additives. Include product characteristics, performance criteria, physical size, finish, and limitations.

.2 Submit copy of WHMIS Safety Data Sheet (SDS) in accordance with Sections 01 35 30 - Health and Safety and 01 35 43 - Environmental Procedures.

.3 Shop Drawings:

.1 Submission of shop drawings is not required.

.1 If required prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and SP-66.

.2 Indicate placing of reinforcement and:

.1 Bar bending details.

.2 Lists.

.3 Quantities of reinforcement.

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

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

.3 Detail lap lengths and bar development lengths to CAN/CSA A23.3, unless otherwise indicated.

.1 Provide Class B unless otherwise indicated.

.4 Indicate position and size of openings in slabs and walls. Coordinate with trades requiring openings.

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan and Waste Reduction Workplan highlighting recycling and salvage requirements.

.5 Quality Assurance Submittals:

.1 Submit in accordance with Section 01 45 00 - Quality Control and as described in PART 2 - SOURCE QUALITY CONTROL.

.2 Mill Test Report: upon request, submit to Departmental Representative certified copy of mill test report of reinforcing steel, minimum 2 weeks prior to beginning reinforcing work.

.3 Upon request submit in writing to Departmental Representative proposed source of reinforcement material.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions and 01 61 00 - Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

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

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

.3 Reinforcing steel: weldable low alloy steel deformed bars to CSA G30.18.

.4 Cold-drawn annealed steel wire ties: to ASTM A1064/A1064M.

.5 Deformed steel wire for concrete reinforcement: to ASTM A1064/A1064M.

.6 Welded steel wire fabric:

.1 Plain in accordance ASTM A1064/A1064M, fabricated from as drawn steel wire into flat sheets; sizes as indicated on Drawings.

.2 Provide in flat sheets only.

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

.8 Tie wire: 1.5 mm diameter annealed wire

.9 Mechanical splices: subject to approval of Departmental Representative

.10 Plain round bars: to CSA G40.20/G40.21.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA A23.1/A23.2, Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada and SP-66.

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

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

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 2 weeks prior to beginning reinforcing work.

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

Part 3 Execution

3.1 PREPARATION

.1 Galvanizing to include chromate treatment.

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

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

3.2 FIELD BENDING

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

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

.3 Replace bars, which develop cracks or splits.

3.3 PLACING REINFORCEMENT

.1 Cutting or puncturing vapour retarder is not permitted; repair damage and reseal vapour retarder before placing concrete.

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

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

.1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.

.2 Apply thick even film of mineral lubricating grease when paint is dry.

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

.5 Maintain cover to reinforcement during concrete pour.

3.4 CLEANING

.1 Progress Cleaning:

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 10 00 – Concrete Forming Accessories

.2 Section 03 20 00 – Concrete Reinforcing.

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM C260/C260M-10a(2016), Standard Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.3 ASTM C494/C494M-16, Standard Specification for Chemical Admixtures for Concrete.

.4 ASTM C 881/C881M-15, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

.5 ASTM C1017/C1017M-13e1, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.6 ASTM C C1059/C1059M-13, Standard Specification for Latex Agents for Bonding Fresh To Hardened Concrete.

.7 ASTM D412-16, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

.8 ASTM D624-2012, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.

.9 ASTM D1751-04 (2013)e1, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

.10 ASTM D1752-04a(2013), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

.2 Canadian General Standards Board (CGSB)

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

.3 CSA Group

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

.2 CSA A283-06-R2016, Qualification Code for Concrete Testing Laboratories.

.3 CSA A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005),

1.3 ABBREVIATIONS AND ACRONYMS

.1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement types:

.1 GU, GUb and GUL - General use cement.

.2 MS and MSb - Moderate sulphate-resistant cement.

.3 MH, MHb and MHL - Moderate heat of hydration cement.

.4 HE, HEb and HEL - High early-strength cement.

.5 LH, LHb and LHL - Low heat of hydration cement.

.6 HS and HSb - High sulphate-resistant cement.

.2 Fly ash types:

.1 F - with CaO content maximum 8%.

.2 CI - with CaO content 15 to 20%.

.3 CH - with CaO minimum 20%.

.3 GGBFS - Ground, granulated blast-furnace slag.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings: convene pre-installation meeting one week prior to beginning concrete works.

.1 Ensure site supervisor, concrete producer, speciality contractor - finishing, forming, key personnel and Departmental Representative attend.

.1 Verify project requirements.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer’s instructions, printed product literature and data sheets for proprietary materials used in Cast-In-Place Concrete and additives and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit copies of WHMIS SDS in accordance with Section 01 35 30 - Health and Safety and 01 35 43 - Environmental Procedures.

.3 Site Quality Control Submittals:

.1 Provide test reports for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters found.

.2 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.

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

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Reduction Workplan and Waste Management Plan highlighting recycling and salvage requirements.

1.6 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Provide Departmental Representative, minimum 4 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.

.1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture meet specified

.3 At least 2 weeks prior to beginning Work, inform Departmental Representative of source of fly ash.

.1 Changing source of fly ash without written approval of Departmental Representative is prohibited.

.4 Minimum 2 weeks prior to starting concrete work, provide proposed quality control procedures for review by Departmental Representative on following items:

.1 Falsework erection.

.2 Cold weather concrete.

.3 Curing.

.4 Finishes.

.5 Formwork removal.

.6 Joints.

.5 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

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

.1 Modifying maximum time limit without receipt of prior written agreement from Departmental Representative and concrete producer as described in CSA A23.1/A23.2. is prohibited.

.2 Deviations submitted for review by Departmental Representative.

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

1.8 SITE CONDITIONS

.1 Placing concrete during rain or weather events that could damage concrete is prohibited.

.2 Protect newly placed concrete from rain or weather events in accordance with CSA A23.1/A23.2.

.3 Cold weather protection:

.1 Maintain protection equipment, in readiness on Site.

.2 Use such equipment when ambient temperature below 5°C, or when temperature may fall below 5°C before concrete cured.

.3 Placing concrete upon or against surface at temperature below 5°C is prohibited.

.4 Hot weather protection:

.1 Protect concrete from direct sunlight when ambient temperature above 27°C.

.2 Prevent forms of getting too hot before concrete placed. Apply accepted methods of cooling not to affect concrete adversely.

.5 Protect from drying.

Part 2 Products

2.1 DESIGN CRITERIA

.1 Alternative 1 - Performance: to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

2.2 PERFORMANCE CRITERIA

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

2.3 MATERIALS

.1 Portland Cement: GU.

.1 Reduction in cement from Base Mix to Actual Supplementary Cementing Materials (SCMs) Mix, as percentage.

.2 Blended hydraulic cement: Type GUb to CSA A3001.

.3 Portland-limestone cement: Type GUL to CSA A3001.

.4 Supplementary cementing materials: with minimum 20% fly ash replacement, by mass of total cementitious materials to CSA A3001.

.5 Water: to CSA A23.1.

.6 Aggregates: to CSA A23.1/A23.2.

.7 Admixtures:

.1 Air entraining admixture: to ASTM C260.

.2 Chemical admixture: to ASTM C494. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.

.3 Corrosion-inhibiting admixture: to

.4 Lithium-based admixture: to

.5 Shrinkage-reducing admixture (SRA): to

.6 Viscosity-modifying agent (VMA): to

.8 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.

.1 Compressive strength: 40 MPa at 28 days.

.9 Curing compound: to CSA A23.1/A23.2 and ASTM C309, Type 1-chlorinated rubber.

2.4 MIXES

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

.1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.

.2 Provide concrete mix to meet following plastic state requirements:

.1 Uniformity: uniform density, air content, and slump.

.2 Workability: free of segregation, surface blemishes, loss of mortar, and colour variations..

.3 Finishability: to CSA A23.1/A23.2.

.3 Provide concrete mix to meet following hard state requirements:

.1 Mix: Type 1

.1 Durability and class of exposure: N.

.2 Compressive strength at 28 day age: 25 MPa minimum.

.3 Intended application: Typical unless noted otherwise.

.4 Aggregate size: 20mm maximum

.2 Mix: Type 2

.1 Durability and class of exposure: F-2.

.2 Compressive strength at 28 day age: 30 MPa minimum.

.3 Intended application: Footings and grade beams.

.4 Aggregate size: 20mm maximum

.3 Mix: Type 3

.1 Durability and class of exposure: C-1.

.2 Compressive strength at 28 day age: 35 MPa minimum.

.3 Intended application: Structurally reinforced concrete exposed to chlorides with or without freezing and thawing.

.4 Aggregate size: 20mm maximum

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

.5 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

Part 3 Execution

3.1 PREPARATION

.1 Obtain Departmental Representative’s written approval before placing concrete.

.1 Provide 48 hours minimum notice prior to placing of concrete.

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

.3 During concreting operations:

.1 Development of cold joints not allowed.

.2 Ensure concrete delivery and handling facilitate placing with minimum of re-handling, and without damage to existing structure or Work.

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

.5 Disturbing reinforcement and inserts during concrete placement is prohibited.

.6 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.

.7 Protect previous Work from staining.

.8 Clean and remove stains prior to application for concrete finishes.

.9 Maintain accurate records of poured concrete items to indicate date, location of pour,

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

3.2 INSTALLATION/APPLICATION

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

.2 Sleeves and inserts:

.1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Departmental Representative.

.2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.

.3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Departmental Representative before placing of concrete.

.4 Confirm locations and sizes of sleeves and openings shown on drawings.

.5 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

.3 Anchor bolts:

.1 Set anchor bolts to templates in coordination with appropriate trade prior to placing concrete.

.2 Protect anchor bolt holes from water accumulations, snow and ice build-ups.

.3 Set bolts and fill holes with epoxy grout.

.4 Drainage holes and weep holes:

.1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms used, remove them after concrete has set.

.2 Install weep hole tubes and drains as indicated.

.5 Grout under base plates and machinery using procedures in accordance with manufacturer s recommendations which result in 100% contact over grouted area.

.6 Finishing and curing:

.1 Finish concrete to CSA A23.1/A23.2 and as indicated on the architectural drawings

.2 Use procedures as reviewed by Departmental Representative or those noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface not damaged.

.3 Use curing compounds compatible with applied finish on concrete surfaces.

.4 Finish concrete floor to CSA A23.1/A23.2. Class A.

.5 Concrete floor to have finish hardness minimum to CSA A23.1/A23.2

.6 Provide steel trowel finish unless otherwise indicated.

.7 Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum radius edges unless otherwise indicated.

.7 Toppings:

.1 Topping mixture to meet minimum requirements as follows: Bonded overlay

.2 Make allowance for bonded overlay topping thickness when pouring base course.

.3 Apply latex bonding agent modified cement/sand grout to base course to CSA A23.1/A23.2.

.4 Place bonded topping to CSA A23.1/A23.2 and topping manufacturer s recommendations.

.5 Ensure joints in topping of same material as those in base course. Ensure their locations precisely match those in base course. Provide reinforcing mesh and edge strips dividers as indicated.

.8 Joint fillers:

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative.

.2 When more than one piece required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Locate and form expansion and construction joints as indicated.

.4 Install joint filler.

.9 Dampproof membrane:

.1 Install dampproof membrane under concrete slabs-on-grade inside building.

.2 Lap dampproof membrane minimum 150 mm at joints and seal.

.3 Seal punctures in dampproof membrane before placing concrete.

.4 Use patching material minimum 150 mm larger than puncture and seal.

3.3 SURFACE TOLERANCE

.1 Concrete tolerance to CSA A23.1 Straightedge Method to tolerance of 8mm in 3000mm

3.4 FIELD QUALITY CONTROL

.1 Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.1 Concrete pours.

.2 Slump.

.3 Air content.

.4 Compressive strength at 7 and 28 days.

.5 Air and concrete temperature.

.2 Inspection and testing of concrete and concrete materials carried out testing laboratory designated by Contractor for review to CSA A23.1/A23.2.

.1 Ensure testing laboratory certified to CSA A283.

.2 Provide the Departmental Representative with a copy of all concrete test results

.3 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.

.4 Inspection or testing by Consultant not to augment or replace Contractor quality control nor relieve Contractor of contractual responsibility.

3.5 CLEANING

.1 Progress Cleaning – Leave work area clean at end of each day.

.2 Waste Management: separate waste materials for recycling and reuse in accordance with 01 74 19 - Waste Management and Disposal.

.1 Divert unused concrete materials from landfill to local facility and/or quarry after receipt of written approval from Departmental Representative.

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

.3 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved Departmental Representative.

.4 Disposal of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location to pose health or environmental hazard is prohibited.

.5 Prevent admixtures and additive materials from entering drinking water supplies or streams.

.6 Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal.

.7 Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM)

- .1 ASTM A36/A36M-14, Standard Specification for Carbon Structural Steel.
- .2 ASTM A325-07a, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- .3 ASTM A325M-14, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength Metric.
- .4 ASTM A123/A123M, Standard Specification for Zinc (Hot Dip Galvanized) coating on Iron and Steel Products
- .5 ASTM A53/53M, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc-Coated, Welded and Seamless.
- .6 ASTM F1554, Standard Specification for Anchor Bolts, Steel 36,55 and 105 ksi Yield Strength

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-85.10-99, Protective Coatings for Metals.

.3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturers Association (CPMA).

- .1 Handbook of the Canadian Institute of Steel Construction.
- .2 CISC/CPMA Standard 2-75, Quick-Drying Primer for use on Structural Steel.

.4 CSA Group (CSA)

- .1 CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CAN/CSA-S16-14, Limit States Design of Steel Structures.
- .4 CAN/CSA-S136-16, North American Specifications for the Design of Cold Formed Steel Structural Members.
- .5 CSA W47.1-19(R2013), Certification of Companies for Fusion Welding of Steel.
- .6 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.
- .7 CSA W55.3-1965 (R2003), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
- .8 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.5 Master Painters Institute

- .1 MPI-INT 5.1-08, Structural Steel and Metal Fabrications.
- .2 MPI-EXT 5.1-08, Structural Steel and Metal Fabrications.

.6 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International

.1 NACE No. 3/SSPC SP-6-07, Commercial Blast Cleaning.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer licensed by EGBC in British Columbia, Canada.

.3 Erection drawings:

.1 Submission of erection drawings is not required. Contactor and erector to ensure details and information necessary for assembly and erection purposes is understood including:

.1 Description of methods.

.2 Sequence of erection.

.3 Type of equipment used in erection.

.4 Temporary bracings.

.4 Source Quality Control Submittals:

.1 Upon request, submit 2 weeks prior to fabrication of structural steel.

.1 Mill test reports to show chemical and physical properties and other details of steel to be incorporated in project.

.2 Provide mill test reports certified by metallurgists qualified to practise in Province of British Columbia

.5 Fabricator Reports:

.1 Provide structural steel fabricator's affidavit stating that materials and products used in fabrication conform to applicable material and products standards specified and indicated.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials in manufacturer s original, undamaged containers with identification labels intact.

Part 2 Products

2.1 DESIGN REQUIREMENTS

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

.2 Shear connections:

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

.2 Select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated.

.3 Upon request, submit sketches and design calculations stamped and signed by qualified professional engineer licensed in Province of British Columbia, Canada for non-standard connections.

2.2 MATERIALS

.1 Structural steel: to CSA-G40.20/G40.21, grades as indicated on structural drawings

.2 Anchor bolts: to F1554 Grade 36.

.3 Bolts, nuts and washers: to ASTM A325 or ASTM A325M unless noted otherwise.

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

.5 Shop paint primer: to CISC/CPMA2-75 solvent reducible alkyd, grey or red oxide.

.6 Hot dip galvanizing: galvanize steel, where indicated, to CAN/CSA-G164, minimum zinc coating of 600 g/m^2.

.7 Shear studs: to CSA W59, Appendix H.

2.3 FABRICATION

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

.2 Install shear studs in accordance with CSA W59

.3 Provide holes in flanges. for attachment of wood nailers where required.

2.4 SHOP PAINTING

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

.2 Clean members, remove loose mill scale, rust, oil, dirt and foreign matter. Prepare surface according to NACE No.3/SSPC-SP-6.

.3 Apply one coat of primer in shop to steel surfaces to achieve minimum dry film thickness except for:

.1 Surfaces to be encased in concrete.

.2 Surfaces to receive field installed stud shear connections.

.3 Surfaces and edges to be field welded.

.4 Faying surfaces of slip-critical connections.

.5 Below grade surfaces in contact with soil.

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

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

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

Part 3 Execution

3.1 APPLICATION

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

3.2 GENERAL

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

.2 Welding: in accordance with CSA W59.

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

3.3 MARKING

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

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

3.4 ERECTION

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

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

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

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

3.5 FIELD PAINTING

.1 Touch up damaged surfaces and surfaces without shop coat with primer to NACE No.3/SSPC-SP-6 except as specified otherwise.

3.6 CLEANING

.1 Progress Cleaning:

.1 Leave work area clean at end of each day.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 06 10 00 - Rough Carpentry.

1.2 REFERENCES

.1 ASTM International

.1 ASTM A53/A53M-07, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A269-08, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

.3 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 CSA International

.1 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

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

.3 CSA S16-09, Design of Steel Structures.

.4 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).

.5 CSA W59-M03(R2008), Welded Steel Construction (Metal Arc Welding) Metric.

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

.1 Material Safety Data Sheets (MSDS).

.4 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current edition.

1.3 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for sections, plates, pipe, tubing and bolts and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit copies of WHMIS MSDS in accordance with Section 01 35 30 - Health and Safety Requirements

.1 For finishes, coatings, primers, and paints applied on site: indicate VOC concentration in g/L.

.3 Shop Drawings:

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

.2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.4 QUALITY ASSURANCE

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

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

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Leave protective coverings in place until final cleaning of the building.

Part 2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CSA G40.20/G40.21, Grade 300W.

.2 Steel pipe: to ASTM A53/A53M standard weight hot dipped galvanized finish.

.3 Welding materials: to CSA W59.

.4 Welding electrodes: to CSA W48 Series.

.5 Bolts and anchor bolts: to ASTM A307. Stainless steel alloy at exposed-to-view exterior applications, galvanized at concealed exterior applications

.6 Screws, lag bolts: purpose-made to suit applications, stainless steel alloy at exposed-to-view exterior applications, galvanized at concealed exterior applications.

.7 Nuts, washers: stainless steel alloy for exterior exposed-to-view applications, galvanized at concealed exterior applications.

.8 Shop coat primer: to CAN/CGSB-1.40.

.9 Ladders: ANSI A14.3.

2.2 FABRICATION

.1 Fabricate in accordance with approved shop drawings.

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

.3 Where possible, fit and shop assemble work, ready for erection.

.4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

.5 Remove welding slag and spatter. Grind smooth all sharp edges and welds.

.6 Unless otherwise detailed, fabricate pipe railing and guard assemblies generally as follows:

.1 Fit round steel caps, full welded in place, at exposed ends and terminations.

.2 Allow minimum 38 mm to maximum 50 mm clearance between railings and wall surfaces.

.3 Use pipe inserts to join railing sections together at joints.

.4 Fabricate railing and post assemblies in as large a size as possible before hot dip galvanizing to minimize on site welding.

.7 All exterior metal assemblies to be hot dipped galvanized to CAN/CSA G164-M92.

.8 Galvanize mesh assemblies separately from rail and guard assemblies and mechanically attach mesh to guard assembly after galvanization.

.9 Remove all rust, scale, oil and other foreign substances by wire brush, sand blasting or any other means which provides clean steel surfaces for first class smooth permanent paint finishes and galvanized coatings.

2.3 FINISHES

.1 All exterior metal fabrications are to be hot dip galvanized.

.1 Do galvanizing after assembly fabrication. Do not alter metal fabrications after galvanizing.

.2 Hot dip galvanize items with not less than 600 g/m^2 zinc coating, to CAN/CSA-G164.

2.4 PIPE RAILINGS AND GUARDS

.1 Steel pipe: 38 mm nominal outside diameter, formed to shapes and sizes as indicated.

.2 Railings: Fabricate railings in as long a length as possible. Fabricate railings to accept galvanized screening where indicated.

.3 Powder coat railings after fabrication.

.4 Railing supports and guard assemblies: Fabricate as detailed. Hot Dip galvanize after fabrication.

2.5 MISCELLEANEOUS

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal fabrications installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 ERECTION

.1 Do welding work in accordance with CSA W59 unless specified otherwise.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Provide suitable means of anchorage acceptable to Consultant such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles. Refer to details.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Supply components for work by other trades in accordance with shop drawings and schedule.

.6 Make field connections with bolts to CSA S16.

.7 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.

.8 Touch-up rivets, bolts and burnt or scratched surfaces with primer after completion of installation.

.9 All field connections to be made with specified fasteners. No field welding allowed without specific permission by Departmental Representative.

3.1 INSTALLATION

.1 Install items plumb and level, accurately fitted, free from distortion or defects.

.2 Provide for erection loads, and for sufficient temporary bracing to maintain true

.3 Perform field welding in accordance with AWS D1.1.

.4 Obtain approval prior to site cutting or making adjustments not scheduled.

.5 Install pipe railings and guard rails in locations indicated.

.6 Core holes in concrete stairs and ramps where required to install railings.

.1 Grout to fill hole. Trowel surface smooth and flush with adjacent surfaces.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal

3.3 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by metal fabrications installation.

END OF SECTION

PART 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 41 11 - Architectural Woodwork and Finish Carpentry

1.2 REFERENCES

.1 ASTM International

- .1 ASTM A123/A123M-15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A153/A153M-16 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .3 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
- .4 ASTM D1761-12, Standard Test Methods for Mechanical Fasteners in Wood.
- .5 ASTM D5055-13e1, Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists.
- .6 ASTM D5456-14b, Standard Specification for Evaluation of Structural Composite Lumber Products.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-11.3-[M87], Hardboard.
- .2 CAN/CGSB-71.26-[M88], Adhesive for Field-Gluing Plywood to Lumber Framing for Floor Systems.

.3 CSA International

- .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .2 CSA O86 Consolidation-14, Engineering Design in Wood.
- .3 CSA O112.9-10(R2014), Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).
- .4 CSA O121-08(R2013), Douglas Fir Plywood.
- .5 CSA O141-05(R2014), Softwood Lumber.
- .6 CSA O151-09(R2014), Canadian Softwood Plywood.
- .7 CSA O325-07(R2012), Construction Sheathing.
- .8 CSA O437 Series-93(R2011), Standards on OSB and Waferboard.

.4 Forest Stewardship Council (FSC)

- .1 FSC-STD-01-001-(version 4-0), FSC Principle and Criteria for Forest Stewardship.

.5 National Lumber Grades Authority (NLGA)

- .1 Standard Grading Rules for Canadian Lumber 2014.

.6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1113-A2011, Architectural Coatings.

.2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wood products and accessories and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 QUALITY ASSURANCE

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.

.3 Sustainable Standards Certification:

.1 Certified Wood: submit listing of wood products and materials used in accordance with CAN/CSA-Z809 or FSC or SFI.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wood and panel materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse as specified in Construction Waste Management Plan and Waste Reduction Workplan in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

1.6 COORDINATION AND COOPERATION

.1 Cut, trim, drill, frame and make good rough carpentry work for passage of work of other sections except where otherwise specified.

.1 Provide location, centering and bracketing for all trades and wood framing for plumbing, heating, electrical and other trades. Make good all defects and fully complete the rough carpentry.

.2 Provide solid backing where required for mounting accessories, including grab bars, millwork, and washroom accessories.

PART 2 Products

2.1 FRAMING, STRUCTURAL AND PANEL MATERIALS

.1 Lumber: softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:

.1 CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Glued end-jointed (finger-jointed) lumber SPS, are not acceptable for exterior wall and shear wall framing.

.3 Framing and board lumber: in accordance with National Building Code of Canada (NBCC) and CSA O86 to the species and grade indicated on the structural drawings.

.4 Wood I-Joists in accordance with Prefabricated Wood I-Joists ASTM D5055

.5 Structural Composite Lumber SCL in accordance with ASTM D5456

.6 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:

.1 Board sizes: "Standard" or better grade.

.2 Dimension sizes: "Standard" light framing or better grade.

.7 Plywood, OSB and wood based composite panels: to CSA O325.

.8 Douglas Fir plywood (DFP): to CSA O121, standard construction and in accordance with structural drawings.

2.2 ACCESSORIES

.1 Air seal: closed cell polyurethane or polyethylene.

.2 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

.1 Sealants: VOC limit 250 g/L maximum to SCAQMD Rule 1168.

.3 Subflooring adhesive: to CAN/CGSB-71.26, cartridge loaded.

.4 General purpose adhesive: to CSA O112.9.

.5 Nails, spikes and staples: to CSA B111.

.6 Bolts: 15.5 mm diameter unless indicated otherwise, complete with nuts and washers.

.7 Self tapping screws: Stainless steel, countersink head, of appropriate length.

.8 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.

.9 Wood Preservative:

.1 Preservative: in accordance with manufacturer's recommendations for surface conditions

.10 Fastener Finishes:

.1 Galvanizing: to ASTM A153/A153M, use galvanized fasteners for exterior work, and interior highly humid areas

PART 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 MATERIAL USAGE

.1 Roof Decking:

.1 As specified in Structural drawings.

.2 Floor sheathing:

.1 Plywood, DFP, select sheathing grade, square edge, 16 mm thick.

.3 Electrical equipment mounting boards:

.1 Plywood, DFP G1S grade, or, square edge 19 mm thick.

3.3 INSTALLATION

.1 Install wood framing, truss system, and sheathing as indicated in Structural and Architectural details.

.2 Install floor sheathing as indicated.

.3 Install rough bucks, nailers and linings to rough openings as required to provide backing for windows, door frames and other work.

.4 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized steel fasteners.

.5 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.6 Countersink bolts where necessary to provide clearance for other work.

3.4 FURRING AND BLOCKING

.1 Co-ordinate and Install proper furring and solid blocking as shown on the drawings and as specified to space-out and/or support

- .1 Truss system.
- .2 Anchoring and mounting cabinets.
- .3 Hardware.
- .4 Electrical equipment.
- .5 Fittings and fixtures not supplied with backing attachments.
- .6 Washroom accessories.
- .7 Wall mounted benches.
- .8 All grab bars as per layout specified in Architect's detail drawings.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

- .1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 – Construction Waste Management and Disposal

- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by work performed under this section.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Custom shop fabricated locker units.

.2 Storage cabinets.

.3 Kitchen cabinets and countertops.

.4 Cabinet hardware.

.5 Free standing and wall hung benches.

.6 Interior window sills.

.7 Wall paneling.

1.2 RELATED SECTIONS

.1 Section 01 45 00 - Quality Control.

.2 Section 06 20 00 - Finish Carpentry.

.3 Section 09 91 23 - Interior Painting.

1.3 REFERENCES

.1 BHMA A156.9-2010 - Cabinet Hardware.

.2 NPA A208.2-2009 - Medium Density Fibreboard (MDF) for Interior Applications.

.3 AWMAC - Architectural Woodwork Standards (AWS) – 1st Edition, 2009.

.4 CAN/CSA O141-91(R1999), Softwood Lumber.

.5 NEMA LD3-2005 - High Pressure Decorative Laminates (HPDL).

.6 Green Seal Environmental Standards

- .1 Standard GC-03-97, Anti-Corrosive Paints.
- .2 Standard GS-11-93, Architectural Paints.
- .3 Standard GS-36-00, Commercial Adhesives

.7 South Coast Air Quality Management District (SCAQMD), California State

- .1 SCAQMD Rule 1113-04, Architectural Coatings.
- .2 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.

1.4 SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.

.3 Product Data: Provide data for hardware accessories.

.4 Provide samples of solid surface and plastic laminate materials for selection by Departmental Representative.

.1 Provide samples from manufacturers standard colour range.

1.5 MOCK UP

.1 Shop prepare 1200 x 1200 mm size wall paneling mock-up mounted on plywood backer to demonstrate fit and appearance. Demonstrate mitre fit of aluminum extrusions where 4 panels meet.

.2 Prepare mock ups to the requirements of Section 01 45 00 - Quality Control.

1.6 QUALITY ASSURANCE

.1 Perform cabinet construction to AWMAC Custom quality.

1.7 DELIVERY, STORAGE, AND PROTECTION

.1 Deliver, store and handle materials in accordance with manufacturers recommendations.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 During and after installation of work of this section, maintain the same temperature and humidity conditions in building spaces as will occur after occupancy.

Part 2 Products

2.1 LUMBER MATERIALS

.1 Lumber: To the requirements of AWMAC, Custom grade.

.2 Hardwood Lumber: plain sawn, maximum moisture content of 6%; with plain sawn grain, of quality suitable for transparent finish.

2.2 SHEET MATERIALS

.1 Sheet Materials: To the requirements of AWMAC custom grade.

.2 Softwood Plywood: Veneer core; Douglas fir of grade to suit application; sanded faces.

.1 Plywood resin to include no added urea formaldehyde.

.3 Maple plywood: 7-ply all hardwood veneer core plywood with no voids, to AWMAC/AWI Custom Grade requirements, no added urea-formaldehyde.

.1 Top veneers (facers): White Maple, plain-sliced/flat-cut, 'A Grade' to AWS Manual 4.2a.16.2 requirements and selected for uniform consistent colour across face.

2.3 WINDOW SILL AND MISCELLANEOUS TRIM MATERIALS

.1 Kiln dried finger joint pine, pre-primed. To CAN/CSA O141-91.

2.4 LAMINATE MATERIALS

.1 High Pressure Laminate: NEMA LD3, high pressure laminate, solid chosen from manufacturers standard colour range, satin finish.

2.5 SOLID SURFACE COUNTERTOP MATERIALS

.1 Synthetic stone countertop material comprised of powdered natural quartz set in a proprietary resin binder. 1cm thickness. Mounted to plywood substrate.

.1 Edges: built up to 25mm thick with square edges.

.2 Outside corners: Square.

.3 Submittals:

.1 Show field-verified dimensions, quartz surfacing dimensions, locations and dimensions of cutouts, required locations of support and blocking members, edge profiles, and installation details and methods. Identify colour(s) and finish(es).

.2 Samples for Colour and edge treatment approval: Submit two (2) samples 10 x 10 inches (250 x 250 mm) of colour and finish selected.

.3 Stone Adhesive: Submit two (2) samples of an adhesive joint for colour quartz surfacing selected. Show colour match of adhesive.

2.6 ACCESSORIES

.1 Adhesive: Type recommended by laminate and solid surface material manufacturer to suit application.

.1 Adhesives to SCAQMD Rule 1168-05.

.2 Plastic Edge Trim (PVC): Extruded flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness; colour as selected. Minimum 3 mm thickness.

.3 Panel Wall Trim: Single and double-sided aluminum extrusions as detailed/indicated.

.1 Clear anodized finish.

2.7 HARDWARE

.1 Hardware: BHMA A156.9.

.2 Shelf Standards and Rests: Formed steel channels and rests, cut for fitted rests spaced at 25 mm centres; satin finish.

.3 Shelf Brackets: Formed steel brackets, formed for attachment with lugs; satin finish.

.4 Drawer and Door Pulls: Extruded aluminum pull, U-shaped satin finish; 100 mm centres.

.5 Cabinet and Locker Locks: Keyed cylinder, two keys per lock, master keyed.

.6 Cabinet Catches: Magnetic.

.7 Drawer Slides: Galvanized steel construction, ball bearings separating tracks, full extension type.

.8 Hinges: European type, satin finish.

.9 Piano hinges: 19mm butt, stainless steel construction. Satin finish, lengths as detailed.

.10 Slide bolts: Stainless steel door bolt. 78mm long, minimum 26 mm throw. Complete with strike.

.11 Hanging rods:

.1 Rods: chrome plated 25 mm o.d x minimum 1.9 mm wall thickness seamless steel tubing.

.2 Flanges: chrome plated steel round "captured" flanges to prevent unauthorized rod removal, complete with chromed plated mounting screws.

.3 Intermediate supports required when rod exceeds 1m length.

.12 Wire shelving:

.1 Ventilated wire shelving 304mm wide, lengths as indicated.

.2 Plastic coated.

.3 Provide supports at 609mm intervals.

.13 Custom fabricated locker room and shower bench supports

.1 Material- Stainless steel sections.

.2 To be fabricated according to detail drawings.

2.8 PLASTIC LAMINATE CASEWORK

.1 Cabinet Construction: Flush overlay, adjustable shelving plywood core.

.2 Exposed Surfaces:

.1 Drawers and Drawer Fronts: High pressure laminate.

.2 Edges: PVC.

.3 Semi-exposed Surfaces:

.1 Surfaces (other than drawer bodies) Thermofused melamine.

.2 Shelves: High pressure laminate.

.3 Edges: PVC.

.4 Drawer Sides and Backs: edgebanded.

.5 Drawer Bottoms: Melamine.

2.9 VENEER PLYWOOD CASWORK

.1 Plywood materials as detailed.

.2 Solid wood edging to AWMAC - Architectural Woodwork Standards (AWS) – 1st Edition, 2009, Custom grade.

2.10 SOLID SURFACE COUNTERTOPS

.1 Comply with AWMAC Quality Standards, Custom grade requirements for counter construction supplemented as follows:

.2 Synthetic stone material tops and edges.

.3 Core Material: Plywood.

.4 Adhesives: To manufacturers specification.

2.11 FABRICATION

.1 Shop prepare and identify components for matching during site assembly.

.2 Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.

.3 When necessary to cut and fit on site, provide materials with ample allowance for site cutting and scribing.

.4 Apply plastic laminate finish in full, uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises.

.5 Fabricate solid surface countertops with integral backsplash and front and side edging as detailed. Pre-cut for sink openings.

2.12 WOOD FINISHES

.1 Factory Finishing:

.1 Finishing System: AWMAC, Custom grade, acrylic lacquer finish system.

.2 Sheen: Satin.

Part 3 Execution

3.1 INSTALLATION

.1 Install Work to AWMAC Custom Grade.

.2 Set and secure casework in place; rigid, plumb, and level.

.3 Use fixture attachments in concealed locations for wall mounted components.

.4 Use concealed joint fasteners to align and secure adjoining counter tops.

.5 Secure cabinet to floor using appropriate angles and anchorages.

3.2 INTERIOR STANDING / RUNNING TRIM

.1 Install in accordance with details and to AWMAC/AWI Custom Grade requirements unless more stringent requirements are specified in this Section.

.2 Job site conditions for installation to be in accordance with AWS Manual requirements at time of installation.

.3 Install items in accordance with details using finishing nails throughout.

.4 Countersink all fixings and fill flush with wood filler.

.5 Site measure, cut and install items using longest practical length pieces to avoid splice joints.

.6 Use one length per location to avoid splice joints.

.7 Caulk junctions between standing/running trim and adjacent walls with sealant make junctions filled and smooth for "painting out".

.8 Co-ordinate application of 1st coat of finishes prior to installation.

3.3 BENCHES

.1 Fabricate metal components per detail drawings.

.2 Fasten maple slats to top portion of bench with stainless steel screws as detailed.

.3 Fasten shower benches to wall at previously installed blocking.

3.4 WALL PANELLING

.1 Fabricate of veneer plywood as detailed.

.2 Conceal fasteners behind aluminum trims.

3.5 ADJUSTING

.1 Test installed work for rigidity and ability to support loads.

.2 Adjust moving or operating parts to function smoothly and correctly.

3.6 CLEANING

.1 Do cleaning in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section - 03 30 00 - Cast-in-Place Concrete.

.2 Section - 07 28 00 – Air and Vapour Barriers.

.3 Section - 07 42 43 - Composite Wall Panels.

.4 Section - 07 61 00 - Sheet Metal Roofing.

1.2 REFERENCES

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

- .1 ASTM C411 - 2011, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
- .2 ASTM C518 - 2010, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- .3 ASTM C578 – 18, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
- .4 ASTM C612 - 2010, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- .5 ASTM A653 / A653M - 17 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- .6 ASTM C665 - 2011, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- .7 ASTM C795 - 2013, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- .8 ASTM C1338 - 2008, Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
- .9 ASTM C1289-05a, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

.2 Underwriters Laboratories of Canada (ULC)

- .1 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.
- .2 CAN/ULC-S702-97, Standard for Thermal Insulation, Mineral Fibre, for Buildings.
- .3 CAN/ULC S114-2005, Standard Method of Test for Determination of Non-Combustibility in Building Materials.
- .4 CAN/ULC-S704-03, Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.

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

- .1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit copy of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's insulation products and adhesives.

.2 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, indicating attachment requirements for insulation clips and girt/hat track assembly.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 19 - Construction/ Waste Management and Disposal.

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

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

Part 2 Products

2.1 INSULATION

.1 Semi Rigid Mineral fibre board: to CAN/ULC-S702

.1 Board insulation for exterior cavity wall: Non-combustible, lightweight, water repellent, rigid insulation board with rigid upper surface to ASTM C612 Type IVB.

.1 Fire performance:

.1 Non-combustibility: To CAN/ULC S114.

.2 Maximum use temperature: 650 ºC.

.3 Surface Burning Characteristics: To CAN/ULC S102.

.1 Flame spread: 0.

.2 Smoke developed: 5.

.2 Thermal resistance (RSI value/25.4 mm at 24 º C: 0.76 m^2K/W to ASTM C518.

.3 Water vapour permeance: 1555 $ng/Pa.s.m^2$ minimum.

.4 Moisture absorption: 1 % maximum to ASTM C1104/C1104M.

.5 Fungi resistance: Zero mould growth to ASTM C1338.

.6 Corrosive resistance:

.1 Steel to ASTM C665: Pass.

.2 Stainless steel to ASTM C795: Conforms.

.7 Recycled content: 40 % minimum.

.8 Acoustical performance sound absorption co-efficients to ASTM C423.

.2 Density:

.1 Outer layer: 100 kg/m^3 to ASTM C612.

.2 Inner layer: 60 kg/m^3 to ASTM C612.

.3 Surfaces:

.1 High density, water repellent outer layer.

.2 Lower density high performance thermal inner layer.

.4 Thickness: as indicated.

.5 Size: as detailed.

.2 Roof Deck Insulation

.1 Polyisocyanurate to CAN/ULC-S704, factory finished both sides with impermeable facers to retard thermal drift of insulation material, glass fibre reinforced core, flat format, square edges. Depatmental Representative will use following ASTM C1289 Long Term Thermal Resistance (LTTR) values range for acceptance of insulation thicknesses required to provide total RSI values detailed/indicated on drawings.

Board Thickness	LTTR value	RSI/25.4 mm
38.1 mm	RSI 1.50	1.00
51.0 mm	RSI 2.01	1.00
63.5 mm	RSI 2.54	1.02
76.2 mm	RSI 3.06	1.02
101.6 mm	RSI 4.16	1.04

.2 Mineral Fiber insulation

.1 Rigid surface

.2 Impregnated with bitumen on surface of insulation.

.3 Thermal resistance to ASTM 518.

.1 R7.5

.4 50mm thick.

.3 Under Slab Insulation

.1 Insulation Board: Extruded polystyrene (XPS) insulation to ASTM C578 – 15b and CAN/ULC-S701, Type VI, thickness as indicated, square edges.

2.2 ACCESSORIES

.1 Insulation Clips: Thermally broken 100% Pultruded glass fiber and thermoset polyester resin insulation clip.

.1 127 mm nominal depth.

.1 Girt clamp end where indicated

.2 Flat end where indicated.

.2 Fasteners:

.1 High hex head washer head with twin lead threaded design.

.2 Heat treated corrosion resistant coated steel.

.2 Provide engineered shop drawings for attachment of clips and girt/hat track assemblies.

.3 Horizontal girts: 22 mm galvanized “Z”bar compatible with insulation clips.

.1 25 mm deep.

.2 Corrosive resistance:

.1 Galvanized Steel to ASTM C653.

.3 Stainless steel fasteners to ASTM C795.

.4 Hat track

.1 25mm deep and 9mm deep as indicated.

.2 Corrosive resistance:

.1 Galvanized Steel to ASTM C653.

.3 Stainless steel fasteners to ASTM C795.

.5 Fasteners

.1 Insulation to deck/wall assemblies: coated insulation fasteners and galvanized plates engineered for wind uplift and corrosion resistance, as recommended by insulation manufacturer.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 WORKMANSHIP

.1 Install insulation after building substrate materials are dry.

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

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

.4 Offset both vertical and horizontal joints in multiple layer applications.

.5 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

3.3 EXAMINATION

.1 Prior to commencement of work ensure:

.1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.4 UNDER SLAB INSULATION

.1 Install over compacted aggregate under vapour barrier in prior to concrete placement.

.1 Fit insulation board tightly together with the minimum of joints.

3.5 EXTERIOR SEMI RIGID INSULATON

.1 Install over self-adhered membrane and fitted tightly around insulation clips. Fasten with screws and washers to manufacturers recommendations and as detailed. Fasten through wall sheathing into studs where possible.

.2 Install in conjunction with girt/hat-track system and the requirements of Section 07 42 43 - Composite Wall Panels.

3.6 ROOF DECK INSULATION

.1 Polyisocyanurate insulation boards.

.1 Install insulation board over self-adhered membrane to produce continuous thermal insulated roof plane.

.2 Trim insulation for tight fit to obstructions, projections and around roof perimeter.

.3 Fix board in place to vapour barrier and other laminated insulation boards using approved fasteners and washers.

.2 Mineral Fiber Insulation Board:

.1 Install insulation board over Polyisocyanurate insulation board to create a laminated assembly.

.1 Offset 2nd layer from 1st layer by 1/2 board each direction to stagger board joints between layers where using 2-layer installation technique.

.2 Laminated boards must be in full contact with each other free of interlayer air passages.

.3 Fix board in place to vapour barrier and other laminated insulation boards using approved fasteners and washers.

3.7 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 REFERENCES

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

.2 ASTM C665-12 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

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

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

Part 2 Products

2.1 INSULATION

.1 Pre formed semi rigid Mineral Wool insulation in batt form, unfaced, friction fit, to ASTM C665.

.1 Thermal resistance and sizes as indicated.

2.2 BATT INSULATION SUPPORT

.1 Flexible carbon steel spring wire rods sized slightly larger than stud spacing.

.1 Designed to hold installed insulation in place against the interior face of wall sheathing.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSULATION INSTALLATION

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

.2 Install insulation in continuous contact with interior side of wall sheathing.

.3 Hold insulation in place with wire rod insulation support system, or approved alternative.

.4 Cut flat on table, do not trim in place

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

.6 Fit insulation tight to windows and doors and other penetrations.

.7 Do not compress insulation to fit into spaces.

.8 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

3.3 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Foamed-in-place insulation in exterior framed walls and at exterior wall crevices requiring a thermal seal.

1.2 RELATED SECTIONS

.1 Section 07 21 13 – Board Insulation.

.2 Section 07 21 16 – Blanket Insulation.

.3 Section 07 28 00 - Air and Vapour Barriers

1.3 REFERENCES

.1 CAN/ULC-S705.1-01 - Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Material - Specification (including Amendment 3).

.2 CAN/ULC-S705.2-05 - Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Application.

.3 CUFCA (The Canadian Urethane Foam Contractors Association).

1.4 SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide product description, insulation properties and preparation requirements for products proposed for use in the work.

.3 Submit Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).

.1 Indicate precautions for workers during handling of sprayed insulation products.

.4 Submit documentation confirming that installers are CUFCA certified.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Ventilate area during sprayed insulation installation by introducing fresh air and exhausting air continuously during and for 24 hours after application to maintain non-toxic, unpolluted and safe working conditions.

.2 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.

.3 Protect adjacent surfaces and equipment from damage by overspray, fall-out and dusting of insulation materials.

.4 Apply insulation only when surfaces and ambient temperatures are within insulation manufacturer prescribed limits.

Part 2 Products

2.1 MATERIALS

.1 Insulation: CAN/ULC-S705.1, spray-applied rigid cellular polyurethane insulation, medium density.

.1 Maximum VOC limit: 100 g/L.

.2 Minimum 5 year "aged" thermal resistance value of RSI 0.6 per 25 mm thickness.

.2 Primer: As required by insulation manufacturer.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify work within construction spaces or crevices is complete prior to insulation application.

.3 Verify that surfaces are clean, dry, and free of matter that may inhibit insulation adhesion.

3.2 PREPARATION

.1 Mask and protect adjacent surfaces from over spray or dusting.

.2 Apply primer in accordance with manufacturer's written instructions.

3.3 INSTALLATION

.1 Apply insulation to CAN/ULC-S705.2 and manufacturer's written instructions whichever is more stringent.

.2 Fill spaces completely to produce continuous thermal protection sealed against air exfiltration/infiltration.

.3 Use primer where recommended by insulation manufacturer.

.4 Apply insulation to thickness detailed/indicated.

.5 Trim excess and protruding insulation so as not to interfere with application of subsequent construction.

3.4 PROTECTION OF FINISHED WORK

.1 Do not permit subsequent construction work to disturb applied insulation.

3.5 INSPECTION

.1 Notify Consultant at least 2 working days in advance for inspection of completed installations.

.2 Do not permit installations to be concealed or enclosed without inspection.

.3 Installation to be completed to CUFCA review standards.

3.6 CLEANING

.1 Do cleaning in accordance with Section 01 74 11 Cleaning.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Sheet and sealant materials for controlling vapour diffusion.

.2 Film vapour barriers.

.3 Sheet air barriers.

.4 Building paper.

1.2 RELATED SECTIONS

.1 Section 06 10 00 - Rough Carpentry.

.2 Section 07 21 13 - Board Insulation

.3 Section 07 92 00 - Joint Sealing.

.4 Section 08 11 00 Metal Doors and Frames

1.3 REFERENCES

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

.1 ASTM E 96-05 Standard Test Methods for Water Vapor Transmission of Materials.

.2 ASTM E154 Standard test methods for water vapour retarders in contact with earth under concrete slabs.

.2 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-37.5-M89, Cutback Asphalt Plastic Cement.

.2 CAN/CGSB 37-GP-56M, Standard for Modified Bituminous Sheet Membranes.

.3 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.

.3 ASTM C1193 - Standard Guide for Use of Joint Sealants.

.4 ASTM E96 - Test Methods for Water Vapour Transmission of Materials.

1.4 DEFINITION

.1 Vapour barrier: A material or assembly of materials that resists water vapour diffusion through it.

1.5 SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data indicating material characteristics, performance criteria and limitations.

.3 Manufacturer's Installation Instructions: Indicate preparation and installation requirements, techniques.

1.6 WHMIS

.1 Comply with WHMIS requirements when handing and using sealant materials.

1.7 INSPECTION TESTING

.1 Coordinate inspection of vapour barrier elements prior to vapour barrier system being covered up by other trades.

Part 2 Products

2.1 VAPOUR BARRIER

.1 Underslab vapour barrier: Purpose made reinforced polyethylene vapour barrier manufactured from virgin materials with a permeance of less than 0.01 perms.

.1 Permeance tested in accordance with ASTM E1745.

.2 Strength to ASTM E1745 Class A.

.3 Thickness: 15 mils minimum.

2.2 SELF ADHESIVE MEMBRANE

.1 Modified Bituminous Membrane: Asphalt and polymer modifiers of styrene-butadiene-styrene (SBS) type, reinforced with non-woven cross laminated polyethylene; smooth surfaced; .8 mm thick. To CAN/CGSB 37-GP-56M.

2.3 SHEATHING PAPER

.1 Building/sheathing paper: To CAN/CGSB-51.32 asphalt saturated kraft paper permitting passage of water vapour; conforming to U.S. Standard UUB-790A for 30 minute water resistance.

2.4 SEALANTS

.1 Underslab membrane: Membrane lap primer/sealant to membrane manufacturer's recommendations.

2.5 ACCESSORIES

.1 Under slab barrier: proprietary seam tape as recommended by manufacturer.

.2 Primer: Water based surface conditioner as recommended by self adhesive membrane manufacturer.

.3 Seam tape- proprietary moisture resistant pressure sensitive adhesive tape.

.4 Staples: corrosion-resistant alloy or plated, lengths required to penetrate sheathing for secure attachment of building/sheathing paper.

.5 Sealants: Refer to Section 07 92 00 - Joint Sealing

Part 3 Execution

3.1 EXAMINATION

.1 Verify condition of substrate and adjacent materials.

3.2 PREPARATION

.1 Remove loose or foreign matter which might impair adhesion.

.2 Verify substrate surface is flat, free of honeycomb, fins, irregularities, materials or substances that may impede installation.

3.3 VAPOUR BARRIER UNDER-SLAB

.1 Install the barrier in accordance with this section and Manufacturer's instructions.

.2 Install vapour barrier as a continuous, airtight floor moisture barrier system under the entire concrete slab. The barrier shall be sealed with manufacturers flexible sealant at all edges, seams and penetrations to provide a water and air tight seal.

.3 Lap seams a minimum of 150 mm sealed in the overlapping areas sealed manufacturers proprietary polyethylene tape.

.4 Continue the barrier vertically up all columns, pipes and interior concrete grade beams for a distance of at least 200 mm.

.5 Tape and seal the floor barrier around columns and pipes.

.6 Tape and seal at all perforations, penetrations and at structural elements.

3.4 SELF ADHESIVE MEMBRANE

.1 Apply primer as recommended by membrane manufacturer.

.2 Apply membrane at exterior of wall sheathing and roof deck as detailed.

.3 Apply membrane at window and door openings as detailed.

.4 Install membrane waterproofing in accordance with manufacturer's instructions.

.5 Roll out membrane. Minimize wrinkles and bubbles.

.6 Remove release paper layer. Roll out on substrate with a mechanical roller to encourage full contact bond.

3.5 SHEATHING PAPER

.1 Install two layers of sheathing paper to the exterior of rigid insulation on roof prior to strapping or girt installation, where indicated.

.2 Install sheathing paper to produce both continuous water shedding barrier over rigid insulation, down onto metal wall flashings.

.3 Install sheathing paper horizontally, starting from bottom of roof deck with each subsequent course shingle lapped over previous course to shed moisture down building/sheathing paper surface.

.4 Overlap subsequent courses minimum 200 mm over previous courses and provide minimum 100 mm overlaps at course ends laps.

.5 Attach building/sheathing paper to sheathing using sufficient quantities of staples to hold paper in place until covered by subsequent construction.

.6 Seal vertical lap joints of each layer using continuous applications of tape.

.7 Repair rips and tears in building/sheathing paper using continuous strips of tape. Repair large holes using patches of building/sheathing paper stapled in place with all edges tape sealed.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 28 00 Air and Vapour Barriers.

.2 Section 07 21 13 Board Insulation.

.3 Section 07 62 00 Sheet Metal Flashing and Trim.

1.2 REFERENCES

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

.1 ASTM E330 / E330M – 14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

.2 ASTM A653/A653M-[07], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM D790 – 07, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

.4 ASTM A792/A792M-06a, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.5 ASTM D2842 – 12, Standard Test Method for Water Absorption of Rigid Cellular Plastics.

.6 ASTM D5420-16, Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact).

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

.1 Material Safety Data Sheets (MSDS).

.3 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1168-[05], Adhesives and Sealants Applications.

1.3 DESIGN REQUIREMENTS

.1 Design composite cladding system to allow for thermal movement of component materials caused by variation in ambient temperature range of 80 degrees C without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.

.2 Maximum deviation from vertical and horizontal alignment of erected panels: 1 to 1000.

1.4 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 cladding system materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 30 Health and Safety Requirements.

.3 Shop Drawings:

.1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia for fastener attachment.

.2 Indicate dimensions and thickness of panels, fastening and anchoring methods, detail and location of joints and gaskets, thermal movement provision, wall openings, head, jamb and sill details, materials and finish, compliance with design criteria and requirements of related work.

.3 Accessories: Include details of the flashing, trim and anchorage.

.4 Samples:

.1 Submit duplicate 100 x 100 mm samples of wall system, representative of materials, finishes and colours.

.5 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.

.1 Certificates: submit certificates signed by manufacturer certifying that composite wall panels comply with specified performance characteristics and physical properties.

.2 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.5 QUALIFICATIONS

.1 Manufacturer: company specializing in producing composite wall panels with 5 years experience with sufficient capacity to produce and deliver required units without causing delay in work.

.2 Installer: person specializing in composite wall panel installations approved by manufacturer.

.3 Mock-ups: construct mock-ups in accordance with Section 01 45 00 - Quality Control and to requirements supplemented as follows:

.1 Provide mock-up for evaluation of surface finishes and workmanship.

.2 Provide initial production units for job-site assembly with other materials for approval.

.3 Co-ordinate type and location of mock-ups with project requirements.

.4 Accepted units will be used as standard for acceptance of production units.

.5 Remove and replace units which are not accepted.

.6 Do not proceed with remaining work until workmanship, colour, and finish are accepted by Departmental Representative.

.7 Refinish mock-up area as required to produce acceptable work.

.8 When accepted, mock-up will demonstrate minimum standard of quality required for this work.

.1 Approved mock-up may remain as part of finished work.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver, store and protect material in accordance with panel manufacturer's recommendations.

.3 Do not expose panels with strippable film to direct sunlight or extreme heat.

.4 Waste Management and Disposal:

.1 Separate waste materials for reuse or recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

1.7 WARRANTY

.1 Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of Composite material panel systems that fail in materials or workmanship within specified warranty period.

.1 Failures include, but are not limited to, the following:

.1 Structural failures including rupturing, cracking, or puncturing.

.2 Deterioration of metals and other materials beyond normal weathering.

.2 Warranty Period: Ten years from date of Substantial Completion.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

.1 Structural Performance: Provide composite material panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 330:

.1 Wind Loads: Provide as assembly designed to withstand wind loads and seismic conditions listed in TBCBC for building location.

.2 Deflection Limits: For wind loads, no greater than 1/100 for frame elements and 1/60 for panel materials.

2.2 MATERIALS

.1 Composite Wall Panels

.1 Factory-formed and assembled high pressure compact laminate panels, thickness of 6mm or greater, designed for outdoor applications. Panels consist of layers of wood –based fibers impregnated with thermosetting resins with decorative surface layers on one side. Components are bonded together with simultaneous application of heat and pressure to create a homogeneous non-porous material

with an integral decorative surface. Transparent top coats cured using electron beam curing method.

.1 Panel and plank formats as detailed.

.2 Flexural strength to ASTM D790 – 07.

.3 Impact resistance to ASTM D5420-16.

.4 Water absorption to ASTM D2842 – 12.

.5 Standard of acceptance: Trespa: Meton and Pura panels.

.2 Wall panel attachment to be comprised of concealed clip and/or exposed fastener mechanical attachments to previously installed hat track and girt system.

.1 Structure supporting the wall panel system are to be galvanized steel girt and hat track system attached to thermally broken insulation clips. Clips to be constructed of glass fiber and thermoset polyester resin. See Section 07 21 13 Board Insulation

.3 Wall panel system shall be designed for positive drainage of water leakage and condensation to exterior of wall panel system.

.2 Composite panels:

.1 Thickness: +- 6 mm.

.2 Core: laminated wood fibers and resins.

.3 Miscellaneous Materials

.1 Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Refer to Section 07 21 13 - Board Insulation and details.

.2 Flashing and Trim: Provide flashing and trim as detailed.

.3 Panel Fasteners:

.1 Panels: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of composite material panels by means of factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

.2 Plank system: Proprietary, concealed clip attachment system.

.4 Panel Sealants: ASTM C 920; elastomeric silicone sealant; of type, grade, class, and use classifications required to seal joints in composite material panels and remain weathertight; and as recommended in writing by composite material panel manufacturer.

2.3 FABRICATION

.1 Factory fabricated high pressure laminated panels:

.2 Tolerances:

.1 Panel bow: maximum 1mm/m.

.2 Panel dimensions: where final dimensions cannot be established by field measurement before completion of panel manufacturing, make allowance for field adjustments as recommended by manufacturer.

.3 Panel lines: sharp, true and surfaces free from warp or buckle.

.3 Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

.1 Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

.2 Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.

.3 Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

.4 Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

.5 Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

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 Before installation examine alignment of substrate and notify Departmental Representative in writing if substrate does not comply with requirements of panel installer.

3.3 PREPARATION

.1 Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages as detailed.

.1 Refer to Section 07 21 13 - Board Insulation.

3.4 INSTALLATION

.1 General: Install plank and panel type composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.

.1 Shim or otherwise plumb substrates receiving metal composite material panels.

.2 Flash and seal metal composite material panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal composite material panels are installed.

.3 Install screw fasteners in predrilled holes.

.1 If field drilling of mounting holes is required, follow manufacturers written instructions concerning drill bit type and drilling methods.

.4 Locate and space fastenings in uniform vertical and horizontal alignment.

.5 Install flashing and trim as metal composite material panel work proceeds.

.6 Locate panel splices over structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

.7 Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

.2 Fasteners:

.1 Use fasteners approved by the manufacturer of the composite panel system.

.3 Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

.1 Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

.4 Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

.5 Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

.1 Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.

.2 Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 3 m with no joints allowed within 605 mm of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 25 mm deep, filled with mastic sealant (concealed within joints).

3.5 ERECTION TOLERANCES

.1 Installation Tolerances: Shim and aligncomposite material wall panel units within installed tolerance of 6 mm in 6 m, non-accumulative, on level, plumb, and location lines as indicated, and within 3-mm offset of adjoining faces and of alignment of matching profiles.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Remove temporary protective coverings and strippable films, if any, as composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of composite material panel installation, clean finished surfaces as recommended by composite material panel manufacturer. Maintain in a clean condition during construction.

.3 After composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

.4 Replace composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

.5 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.6 Leave work areas clean, free from grease, finger marks and stains.

END OF SECTION

Part 1 .General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 00 - Rough Carpentry.

.2 Section 07 62 00 - Sheet Metal flashing and Trim.

1.2 REFERENCES

.1 ASTM International Inc.

.1 ASTM D6163-00(2008), Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-37.5-M89, Cutback Asphalt Plastic Cement.

.3 Canadian Standards Association (CSA International)

.1 CSA B272-93(R2000), Prefabricated Self-Sealing Roof Vent Flashings.

.4 NBC, National Building Code of Canada (issue date listed in Section 01 41 00 - Regulatory Requirements).

.5 Roofing Contractors Association of British Columbia (RCABC).

.1 RGC, RCABC Guarantee Corporation.

.2 RGC Manual, RGC Roofing Practices Manual published by RCABC.

.6 Underwriters Laboratories' of Canada (ULC)

.1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.3 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 QUALITY ASSURANCE

.1 Do Work in accordance with latest standards published in RGC Manual.

.2 Follow respective membrane manufacturer installation requirements in order to provide required product guarantees wherever such requirements are more stringent that those published in RGC Manual.

.3 Health and safety requirements: do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety.

1.4 WIND UPLIFT REQUIREMENTS

.1 Provide membrane roofing assemblies that will withstand 25% greater than wind uplift conditions listed in NBC for building location, unless more stringent values are identified on drawings.

1.5 SUBMITTALS

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

.2 Product Data:

.1 Provide copies of most recent technical roofing components data sheets describing materials' physical properties and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide copies of WHMIS MSDS in accordance with Section 01 35 30 - Health and Safety Requirements and indicate VOC content for all products used in the work.

.1 Indicate precautions for workers when handling roofing materials, sealants and mastics.

.3 Submit physical samples of paver stones from manufactures standard range for colour selection.

.4 Samples: submit samples of accessories proposed for use in Work upon Departmental Representatives request.

1.6 FIRE PROTECTION

.1 Comply with Section 01 35 35 Fire Safety Requirements.

.2 Provide and maintain approved ABC dry chemical-type fire extinguishers in ready and accessible condition with at least one extinguisher always within 6 metres of each torching operation.

.3 Provide "fire watch" for minimum of one hour after termination of torching operations to check for hot spots and signs of smouldering.

.4 Permit only experienced and trained personnel to operate torch equipment.

.5 Maintain fire watch for 1 hour after each day's roofing operations cease.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions and the requirements of Section 01 61 00 Common Product Requirements.

.2 Storage and Handling Requirements:

.1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.

.2 Provide and maintain dry, off-ground weatherproof storage.

.3 Store membrane rolls in heated enclosures prior to use where climatic conditions necessitate and as recommended by membrane manufacturer; bring only enough rolls for immediate use to work area.

.4 Remove only in quantities required for same day use.

.5 Store sealants at +5 degrees C minimum.

.6 Lay out base and cap sheets and allow to flatten uncurl before attempting installation.

.7 Avoid prolonged exposure of light and heat sensitive materials to sunlight.

.8 Store combustible materials away from heat and open flame.

.9 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

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

1.8 WHMIS

.1 Comply with WHMIS requirements when handling primers and mastics.

1.9 SITE CONDITIONS

.1 Do not perform work during inclement weather.

.2 Install roofing on dry deck, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into roofing system.

.3 Do not expose material vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

.4 Consult membrane manufacturer minimum ambient application temperature for cold weather applications and do not carry out roofing work when ambient temperature is less than 0 degrees C.

1.10 PROJECT REQUIREMENTS

.1 Protect surrounding surfaces from damage during roofing work. Where hoisting is necessary, hang tarpaulins to protect walls during delivery of materials from ground to roof level. Protect existing roofing from traffic damage by installing temporary mats or plywood.

.2 Where work must continue over new installed roofing, protect surfaces with plywood sheets. Arrange sheets to avoid tripping hazards. Weigh down sheets to prevent dislocation by wind uplift.

.3 Remove bituminous markings from finished surfaces. In areas where finished surfaces are soiled by bitumen or any other source of soiling caused by roofing work consult manufacturer of surfaces as to recommended cleaning methods and conform to their advice.

.4 Do not store materials on roof in concentrations which exceed roof design live load.

.5 Locate equipment and roofing materials to provide minimum interference and maximum useable space around job site.

1.11 WASTE MANAGEMENT

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

1.12 WARRANTY

.1 For Work of this Section 07 52 00 - Modified Bituminous Membrane Roofing, 12 months warranty period is extended to:

.1 60 months for membrane roofing and membrane flashing installations remaining in place and maintaining leakproof assemblies.

.2 120 months for membrane materials being free from manufacturing defects. Defective products to be corrected, replaced or maintained without cost to Canada as necessary to enable such products to perform as warranted.

.3 240 months for pre-manufactured vent pipe flashings/roof jacks to be free of leaks, condensation and defects in materials.

.4 Warranty to be in form of manufacturer's warranty.

.2 Start warranties at date of Final Certificate of Completion.

1.13 CLOSEOUT SUBMITTALS

.1 Provide following in accordance with Section 01 78 00 - Closeout Submittals.

.1 Warranty certificates.

Part 2 Products

2.1 MATERIALS

.1 Roofing membrane sheets, membrane flashing sheets: containing not less than 15% Styrene-Butadiene-Styrene (SBS) elastomeric polymer, non-woven polyester plus glass grid reinforcement.

.1 Roofing membrane sheet 1 (base sheet): to ASTM D6162, minimum 2.5 mm sheet thickness, non-woven polyester plus glass grid reinforcement thermofusible polypropylene top surface, Self adhesive bottom face.

.2 Base flashing sheet: to ASTM D6163, minimum 2.5 mm sheet thickness, glass grid reinforcement, self-adhesive underside protected by silicone release sheet, thermofusible polypropylene top surface.

.3 Roofing membrane sheet 2 (cap sheet), cap flashing sheet, roof edge warning strip: to ASTM D6162, minimum 4.0 mm sheet thickness, non-woven polyester plus glass grid reinforcement, thermofusible polypropylene underside, coloured granular top surface in colour selected by Departmental Representative.

.2 Fasteners

.1 Miscellaneous: #10 size, hot dip galvanized finish roofing nails with 13 mm dia. heads.

2.2 ACCESSORIES

.1 Plastic cement/mastic: to CAN/CGSB-37.5.

.2 Concrete pavers:

.1 Description: proprietary hydra-pressed concrete paving units; uniform in material, colour and size; from one manufacturer and from same production run for each colour applicable to prevent visual inconsistency in final installations.

.1 Colour to be chosen from manufacturer's standard range of colours.

.2 Sizes: refer to drawings.

.3 Colour: Textured appearance for non-slip surface.

.3 Paver pedestals: 114 x 114 mm x 16 mm high purpose-made high density polyethylene pre-engineered paver pedestals each with spacer lugs positioned to receive 4 paver corners at pre-set spacing, complete with companion stacking polyethylene shims to adjust paver heights on pedestals.

Part 3 Execution

3.1 PREPARATION

.1 Ensure new decking is clean, dry and properly prepared to receive roofing materials

3.2 MANUFACTURER INSTRUCTIONS

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

3.3 WORKMANSHIP

.1 All materials must be dry (as manufactured) at time of application.

.2 Complete roofing on same day started.

.3 Perform moisture checks using an electronic moisture meter if work underway has become wet. Do not continue roofing until moisture content is reduced to acceptable levels.

.4 Ensure that inspections have been completed and defects corrected before starting each subsequent stage of roofing.

3.4 INSTALLATION

.1 Roof Membrane, membrane flashing:

.1 Install 2-ply modified bituminous roof membrane and membrane flashings (strippings) over plywood deck, to comply with RGC requirements and roofing membrane manufacturers recommendations.

.2 Starting at low point of roof, perpendicular to slope, unroll sheets, align and re-roll from both ends.

.3 Each layer to be free of blisters, fishmouths and wrinkles.

.4 Offset joints in cap sheet not less than 300 mm from those in base sheet.

.5 Test laps for complete continuous sealing.

.6 For torch fixing to overlayment board:

.1 Torch apply roofing membrane sheet 1 (base sheet).

.2 Torch apply membrane sheet 2 (cap sheet) over inspected membrane sheet 1 (base sheet).

.7 Membrane flashings:

.1 Install base sheet using self-adhesive properties.

.1 Provide 75 mm minimum side lap and seal.

.2 Install cap sheet using torch method.

.1 Provide 75 mm minimum side lap and seal.

.3 Install membrane flashings without sags, blisters, fishmouths or wrinkles.

.4 Re-finish all lap joints, bitumen overflows and runs of cap sheets. Lap and seal membrane to all components penetrating roof.

3.5 ROOF SPECIALTIES AND ACCESSORIES

3.6 Cleaning

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.1 Progress cleaning: leave Work area clean at end of each day.

.2 Final cleaning: on completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, equipment and barriers.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Precoated Galvanized steel roofing, associated integral flashings, and underlayment.

1.2 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 07 21 13 - Board Insulation

.3 Section 07 28 00 - Air and Vapour Barriers

.4 Section 07 62 00 - Sheet Metal Flashing and Trim

1.3 REFERENCES

.1 American Society for Testing Materials International

- .1 ASTM A653/A653M - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 ASTM A792/A792M-9a, Standard Specifications for Steel Sheet,55% Aluminum-Zinc Alloy-Coated by the Hot Dip process.
- .3 ASTM D523-08,Standard Test Method for Specular Gloss.
- .4 ASTM D822-01(2006), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.2 Roofing Contractors Association of British Columbia(RCABC)

- .1 RGC manual, RGC Roofing Practices Manual, Published by RCABC.

.3 TBCBC- The British Columbia Building Code (TBCBC) 2012.

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00: Shop drawings, Product Data and samples.

.2 Product Data

- .1 Submit manufacturer printed product literature, specifications and datasheets for sheet membranes and for insulation. Include:
  - .1 Product characteristics
  - .2 Performance Criteria
  - .3 Limitations

.3 Provide mill certificates for sheet metal materials indicating country of origin.

.4 Submit Workplace Hazardous Materials Information System (WHMIS)Material Safety Data Sheets (MSDS).

.1 Indicate precautions for workers during handling of primers, mastics and sealant products.

.5 Shop Drawings: Indicate arrangements of sheets and joints, types and locations of fasteners and special shapes and relationship of panels to building roof framing.

.6 Samples

.1 Submit full colour range of metal roofing for use in colour selection.

.2 Submit samples of metal roofing for final finish/colour verification prior to ordering project material. Samples to be cured finish applied to metal.

.3 Submit 300 mm length full width metal roof panel of each type proposed for use prior to commencement of work.

.7 Manufacturers instructions.

.1 Submit manufacturer installation instructions.

1.5 QUALITY ASSURANCE

.1 Comply with RCABC published manuals, detail and specifications and with metal roof manufacturer recommendations, unless detailed/indicated or stated otherwise. Comply with more stringent requirements of these two provisions. Do work in accordance with RCABC 10 Year Guarantee Standards, unless stated otherwise.

.2 Engage crew(s) of competent, qualified trade workers, using adequate plant and equipment to perform work of this Section.

1.6 PERFORMANCE REQUIREMENTS

.1 Provide metal roofing that will:

.1 Withstand wind loads, snow loads and rain loads and seismic conditions listed in TBCBC for building location, unless more stringent values are identified on drawings,

.2 Accommodate local temperature extremes,

.3 Accommodate building movement,

.4 Produce watertight installations.

.2 Provide for drainage of any trapped moisture to exterior, discharging moisture in a manner avoiding staining of architectural finishes, collecting in puddles, formation of icicles and dripping onto pedestrians.

1.7 DESIGN REQUIREMENTS

.1 Provide metal roofing system that is:

.1 Continuous from ridge to eaves without horizontal lap or horizontal seam,

.2 Free of through fasteners, except at ridges where all such fasteners must be covered by cap flashings and

.3 Not dependent on sealants for primary exclusion of water.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Section 01 61 00: Deliver, store, protect and handle products to site.

.2 Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

.3 Prevent contact with materials which may cause discolouration or staining.

.4 Store materials requiring protection from weather in weatherproof shelters. Avoid exposing light or heat sensitive materials to sunlight for prolonged periods of time.

.5 Do not store materials on roof in concentrations which exceed design live loads.

.6 Protect installed work and materials from damage. Replace damaged materials and damaged roofing panels, at no cost to Contract.

1.9 SITE CONDITIONS

.1 Do not install during periods of precipitation to prevent moisture from becoming trapped in assemblies.

.2 Do not apply roofing to wet, frozen or unsuitable deck surfaces.

.3 Do not expose material vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

.4 Limit access across installed metal roofing to:

.1 Roofing Trade
.2 Departmental Representative
.3 Roofing Manufacturing Representative

Part 2 Products

2.1 SHEET METAL MATERIALS

.1 Zinc coated steel sheet: to ASTM A653/A653M, commercial quality, Grade 33 with Z275 designation galvanized zinc coating.

.2 Aluminum-zinc alloy coated steel sheet: to ASTM A792/A792M, commercial quality, Grade 33 with AZM180 designation coating, pre-finished.

.3 Sheet metal materials to be produced by North American mills.

2.2 FINISH

.1 Pre-finish aluminum-zinc alloy coated sheet steel with coil stock applied polyvinylidene fluoride gloss paint on epoxy primer prior to profile fabrication with colour coat containing not less than 70% pvdf resin. Include permanent-type treatment to reverse side of coil stock to prevent corrosion of backside surfaces.

.1 Class F2S.
.2 Color: selected by the consultant
.3 Specular Gloss: 30 units 1/-5 to ASTM D523
.4 Coating thickness: not less thatn 22 micrometers

.5 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822 as follows:

.6 Outdoor exposure period 2500 hours.

.7 Humidity resistance exposure period 5000 hours.

.8 Solar reflectance (albedo): as part of 'Energy Star' Roof Product Program, the U.S. EPA has established criteria for solar reflectance of coatings applied to low-sloped and high-sloped roofs. Following target figures apply to this project.

.9 Initial albedo level: no less than 0.3 average.

.10 3-year albedo level: no less than 0.2 average.

2.3 COMPONENTS

.1 Underlay membrane: glass fibre based breathable dry sheathing material to RCABC requirements and to metal roofing manufacturer's recommendations.

.2 Clips: zinc coated sheet steel purpose-made formed shapes, designed specifically to engage and friction retain metal roofing panels allowing for panel movement.

.3 Standing-seam style metal roof panels:

.1 Description: factory fabricated or site rolled metal roof panels suitable for concealed clip metal roofing installation.

.2 Profile: approx. 300 mm width coverage, minimum 25 mm high interlocking friction locking edge seams not requiring site cinching in order to achieve weatherseal, with formed with intermediate minor ribs to lessen oil-canning between edge seams.

.3 Material: minimum 0.61 mm (24 ga.) design thickness aluminum-zinc coated sheet steel.

.4 Fasteners

.1 Concealed locations: stainless steel alloy or galvanized steel, type of sizes/strengths required for adequate anchorage of components.

.2 Exposed locations: stainless steel, type of sizes and strengths required to provide adequate anchorage of components, socket head design, complete with self-sealing soft neoprene washers.

.5 Filler strips: closed cell PVC or neoprene foam, over-sized 30-50% to ensure tight fitting installation.

.6 Sealants: types recommended by metal roofing manufacturer and installer to suit applications, compatible with substrates and adequate to provide permanent seal at temperature ranges anticipated, colours selected by Consultant to match adjacent metal roofing/flashing colours where exposed to view.

.7 Touch-up coating: paintable type recommended by panel manufacturer for use in repairing minor surface damage.

.8 Roof jacks: pre-fabricated purpose-made assemblies, integral nailing flange, suitable for Project roof pitches, with companion lead settle caps.

2.4 SHOP FABRICATION

.1 Fabricate items in accordance with reviewed shop drawings.

.2 Form sections and pieces square, true and accurate to size, free from distortion and other defects detrimental to appearance and performance.

.3 Fabricate all components in sizes required to produce least number of joints.

.4 Fabricate metal roof panels using commercial production quality progressive die forming equipment capable of producing repeated identical straight, accurate, crisp formed panels free of distortion, buckles and damage to pre-finished surfaces.

.5 Trim, edging, flashings, fascia:

.1 Fabricate using minimum 0.61 mm (24 ga.) design thickness aluminum-zinc coated sheet steel to match roof panels, unless noted otherwise on the drawings

.2 Fabricate flashings required for metal roof areas. Produce in accordance with RCABC standards and details or metal roofing system standards whichever is more stringent. Use standing seam construction throughout.

Part 3 Execution

3.1 EXAMINATION

.1 Inspect roof deck to verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to eaves.

.2 Verify deck is dry and free of snow or ice. Verify joints in wood deck are solidly supported and fastened.

3.2 INSTALLATION

.1 General: install metal roof system in accordance with reviewed shop drawings.

.2 Underlayment membrane

.1 Apply over completed roof insulation building paper and strapping installation.

.2 Arrange joints to shed moisture down roof slopes.

.3 Roof panels and flashings:

.1 Install roof panels to comply with RCABC requirements and roofing manufacturer recommendations complete with associated flashings and assembly components.

.2 Use metal roofing manufacturer proprietary fastener clips to anchor roof panels to sheathing.

.3 Form and tailor panels to ensure weathertight installation. Fabricate and install system rain excluders.

.4 Install metal panels, associated flashings and assembly components rigidly secured in place, with laps as required to allow for expansion/contraction, weathertight and to meet performance requirements specified.

.5 Install components progressively, in a manner to prevent damage to finished surfaces.

.6 Install related metal flashings.

.7 Incorporate roof jacks of correct sizes to suit plumbing vents. Finish each installation with correct size of settle cap.

3.3 PROTECTION OF FINISHED WORK

.1 Do not permit traffic over unprotected roof surface.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 07 61 00 - Sheet Metal Roofing.

.2 Section 08 11 00 - Metal Doors and Frames.

.3 Section 08 53 13 – Fiberglass Windows

1.2 REFERENCES

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

.1 ASTM A240/A240M-07e1, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.2 ASTM A653/A653M-07, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM B32-04, Standard Specification for Solder Metal.

.4 ASTM D523-89(1999), Standard Test Method for Specular Gloss.

.5 ASTM D822-01(2006), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.6 ASTM C920-08, Standard Specification for Elastomeric Joint Sealants.

.2 Aluminum Association (AA)

.1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.

.3 American Architectural Manufacturers Association (AAMA)

.1 AAMA 611-98, Voluntary Specifications for Anodized Finishes Architectural Aluminum.

.4 NBC, National Building Code of Canada (issue date listed in Section 01 41 00 Regulatory Requirements)

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

.1 Material Safety Data Sheets (MSDS).

1.3 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.

.3 Samples:

.1 Submit duplicate samples of each type of sheet metal material, finishes and colours for Departmental Representative color selection.

1.4 PERFORMANCE REQUIREMENTS

.1 Provide metal flashings that will withstand wind uplift conditions listed in NBC for building location, unless more stringent values are identified on drawings.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturers recommendations.

.2 Protect pre finished materials from scratching.

.3 Stack pre-formed materials in manner to prevent twisting, bending and rubbing.

1.6 WASTE MANAGEMENT AND DISPOSAL:

.1 Separate waste materials for recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Zinc coated sheet steel: to ASTM A653/A653M, commercial quality, Grade 33, with not less than Z275 designation zinc coating, pre-finished.

.1 Pre-finish: coil stock finished with polyvinylidene fluoride gloss paint on epoxy primer prior to profile fabrication, with colour coat containing not less than 70% pvdf resin. Include permanent-type treatment to reverse side of coil stock to prevent corrosion of backside surfaces.

.1 Specular gloss: 30 units +/- in accordance with ASTM D523.

.2 Coating thickness: not less than 22 micrometres

.3 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

.4 Colours: As selected by Departmental Representative.

.2 Sheet steel to be produced by North American mills to ensure compliance with above-referenced standards. Submit evidence of North American mill source upon Departmental Representative request.

.2 Touch-up paint: type compatible with and matching pre-finish paint/colour.

.3 Flashing fasteners: #8-18x19mm, self-tapping screws.

.4 Sealants: non-sag polyurethane, one part formulation, to ASTM C 920 Type S, Grade NS, Class 35, Use NT, M, A and O; colours selected by Departmental Representative where exposed to view.

.5 Self-adhesive SBS membrane: minimum 1 mm thick self-adhering composite sheet membrane comprised of 0.8 mm thick rubberized asphalt integrally bonded to 0.1 mm thick film of polyethylene, bottom surface protected with silicone release sheet.

2.2 FABRICATION OF FLASHING

.1 Fabricate in accordance with detail drawings.

.2 Fabricate typical flashings using not less than 0.61 mm thick pre-finished zinc coated sheet steel, unless detailed/indicated otherwise. Use greater metal thickness at locations of wider span to prevent "oil-canning" and deformation of flashings.

.3 Fabricate flashings accurately with true crisp lines and quality metalwork joinery suitable for exposed installation.

.4 Pre-fabricate corners with mitred joints. Form watertight lock-seams set in sealant for all mitred corner joints.

.5 Maintain 1:6 minimum slope on horizontal surfaces.

.6 Hem exposed edges. Fold under minimum 10 mm.

.7 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.8 Refer to drawings for self-adhesive SBS membrane locations under metal flashings.

2.3 FABRICATION OF WINDOW FLASHINGS

.1 Fabricate in straight sections as indicated.

2.4 GUTTERS

.1 Material: ASTM B209M utility sheet aluminum, shop pre-coated with high molecular weight polyester (hmp) gloss paint on epoxy primer prior to profile fabrication, colours selected by Departmental Representative to match sheet metal roofing.

.2 Components:

.1 Gutters: 125 mm size rectangular profile, not less than 0.80 mm metal thickness.

.2 Downspouts: 75 mm o.d. round profile, not less than 0.48 mm metal thickness.

.3 End caps, downspout outlets, straps, support brackets, downspout strainers: profiled to suit gutters and downspouts.

.3 Accessories:

.1 Anchorage devices: stainless steel alloy screws and washers.

.2 Gutter supports: designed to fit into, engage and support gutters; non-corroding plated finish stamped metal or aluminum alloy casting fabrications.

.3 Downspout supports: straps.

.4 Downspout adapters: ABS plastic units sized to downspouts and to drain pipes, offset and straight designs, colours selected by Departmental Representative.

.4 Fabrication:

.1 Form gutters and downspouts of profiles and sizes detailed/indicated.

.2 Form sections square, true and accurate in size, in maximum possible lengths and free of distortion or defects detrimental to appearance or performance.

Part 3 Execution

3.1 INSTALLATION

.1 Metal Flashings

.1 Install in accordance with detail drawings.

.2 Fit flashings together so that one end of each section is free to move in joint.

.3 Fit flashings secure in place. Make corners square, surfaces true and straight in all planes, and all lines accurate to profiles.

.2 Gutters and downspouts

.1 Install in accordance with detail drawings.

3.2 CLEANING

.1 Do cleaning in accordance with Section 01 74 11 - Cleaning.

.2 Clean flashings to remove handling marks and smudges.

.3 Progress cleaning: leave Work area clean at end of each day.

.4 Final cleaning: on completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, equipment and barriers.

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 Underwriter's Laboratories of Canada (ULC).

.1 ULC-S115-1995, Fire Tests of Fire stop Systems.

.3 Green Seal Environmental Standards.

.1 Standard GS-36-00, Commercial Adhesives.

.4 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards.

.1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

1.2 DEFINITIONS

.1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.

.2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.

.3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.

.4 Tightly Fitted; (ref: NBC Part 3.1.9.1.1 and 9.10.9.6.1): 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.

1.3 SUBMITTALS

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

.2 Product Data:

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

.2 Submit product manufacturer's ULC result cut sheets for each fire stopping condition.

.3 Submit electronic copies of WHMIS MSDS - Material Safety Data Sheets (MSDS).

.1 Indicate precautions for workers using fire stopping products.

.3 Submit product data for Low-Emitting materials sealants) for inclusion in Sustainability Binder. See Section 01 35 21 Sustainability Requirements.

.4 Shop Drawings:

.1 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation.

.2 Construction details should accurately reflect actual job conditions.

.5 Samples:

.1 Submit samples showing actual fire stop material proposed for project on Departmental Representative's request.

.2 Submit manufacturer installation instructions and special handling criteria, installation sequence, cleaning procedures.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: company specializing in fire stopping installations with 5 years documented experience.

.2 Overall Project quality control:

.1 Employ one applicator firm to install all firestopping throughout project, using personnel that meet installer qualifications stated above.

.2 Do not permit separate trades to firestop their own service penetrations.

.3 Health and safety requirements: do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.5 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

.3 Waste Management and Disposal:

.1 Separate waste materials for recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.

.1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN-ULC-S115 and not to exceed opening sizes for which they are intended.

.2 Fire stop system rating: Refer to drawings for assembly ratings

.2 Service penetration assemblies: systems tested to CAN-ULC-S115.

.3 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.

.4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

.5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.

.6 Fire stopping materials to conform to the requirements of:

.1 Green Seal Environmental Standards.

.1 Standard GS-36-00, Commercial Adhesives.

.2 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

.7 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

.8 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.

.9 Sealants for vertical joints: non-sagging.

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.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

3.4 FIELD QUALITY CONTROL

.1 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

.2 Installed firestopping will be examined to determine if assemblies have been installed in accordance with respective ULC listings.

.1 Allow for destructive testing of installed firestopping during examination including re-instatement of damaged firestopping during inspection, at no additional cost to Contract.

.2 Deviation from ULC listed systems will be considered grounds for rejection and will require replacement of firestopping to conform with respective ULC listings, at no additional cost to Contract.

3.5 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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 61 00 - Sheet Metal Roofing.

.2 Section 07 62 00 - Sheet Metal Flashing and Trim.

.3 Section 08 11 00 - Metal Doors and Frames.

.4 Section 08 50 00 – Windows.

.5 Section 09 91 00 – Painting.

1.2 REFERENCES

.1 ASTM International

.1 ASTM C919-08, Standard Practice for Use of Sealants in Acoustical Applications.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).

.2 CAN/CGSB-19.13- M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.

.3 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.

.4 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.

.3 General Services Administration (GSA) - Federal Specifications (FS)

.1 FS-SS-S-200-E(2)1993, Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.

.4 AAMA 809 Voluntary Specifications and Test Methods for Sealants.

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

.1 Material Safety Data Sheets (MSDS).

.6 Green Seal Environmental Standards

.1 Standard GS-36-00, Commercial Adhesives.

.7 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards.

.1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

1.3 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for joint sealants and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Manufacturer's product to describe:

.1 Caulking compound.

.2 Primers.

.3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.3 Samples:

.1 Submit samples of each type of material and colour.

.2 Cured samples of exposed sealants for each colour where required to match adjacent material.

.4 Manufacturer's Instructions:

.1 Submit instructions to include installation instructions for each product used.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturers recommendations.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

1.5 WHMIS

.1 Submit copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOCs during application.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

1.7 SITE CONDITIONS

.1 Environmental Conditions:

.1 Proceed with installation of joint sealants only when:

.1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4 degrees C.

.2 Joint substrates are dry.

.3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.2 Joint-Width Conditions:

.1 Proceed with installation of joint sealants only where joint widths are more than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:

.1 Proceed with installation of joint sealants only after contaminants capable of interfering with sealant bonding have been removed.

.4 Where sealants are qualified with primers use only these primers.

Part 2 Products

2.1 SEALANT MATERIALS

.1 Sealant materials to conform to the requirements of:

.1 Green Seal Environmental Standards.

.1 Standard GS-36-00, Commercial Adhesives.

.2 South Coast Air Quality Management District (SCAQMD), California State.

.1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

.2 VOC limit maximum 250 g/L for sealers used within the building envelope.

.3 Where sealants are qualified with primers, use only these primers.

2.2 SEALANT MATERIAL DESIGNATIONS

.1 Polyurethanes: colours selected by Departmental Representative.

.1 Non-sag formulation: 1-part, to CAN/CGSB-19.13, Type 2, MCG-2-25, MCG-2-40.

.2 Self-levelling formulation:

.3 1-part: to CAN/CGSB-19.13, Type 1.

.4 2-part: to CAN/CGSB-19.24, Type 1, Class B.

.2 Non-drying butyl sealant to AAMA 809.

.3 Silicones one part: to CAN/CGSB-19.13.

.4 Acrylics one part: to CGSB 19-GP-5M.

.5 Acrylic latex: one part, non sag siliconized acrylic polymer to CAN/CGSB-19.17.

.6 Preformed compressible and non-compressible back-up materials:

.1 Polyethylene, urethane, neoprene or vinyl foam:

.1 Extruded closed cell foam backer rod.

.2 Sized as required.

.2 Neoprene or butyl rubber:

.1 Round solid rod, Shore A hardness 70.

.3 High density foam:

.1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m^3 density, or neoprene foam backer, size as recommended by manufacturer.

.4 Bond breaker tape:

.1 Polyethylene bond breaker tape which will not bond to sealant.

2.3 SEALANT SELECTION

.1 Penetrations in exterior walls to fill joints watertight including but not limited to exterior perimeters of door frames, window frames, curtain wall frames; exterior perimeters of wall vents; exterior perimeters of all other wall penetrations.

.1 Polyurethane, non-sag.

.2 Interior perimeters of door frames and trims, window and curtain wall frames to make junctions filled, smooth and invisible suitable for subsequent "painting out" with interior wall finishes.

.1 Acrylic latex.

.3 Gypsum board control joints: to make joints suitable for subsequent "painting out" with interior wall finishes.

.1 Acrylic latex.

.4 Junctions between counter tops and walls to produce permanent sanitary and watertight seal; junctions between plumbing fixtures and walls, floors and counter tops/vanities to produce permanent sanitary and watertight seal. Co-ordinate with plumbing trade to avoid omission/duplication.

.1 Mildew-resistant silicone.

.5 Under-slab vapour barrier

.1 Non-drying butyl sealant to AAMA 809

2.4 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's written recommendations.

.2 Primer: in accordance with sealant manufacturer's written recommendations.

Part 3 Execution

3.1 SURFACE PREPARATION

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

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.2 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.3 BACKUP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.4 MIXING

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

3.5 APPLICATION

.1 Sealant:

.1 Apply sealant in accordance with manufacturer's written instructions.

.2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.

.3 Apply sealant in continuous beads.

.4 Apply sealant using gun with proper size nozzle.

.5 Use sufficient pressure to fill voids and joints solid.

.6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.

.7 Tool exposed surfaces before skinning begins to give slightly concave shape.

.8 Remove excess compound promptly as work progresses and upon completion.

.2 Curing:

.1 Cure sealants in accordance with sealant manufacturer's instructions.

.2 Do not cover up sealants until proper curing has taken place.

3.6 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Non-rated, fire rated and thermally insulated steel frames.

.2 Non-rated, fire rated and thermally insulated steel doors.

1.2 RELATED SECTIONS

.1 Section 08 71 00 - Door Hardware: Hardware, silencers, and weather-stripping.

.2 Section 08 80 50 - Glazing.

.3 Section 09 91 23 - Painting: Field painting of frames.

1.3 REFERENCES

.1 ASTM A653/A653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM E152 - Methods of Fire Tests of Door Assemblies.

.3 CSDFMA (Canadian Steel Door and Frame Manufacturers Association).

.4 DHI - Door Hardware Institute: The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.

.5 NFPA 80 - Fire Doors and Windows.

.6 NFPA 252 - Fire Tests for Door Assemblies.

.7 SDI-100 - Standard Steel Doors and Frames.

.8 UL 10B - Fire Tests of Door Assemblies.

.9 ASHRAE 90.1 2013- Energy Standard for Buildings Except Low Rise Residential Buildings

1.4 SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Indicate frame configuration and finishes. Indicate door configurations, location of cut-outs for hardware reinforcement.

.3 Shop Drawings: Indicate frame elevations, reinforcement, anchor types and spacings, location of cut-outs for hardware, and finish. Indicate door elevations, internal reinforcement, closure method, and cut-outs for glazing, louvers, and finishes.

1.5 QUALITY ASSURANCE

.1 Conform to requirements of CSDFMA SDI-100.

1.6 REGULATORY REQUIREMENTS

.1 Fire Rated Frame Construction: Conform to UL 10B.

.2 Installed Door and Frame Assembly: Conform to NFPA 80 for fire rated class as scheduled.

1.7 PROJECT CONDITIONS

.1 Coordinate the work with frame opening construction, door, and hardware installation.

PART 2 PRODUCTS

2.1 DOORS

.1 Exterior doors: Air infiltration to comply with ASHRAE Standard 90.1 2010 & 2013 requirements of less than .4 CFM/$FT^{2.}$

.2 Insulated Core Doors: minimum, 1.2 mm surface sheets, and top and bottom end channels; cores filled with insulation.

.3 Honeycomb Core Doors: minimum ,1.2 mm surface sheets and, top and bottom end channels; cores filled with honeycomb material laminated under pressure to surface sheets.

.4 Fire Rated Doors: Minimum, 1.2 mm surface sheets and, top and bottom end channels, of ULC label requirements indicated on drawings.

.5 Reinforcement for hardware:

- .1 Locks: minimum 1.52 mm steel.
- .2 Butts: minimum 3.42 mmsteel.
- .3 Flush Bolts: minimum 3.42 mm steel.
- .4 Door Closures: minimum 1.9 mm steel.

.6 Glazing Stops: 0.9 mm rolled steel channel shape, butted corners; 16 mm high profile; prepared for countersink screws.

2.2 FABRICATION DOOR FRAMES

.1 Fabricate frames in accordance with CSDMA specifications and following requirements

.2 Fabricate frames as welded unit.

.3 Fabricate frames with hardware reinforcement plates welded in place.

.4 Reinforce frames wider than 1 200 mm with roll formed steel channels fitted tightly into frame head, flush with top.

.5 Prepare frames for silencers. Provide three single silencers for single doors and mullions of double doors on strike side. Provide two single silencers on frame head at double doors without mullions.

.6 Attach fire rated label to each fire rated door unit.

.7 Glazing Stops: 0.9 mm rolled steel channel shape, butted corners; 16 mm high profile; prepared for countersink screws.

.8 Provide drywall returns on all frames.

.9 Attach channel spreaders at bottom of frames for shipping.

2.3 FABRICATION - DOORS

.1 Fabricate hollow metal doors and panels in accordance with requirements of "Canadian Manufacturing Standards for Steel Doors and Frames" produced by the Canadian Steel Door and Frame Manufacturer's Association and as indicated on Drawings. Fabricate doors with hardware reinforcement welded in place.

.2 Fabricate fire rated hollow metal doors in accordance with requirements of Underwriters Laboratories of Canada (ULC). Place ULC labels where visible when in installed position.

.3 Longitudinal seams: Mechanically interlocked, continuously welded, filled and sanded with no visible edge seams. Top and bottom of doors closed with end channels recessed and spot welded in place.

.4 Reinforce and prepare doors to receive hardware. Refer to Section 08 71 00 for hardware requirements.

.5 Undercut doors where indicated.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that opening sizes and tolerances are acceptable.

3.2 INSTALLATION

.1 Install frames in accordance with CSDFMA.

.2 Coordinate with masonry, gypsum board, concrete wall construction for anchor placement.

.3 Coordinate installation of glass and glazing.

.4 Coordinate installation of doors and frames with installation of hardware specified in Section 08 71 00.

.5 Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

.6 After installation, touch up all scratched or damaged surface and prime.

.7 Insulate all frames exposed to the exterior.

.8 Install door louvers, plumb and level.

3.3 ERECTION TOLERANCES

.1 Maximum Diagonal Distortion: 1.5 mm measured with straight edges, crossed corner to corner.

.2 Clearance on steel doors at head and jambs shall be: 3 mm maximum, maximum between pairs of doors

3.4 ADJUSTING

.1 Adjust door for smooth and balanced door movement.

3.5 CLEANING

.1 Do cleaning in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Flush wood doors, non-rated.

1.2 RELATED SECTIONS

.1 Section 08 11 00 - Metal Doors and Frames.

.2 Section 08 80 50 - Glazing.

.3 Section 08 71 00 - Door Hardware.

1.3 REFERENCES

.1 AWI/AWMAC - Quality Standards Illustrated (QSI), current edition.

.2 CSA O115-M1982, Hardwood and Decorative Plywood.

.3 CAN/CSA O132.2 Series-90, Wood Flush Doors.

.4 UL 10B - Fire Tests of Door Assemblies.

1.4 SUBMITTALS

.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, and undercuts required.

1.5 QUALITY ASSURANCE

.1 Perform work in accordance with AWI/AWMAC QSI, Custom Finish doors in accordance with AWI/AWMAC QSI Quality Standard.

.2 Health and safety requirements: do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.6 DELIVERY, STORAGE, AND PROTECTION

.1 Package, deliver and store doors in accordance with AWI/AWMAC QSI.

.2 Protect doors from dampness. Arrange for delivery after work causing abnormal humidity has been completed.

.3 Store doors in well ventilated room, off floor, in accordance with manufacturer's recommendations.

.4 Protect doors with resilient packaging. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges if stored more than one week.

1.7 WASTE MANAGEMENT AND DISPOSAL

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

.2 Dispose of all packaging material in appropriate on-site bin for recycling in accordance with Section 01 74 19 - Consttruction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 DOOR TYPES

.1 Flush Interior Doors: Solid core: to CAN/CSA-O132.2.1.

2.2 DOOR CONSTRUCTION

.1 Non rated, solid particleboard core: stile and rail frame bonded to particleboard core with wood lock blocks 3-ply construction.

2.3 FLUSH DOOR FACING

.1 Veneer Facing: QSI A Grade quality Maple veneer, quarter sliced with bookmatched grain, for transparent finish.

2.4 FABRICATION

.1 Fabricate non-rated doors in accordance with QSI Custom Grade Quality Standards requirements.

.2 Provide lock blocks at lock edge and top of door for closer for hardware reinforcement.

.1 Door Edge Detail to conform to QSI No. 1 Edge, hardwood vertical edges of species to match face veneer.

.3 Bond edge banding to cores.

.4 Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware.

.5 Provide edge clearances in accordance with AWMAC unless otherwise noted.

2.5 FINISH

.1 Factory finish doors in accordance with approved sample.

.2 Seal door top edge with sealer to match door facing.

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.

3.2 INSTALLATION

.1 Install doors in accordance with manufacturer's instructions.

3.3 ADJUSTING

.1 Adjust door for smooth and balanced door movement.

.2 Adjust closer for full closure

3.4 CLEANING

.1 Do cleaning in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials and requirements for access doors and panels to all concealed mechanical equipment for operating, inspecting, adjusting, balancing and servicing.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings for each type of access door.

.2 Closeout Submittals

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

Part 2 Products

2.1 ACCESS DOORS

.1 Supply flush mounted access doors, for installation by Building Trades in non-accessible type ceilings and walls where necessary for access to service and/or to inspect mechanical equipment and accessories and life safety devices and where specifically indicated.

.2 Sizes: Except as indicated otherwise, to be minimum sizes as follows:

.1 600 x 600 mm [24” x 24”] for body entry.

.2 300 x 300 mm [12” x 12”] for hand entry.

.3 200 x 200 mm [8” x 8”] for cleanout access.

.4 Access doors in building surfaces shall be at least as large as duct access panels accessed through them and shall be oversized when necessary.

.3 Construction: 180 degree door swing, mitred rounded safety corners flush welded, concealed hinges, screwdriver latches, and anchor straps or lugs to suit construction, all steel shall be prime coated.

.4 Wet wall construction: 14 gauge bonderized steel, flush with wall or ceiling, with concealed flange.

.5 Masonry or drywall construction: 16 gauge for 400 mm x 400 mm [16” x 16”] and smaller, 14 gauge for 450 mm x 450 mm [18” x 18”] and larger, bonderized steel, mounted on face of wall or ceiling with exposed flange.

.6 Tile or wet wall construction in washrooms and other special areas: 14 gauge stainless steel flush with wall or ceiling with concealed flange.

.7 Feature wall construction: Recessed wall type that is selected to complement and conform to the architectural module, treatment, or panelling. The size shall conform to adjacent finishes.

.8 Access panels in fire separations and firewalls shall have a compatible fire rating and ULC label, a tamper-proof latch and shall be self closing.

2.2 EXCLUSIONS

.1 Lay-in tile ceilings: use unobtrusive identification locators.

Part 3 Execution

3.1 LOCATION

.1 Locate access doors so that all concealed items are within view, readily accessible for adjustment, operation, maintenance and inspection without using special tools.

.2 Locate in service and storage areas wherever possible.

.3 Do not locate in panelled, feature or special finish walls or ceilings, without prior approval of the Departmental Representative.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Electric overhead sectional door.

.2 Operating hardware, supports, and controls.

1.2 RELATED SECTIONS

.1 Section 07 92 00 - Joint Sealants: Perimeter sealant and backup materials.

.2 Section 08 80 00 – Glazing: Glass for door lights.

.3 Division 26 - Electrical: Electrical service connection to door controller.

1.3 REFERENCES

.1 ASTM A653/A653M-08 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 .2 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.

.2 CAN/CGSB-12.8-M90, Insulating Glass Units.

.3 CAN/CGSB-12.10-M76, Glass, Light and Heat Reflecting.

.3 IGMAC, Insulating Glass Manufacturer's Association of Canada, Glazing Guidelines for Sealed Insulating Glass Units.

.4 TBCBC, The British Columbia Building Code (TBCBC) 2006.

1.4 SYSTEM DESCRIPTION

.1 Panels: Flush steel with glazed panels.

.2 Lift Type: High lift operating style with track and hardware.

.3 Operation Electric.

.4 Design doors to withstand local wind loads listed in TBCBC without suffering permanent deformation or from becoming dislodged from wall openings.

.5 Design doors to withstand local seismic conditions listed in TBCBC without suffering collapse or becoming dislodged from wall openings.

1.5 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Shop Drawings:

.1 Indicate door design, dimensions, construction, finishes, glazing arrangements.

.2 Indicate arrangement of hardware, operating mechanisms and required clearances, fixing and anchorage requirements, finishes.

.3 Indicate electrical power and control requirements, safety devices.

.4 Use qualified professional structural engineer registered in British Columbia for wind load and seismic designs.

.5 Submit shop drawings under seal of same professional engineer responsible for wind load and seismic designs.

.3 Product Data: Submit manufacturer printed product literature, specifications and data sheets.

.4 Samples: Submit exterior panel finish samples illustrating colour and finish prior to ordering project materials. Printed paper color samples are not acceptable.

1.6 CLOSEOUT SUBMITTALS

.1 Section 01 78 10: Submission procedures.

.2 Operation and Maintenance Data:

.1 Full identification of each type of door installed (i.e., model and model/series number) for Owner's later use in obtaining service and replacement parts.

.2 Name, address and telephone numbers of installer and of local service/repair agent.

.3 Warranty certificates made out to Owner.

.4 Certification under seal of same professional engineer responsible for sealing shop drawings that door assemblies have been installed in accordance with sealed shop drawings.

1.7 QUALITY ASSURANCE

.1 Use sectional door products that have been used in similar applications for at least 10 years.

.2 Furnish names and addresses of building owners/managers where proposed sectional doors have been installed, upon request.

.3 Installer Qualifications: Company specializing in performing the work of this section with minimum 5years documented experience.

.4 Furnish evidence of installer experience on request.

1.8 WARRANTY

.1 Provide door manufacturer 10 Year written warranty for insulating glass units of this Section against failure. Remove and replace failed sealed insulated glass units which fail within guarantee period at no cost to Owner. Unit failure will be deemed to occur if any of following are noted.

.1 Appearance of condensation between panes.

.2 Obstruction of vision within unit perimeter.

.3 Chipping, cracking or breakage of glass panes occurring due to manufacturing defects or under

.4 specified service conditions.

.5 Migration of edge spacer.

.6 Warranties start at Date of Substantial Performance of Work for total Project.

Part 2 Products

2.1 MATERIALS

.1 Sheet Steel: ASTM A653/A653M galvanized to Z275; pre-coated with silicone polyester finish.

.2 Insulation: Rigid polyurethane same thickness as core framing members bonded to facing.

2.2 PANEL CONSTRUCTION

.1 Solid door sections: 45 mm thick x 610 mm wide x lengths required to suit door opening stucco embossed multi-rib profile door sections using minimum 0.48 mm metal thickness galvanized sheet steel interior and exterior faces interlocked together mechanically, interior face isolated from exterior face by means of continuous effective thermal break, arranged in hinged door sections full width of each opening, each section filled completely with HCFC and CFC-free foamed-in-place polyurethane core providing RSI 2.4 (R14.2) insulation value through non-glazed door sections, minimum 1.6 mm metal thickness door section end caps.

.2 Glazed door sections: as indicated x lengths required to suit door opening full vision glazing sections.

.1 Glazing: 12.7mm thick insulating glass units to CAN/CGSB-12.8 and IGMAC requirements containing CAN/CGSB-12.1/CAN/CGSB-12.10 tempered safety low emissivity glass to exterior side with CAN/CGSB-12.1 tempered clear safety glass to interior side, argon gas filled space kept dry with dehydrating agent, separated by "warm edge" separators.

2.3 DOOR COMPONENTS

.1 Track: minimum 75 mm size x 2.75 mm metal thickness galvanized sheet steel profiles, with fittings suitable for torsion spring lifting, including all required attachment/suspension items.

.2 Hinges: door manufacturer standard, non-corroding finish.

.3 Track guards: minimum 4.76 mm metal thickness formed galvanized sheet steel profiles, 1500 mm high.

.4 Rollers: minimum 75 mm dia. full floating hardened steel ball-bearing type.

.5 Roller brackets: heavy duty galvanized sheet steel adjustable profile.

.6 Counterbalances:

.1 Torsion springs: oil tempered, helically wound, 200,000 cycle rating.

.2 Shafts: ball-bearing mounted keyed steel profile.

.3 Drums: precision grooved steel profiles.

.4 Cables: aircraft quality.

.7 Pusher springs: door manufacturer standard design.

.8 Weatherstripping:

.1 Jambs: continuous vinyl sweeps to seal doors to jambs.

.2 Heads: continuous vinyl stripping or tube to seal doors to head jamb.

.3 Bottom: continuous vinyl tube to seal door bottom to floor.

.4 Section-to-section: continuous vinyl tube to seal hinged door sections to each other.

.9 Operation: Electric.

2.4 OPERATORS

.1 Jack shaft operator, DC motor drive and controller, with manual disconnect for use during power failure, auto stopping when striking an object or detecting object in path via photo electric detector across doorway.

.1 Electrical motors, controller units, relays and other electrical components to CSA approval with CSA enclosure Type CEMA 1.

.2 Verify electrical power supply with Owner's General Contractor before ordering.

.3 Controller units with integral motor reversing starters and heater elements for overload protection, with relays as applicable.

.4 Motor capacity and rating: sized for intended door usage and cycles.

.2 Controls stations: momentary contact pushbutton to initiate door open/close cycles from inside building, adjacent to each respective door.

.3 Electric operator safety switch: infra-red photo-electric cells positioned across indoor face of opening which when detecting vehicle or obstruction will reverse door closing travel to full open position and initiate delayed automatic closing cycle.

2.5 FINISHES

.1 Door finishes: 2 coat baked-on paint system consisting of primer plus polyester finish coat.

.1 Colour: Selected from manufacturers full range of colours.

.2 Finish all other galvanized sheet steel components using Z275 designation zinc coating.

Part 3 Execution

3.1 INSTALLATION

.1 Install sectional doors, track, operators and all required hardware in accordance with reviewed shop drawings and door manufacturer instructions.

.2 Maintain dimensional tolerances and alignment with adjacent construction.

.1 Variation from plumb: maximum 3 mm.

.2 Variation from level: maximum 3 mm.

.3 Fix track and hardware items in place to resist pulling away and loosening.

.4 Install electrical motors, controller units, detectors, relays and other electrical equipment required for full door operation. Make following connections or arrange for connections to be made by appropriate trades where this trade is excluded from making such connections.

.1 Connections and electric wiring between doors and fused power supply locations.

.2 Connections and wiring between doors and control station locations through building conduit.

.3 All safety device wiring and connections.

.5 Adjust operable parts for correct operation.

.6 Adjust safety switch devices for proper operation.

.7 Touch up damaged paint and galvanized finishes

3.2 ADJUSTING

.1 Adjust door assembly to smooth operation and in full contact with weatherstripping.

3.3 DEMONSTRATION

.1 Instruct Owner's personnel on operation and adjustment of sectional doors and related devices, at no additional cost to Contract.

3.4 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 Clean doors, frames and glass.

.3 Remove temporary labels and visible markings.

3.5 PROTECTION OF FINISHED WORK

.1 Section 01 78 40: Protecting installed work.

.2 Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION

1.0 GENERAL

1.1 WORK INCLUDED

.1 Window frames and sashes constructed of fiberglass pultrusions.

.2 Windows as pre-assembled units, including factory installation of glass and glazing.

.3 Furnish all labour, materials, equipment and services required for the design, fabrication, supply and installation of windows as shown on the drawings and as specified. Furnishment to include, but not be limited to the following:

- .1 Fully glazed fiberglass window assemblies including fiberglass shapes and glass.
- .2 All glazing accessories for window assemblies including gaskets, setting blocks, and sealants as required to meet the air and water tightness requirements of the section.
- .3 All necessary reinforcing members, brackets, anchors, fasteners and other accessories as required to meet the structural requirements of the installation and specifications in this section.
- .4 Shop applied galvanizing and electrolytic barrier painting of all steel parts.
- .5 All perimeter closures, membranes, sealants, flashings, and trim required to integrate the window assemblies with other cladding and finishing materials.
- .6 Assessment of the alignment of the existing façade elements as required to allow design and layout of the work in this section.
- .7 All fastening of the window assemblies to the rough openings

.4 Include also the following:

- .1 Checking of building lines and levels as required for the proper layout and installation of all work included in this section.
- .2 Shop painting of all steel shapes and ferrous metal used in attachment or reinforcing of window and field painting after steel shapes are installed.

.5 Window systems of the following types:

- .1 Single fixed lites.
- .2 Composite, with fixed lites and operable casement lites.
- .3 Bedroom Windows to be triple glazed.

1.2 REFERENCE STANDARDS (Most recent version unless noted otherwise.)

.1 AAMA/WDMA/CSA101/I.S.2/A440-08-NAFS- North American Fenestration Standard/ Specification for windows, doors, and skylights.

.2 CSA A440S1 – 09 “Canadian Supplement to AAMA/WDMA/CSA101/I.S.2/A440-08 – NAFS – North American Fenestration Standard/Specification for windows, doors, and skylights”.

.3 British Columbia Energy Efficiency Act – Energy Efficiency Standards Regulation (BCEEA).

.4 CAN/CSA-A440-Windows; A440.1 User Selection Guide to A440; A440.2 Energy

Performance Evaluation; A440.3 User Guide to A440.2; A440.4 Window and Door Installation.

.5 CAN/CSA-G164-Hot-Dip Galvanizing of Irregularly Shaped Articles.

.6 CAN/CGSB-1.40-Primer, Structural Steel, Oil Alkyd Type.

.9 Glazing Contractor's Association of B.C. (GCABC) publication: Glazing Systems Specifications Manual.

.10 IGMA Glazing Recommendations for Sealed Insulating Glass Units.

1.3 DEFINITIONS

.1 Single Unit Window: a window consisting of one fixed or one operable lite.

.2 Composite Window: a window consisting of a maximum of three lites in one main frame. Composite windows may consist of fixed or operable windows, or a combination of both.

1.4 DESIGN CRITERIA

.1 Materials, fabrications, attachments, accessories, assembly and performance, other that thermal performance, shall meet or exceed applicable requirements of CSA-A440, Windows, including appendices. The more stringent of CSA-A440 or this specification shall apply.

.2 Thermal performance shall be determined in conformance with CSA-A440.2, Thermal Performance Evaluation of Windows and Sliding Glass Doors, and Appendix A – Overview of the Procedure for Determining the U-Value by Computer Simulation.

.3 Design windows to be glazed from the interior.

.4 Design windows to equalize both positive and negative pressure between outside air and:
.1 cavities surrounding insulating glass units, and
.2 cavities surrounding operable sash.

.5 Design windows to provide drainage from spaces around operable sash and around insulating glass units to exterior.

.6 Design windows to provide for the continuity of the air seal from the inside face of the sealed unit to the surrounding frame.

.7 Design window anchorage to withstand wind load equal to or greater than calculated loads as per CSA A440S1-09 in accordance to the Performance Class specified herein or to Part 4 of the BC Building Code.

.8 Design vinyl components to accommodate thermally induced movement and to prevent creep deflection. Limit of creep deflection 3mm per meter in any member or assembly.

.9 Design assembly to accommodate structure movements due to wind, seismic, creep and live loads where applicable and/or as noted.

1.5 PERFORMANCE REQUIREMENTS

.1 This is a performance specification issued in conjunction with the drawings for the work. The drawings show the general arrangement of the finished work and these specifications described the minimum requirements of the finished system. The Contractor is responsible for designing and furnishing a window system that will fulfill the requirements of the specifications and drawings including items which may not be shown or specified but are required for performance of the system.

.2 The window shall be designed, fabricated and installed to meet or exceed the criteria in this subsection.

.3 Structural

- .1 Wind Load Resistance to NAFS in conjunction with CSA A440.09.
- .2 The window assembly and fasteners shall be designed to withstand negative and positive wind loads in accordance to BCBC using an annual probability factor of **1/50 years** for the reference wind velocity, and 8 per 1000 glass failure rate under this load.
- .3 The glass and window frames shall be designed to withstand guard loads at locations required by the BCBC.
- .4 The glass shall be designed to withstand thermal stresses imposed in service. In calculation, assume the use of blinds located not less than 50 mm from the inside surface of the glass.
- .5 The window system shall be designed to limit deflection orthogonal to the plane of the glass under wind or guard loads to **L/175** in all clear span dimensions of glass and framing members.
- .6 Anchors and fasteners shown on the drawings do not represent the required location or types required for installation of the new widow. Any attachment points must be shown on shop drawings for review by the Consultant.
- .7 All fastenings and attachments shall be concealed.
- .8 Movement and Tolerances
  - .1 The window installation shall accommodate a building structure live load deflection of 9 mm at midspan of longest project window header/lintel without transferring load to the window.
  - .2 The window shall accommodate expansion and contraction of component materials over an exterior air temperature range of -18ºC to 35ºC and a possible solar heating range to 70ºC, and an interior temperature range of 0ºC to 30ºC without causing:
    - .1 failure of joint seals necessary for air and water tightness of the system,
    - .2 failure of perimeter seals at interfaces to adjacent wall systems,
    - .3 overstressing of fasteners,
    - .4 pinching or distortion or breakage of glass,
    - .5 distortion of aluminum members,
    - .6 or other harmful effects.

.4 The window shall be fabricated and installed square, level and plumb as follows:

- .1 Plumb to within 3 mm of vertical over the height of each unit.
- .2 Within 3.0 mm of level relative to a datum established for frames at the same floor.

.3 Within 1.5 mm of level relative to an adjacent frame.
.4 Each frame shall be within 3.0 mm of square when measured across the diagonals.
.5 Clearances required for installation should be considered and indicated on the shop drawings.
.6 All movements of the window system shall be noiseless.

.5 Weather Tightness
.1 Water Tightness to NAFS in conjunction with CSA A440.09.
.2 The glazing system shall be installed so that it forms a continuous unbroken air seal on the room side of the assembly. The air seal shall extend from the glazing assembly to adjoining wall components at all interfaces. Airtightness of the window and interfaces shall restrict infiltration and exfiltration of air through the system in accordance to NAFS.
.3 The window system shall be designed in accordance with rainscreen principles, incorporating venting and drainage mechanisms and separate air and water barriers, effective so that any water entering the system past exterior seals drains harmlessly to the exterior via pressure equalized drainage cavities.
.4 Vent and drain holes shall be present in inconspicuously locations and shall not contribute to staining or marking of glass, mullions, or spandrels.

.6 Durability
.1 The window frames and integral seals shall be designed to have an expected service life of 30 years. All seals, gaskets, corrosion protection, coatings and attachments are expected to be serviceable at the end of this service period.

.2 The glazing shall have a guaranteed service life of twenty years. Any glazing failing to meet this service life shall be removed and replaced at no cost to the Owner under guarantee by the Contractor. Failure of any glazing shall be deemed to occur if any of the following are noted:
.1 Chipping, cracking, or breakage of glass panes occurring due to manufacturing defects or under specified service conditions.

.3 Seals between unitized components of the glazing system shall be formed with clamped rubber gaskets. Seals between frame units made with field applied sealants alone will not be accepted.

1.6 RESPONSIBILITY FOR MEETING PERFORMANCE REQUIREMENTS

.1 Meeting the performance requirements of this section during the design fabrications and installation of the work shall be the complete responsibility of the Contractor.

.2 The details shown on associated drawings show dimensions and profiles similar to those expected to be required to meet the specifications of this section. The Contractor may submit design proposals with minor changes to the details shown on the drawings in order to meet or exceed the performance requirements of this section by using proprietary technology. Every effort has been made to show on the drawings and in the specification items of the design that may not be altered or altered only to limited extents.

.3 The structural and energy use requirements of this section shall be certified by an Engineer employed by the Contractor using standards recognized by the local authority having jurisdiction, the product manufacturer and current trade associations.

.4 The design of the product and the responsibility of the Contractor's Engineer shall extend to accommodate all temporary conditions associated with fabrication, transport, storage, lifting, installation and temporary closure of the building without detrimental effect on the performance requirements of these contract documents.

.5 The Consultant's review of the Contractor's submittals and the work is of the benefit only of the Owner. The Contractor shall remain responsible for the design, fabrication, installation and performance of the product.

1.7 SUBMITTALS

.1 Submittals to be made in accordance with Section 01 33 00 - Submittals.

.2 Product Data: Submit catalogue details for each type of window and framing system illustrating profiles, dimensions and methods of assembly, installation procedures, recommendations and data that products have been tested and comply with performance requirements.

.3 Submit test reports form an independent testing agency acceptable to the Consultant, indicating windows to be supplied for the project meet specified requirements, including compliance with AAMA/WDMA/CSA101/I.S.2/A440-08- NAFS. Testing conducted by manufacturer to follow all required product test and sequence tests as described under Clause 5 in AAMA/WDMA/CSA101/I.S.2/A440-08- NAFS in conjunction with CSA A440S1-09.

.4 Energy Conformance: Supply documentation sufficient to confirm conformance of project window sizes and configurations with the British Columbia Energy Efficiency Act, using one of the following testing agencies or persons.
- .1 A person or organization accredited by the Standards Council of Canada
- .2 National Fenestration Rating Council accredited Inspection Agency
- .3 Architect or Professional Engineer, authorized to practice in British Columbia.

.5 Shop Drawings:
- .1 Submit shop drawings of windows prepared under the supervision and bearing the seal of a Professional Engineer of the Province of BC. Submit completed BC Building Code Letters of Assurance (Schedules B1 and B2) together with the initial shop drawing submission. Upon request, provide structural calculations per conformance to Building Codes, By-Laws and CAN/CGSB 12.20.
- .2 Clearly indicate each type of window, hardware and locations, framing system, extrusion profiles, methods of assembly, section and hardware reinforcement, anchorages and location of exposed fasteners, isolation coatings, finishes, glazing components, insect screens, and location of manufacturer's name plates (if applicable).
- .3 Provide scaled elevations, sections, plans, dimensions and quantity of units. Indicate rough opening requirements and tolerances of adjacent construction.
- .4 Provide full size details for head, sill and jamb conditions, junctions between

combination units (coupling mullions), and interior and exterior trim. Clearly indicate method and location of connection and continuity of the envelope air, vapour and water seals. Clearly indicate drainage and ventilation paths within the window assembly and at the interface to the building envelope. Confirm compatibility of materials that form the air/vapour/water barrier of the integrated system.

.5 Provide manufacturer's assembly instructions for operable units if they will be supplied demounted from main frame.

.6 Shop drawings are submitted to allow the Departmental Representative to review conformance of the proposed system. Review of the shop drawings by the Departmental Representative shall not relieve the Contractor of any responsibilities to perform under the terms of this specification. Notify the Departmental Representative of any sequencing of submittals and reviews that will expedite the Contractor's delivery of the project

.7 No materials shall be purchased or units fabricated until final review of shop drawings is completed by the Departmental Representative.

.6 Samples: If requested, make the following samples available for Departmental Representative review at least one week prior to shop drawing preparation:

.1 150 mm long corner sections of head, jamb, sill, mullions, and coupling mullions to indicate profile.

.2 One (1), 4'x 4' with 2' operable section, representative model of each type of window.

.7 Letters of Assurance: The Registered Professional Engineer who signed and sealed the shop drawings shall perform sufficient field reviews in order to provide a letter of professional assurance after completion of the Work, giving assurance that the Work has been fabricated and installed in general conformance with the sealed shop drawings. Approved forms are BC Building Code Letters of Assurance (Schedule C). Written inspection reports of field reviews shall be submitted to the Architect promptly as the field reviews are made.

.8 Maintenance Data: Provide in accordance with Section 01 78 10 – Maintenance and Renewal Manual, the following data for incorporation into specified maintenance manual:

.1 A recommended inspection procedure and schedule and component replacement schedule.

.2 Data for cleaning and maintenance of framing finishes, glazing and hardware.

.9 Warranties:

.1 Provide a written warranty signed and issued in the name of the Owner stating:

.1 All windows will be free from defects in material and workmanship for a period of two (2) years from the date of substantial Performance of the Work.

.2 All windows will continue to provide satisfactory resistance to water penetration for a period of five (5) years from the date of Substantial Performance of the Work.

.3 All insulating sealed double glazing units shall be covered for a period of twenty (20) years from the date of Substantial Performance of the Work,

against material obstruction of vision as a result of hermetic seal failure and dust or film formation on inner glass surfaces.

.2 If a 3rd party warranty is provided then the warranty requirements are to be the most stringent of the 3rd party warranty or the requirements listed above.

.3 Satisfactory performance means compliance with the performance criteria and the testing and construction standards of this specification, and with the reviewed shop drawings. This includes the performance of finishes, hardware glass and glazing materials, structural attachment, sealants and flashings.

.4 Correct all deficiencies that appear during the warranty period at no cost to the Owner.

1.8 QUALITY ASSURANCE

.1 Sealed insulation unit manufacturer to be a member in good standing of the Insulating Glass Manufacturers Alliance (IGMA).

.2 Glass and glazing work under this section to conform to IGMA standards.

.3 Window manufacturer and installation contractor to be a member in good standing of the Glazing Contractors Association of BC (GCABC) and have a minimum of 5 years uninterrupted experience in successfully carrying out projects of similar size. Contractor to document past experience on request.

2.0 PRODUCTS

2.1 WINDOWS

.1 Description: sash comprised of purpose-made fiberglass pultrusions, thermally broken, rain screen design with fiberglass sub sill, exterior flange mount, fitted with insulated glass unit glazing and rigid pultruded fiberglass snap-in glazing stop, in sizes and arrangements detailed/indicated.

2.3 SINGLE UNIT WINDOWS

.1 Meet or exceed requirements of selected Performance Class and Performance Grade as per AAMA/WDMA/CSA101/I.S.2/A440-08- NAFS- North American Fenestration Standard/Specification for windows, doors, and skylights and CSA A440S1- 09 – Canadian Supplement to NAFS and the secondary performance requirements:

.1 All windows shall conform to:
  .1 Class **CW – PG30 (metric)** - Fixed
  .2 Class **CW – PG30 (metric)** – Casement and Awning
.2 Water Penetration: Water penetration test pressures shall be **400 Pa.**
.3 Air Tightness Rating, Fixed Windows: Fixed Level.

.4 Air Tightness Rating, Operable Windows: A3 Level
.5 Operation Force for: Casement window - Normal Use (Clause 5.3.1.1, Table 6)
.6 Energy Performance: Overall Window U-Value averaged over all fenestration products within the scope of work to be no more than **1.8 W/m2•K**.
.7 All windows are to be labeled with the AAMA, CSA or WDMA label and have sash, leaf and size shown on the drawings.

2.4 COMBINATION WINDOWS

.1 Meet or exceed requirements of selected Performance Class and Performance Grade as per AAMA/WDMA/CSA101/I.S.2/A440-08- NAFS- North American Fenestration Standard/Specification for windows, doors, and skylights and CSA A440S1- 09 - Canadian Supplement to NAFS, and the secondary performance requirements. Refer to Clause 2.1.1 for Window Performance Grades and Energy Performance.

.2 Air and water tightness of joints along frames mulled together, and at mullions where lites within one main frame join, shall meet or exceed performance ratings specified for the higher rated adjacent single unit windows.

.3 Lateral deflection of mulled frames shall not exceed **L/175** of span when subjected to loading equivalent to wind load resistance of the adjacent single unit windows.

2.5 WINDOW TYPES

.1 Fixed: with removable double-glazed insulated sealed units. Minimum performance standard to meet AAMA/WDMA/CSA 101/I.S.2/A440-08 – NAFS Class CW-PG30.
.2 Casement (Outswing sash): with removable double-glazed insulated sealed units. Minimum performance standard to meet AAMA/WDMA/CSA 101/I.S.2/A440-08 – NAFS Class CW-PG30.
.3 Screens: provide on ventilating portions of windows.

2.6 FRAME AND SASH REQUIREMENTS

.1 Frame and sash profiles and glazing detailed on drawings are not intended to restrict product types conforming to these specifications.
.2 Provide fiberglass frame and sash conforming to the following standards:
.4 Minimum external wall thickness of extrusions: 2.5 mm nominal.

.3 Seal sash perimeter continuously at three locations minimum, with primary seal located between operator and interior seal.
.4 Secure hardware and attachments using screws into H-ports or penetrating minimum of two walls of framing or internal steel reinforcement.
.5 Join single units to form combination units with joints at combination unit frame perimeter finished with sealant and steel plate, 75 mm x 75% of depth of framing. Plate shall be screw fastened with a minimum of four screws through plastic into steel reinforcing.
.6 Anchor using metal retaining clips at head, nailing flanges at jambs and continuous back angle at sill.

2.7 GLASS AND GLAZING MATERIAL

.1 Insulating Glass Units: meet or exceed requirements as described in AAMA/WDMA/CSA101/I.S.2/A440-08- NAFS and CSA A440S1- 09 - Canadian Supplement to NAFS . Units shall be certified by the Insulating Glass Manufacturers Alliance (IGMA). Overall unit thickness shall be a minimum of 24 mm using a minimum of 4 mm glass thickness. In combination and composite units use the greater glass thickness throughout. Use two-stage seal method of manufacture, as follows:

- .1 Primary Seal: polyisobutylene or hot-melt butyl.
- .2 Secondary Seal: polyisobutylene, silicone or polysulphide based sealant, filling gap between the two lites of glass at the edge up to the spacer/separator and primary seal.
- .3 Spacer/separator: non-conductive, as required to suit performance requirements.

.2 Insulated glass unit assembly to provide following minimum performance requirements. Following is based on 6 mm thick Low E glass in 25 mm thick insulating unit with 13 mm thick Argon gas filled space and 6 mm thick clear inner glass.

.1 Transmittance:

Ultra-violet (UV) light: 19%
Visible daylight: 70%
Total solar energy: 33%

.2 Reflectance:

Visible light: 11%
Total solar energy: 30%

.3 U-values (Imperial):

Winter night time: 0.25
Summer day time: 0.25

.4 Shading coefficient factor: 0.44

.5 Solar heat gain coefficient: 0.37
.6 Light-to-solar gain (LSG): 1.84

.3 Bedroom windows to be fitted with triple glazed units, refer to window schedule.

.4 Clear Float Glass: to CAN/CGSB-12.3, glazing quality, for inner and outer lite.

.5 Glazing Gaskets for PVC Sections: neoprene, thermoplastic rubber or EPDM, flexible at minimum design temperature, and as follows:

- .1 Profiles with a minimum of two (2) fins to contact glazing at interior and exterior of glass units
- .2 Designed to maintain pressure contact against glass units through design temperature range.
- .3 Co-extruded gaskets are not acceptable on the main frame or sash.
- .4 Foam or butyl glazing tapes are not acceptable.

.5 Other Glazing Accessories: setting blocks to AAMA/WDMA/CSA101/I.S.2/A440-08-NAFS.

2.8 HARDWARE

.1 Exposed Hardware Components: cast metal, in finish selected by Consultant from hardware manufacturer's standard range.

.2 Hardware exposed to exterior environment with sash in closed and open positions shall be corrosion-resistant stainless steel or bi-chromated steel composites.

.3 Secure hardware and attachments using screws into H-ports or penetrating a minimum of two walls of framing. Wherever possible provide metal reinforcement embedded in vinyl frames at screw attachment locations.

.4 Equip operable windows with hardware as follows:
- .1 Casement: concealed dual arm operator and stainless steel tracks, with under screen roto operator assembly. Provide multi-point locking with single handle operation.
- .2 Hardware to be adjustable to accommodate compression set of weather and air seals.

.5 Provide ADA approved handles for roto operators.

.6 Force to operate locking devices shall not exceed 20 N.

.7 Provide pole operated hardware where window latching devices are located in excess of 1900 mm above floor level:

2.9 ACCESSORIES

.1 Weatherstripping for operable sash: neoprene, thermoplastic rubber or EPDM, flexible at minimum design temperature, and as follows:
- .1 Profiled to mechanically key into window and sash framing members, at interior and exterior of sash.
- .2 Removable without special tools and without dismantling of frames.
- .3 Designed to maintain pressure contact against frame through design temperature range.
- .4 Provide a minimum of one weather seal gasket to the exterior and one air seal gasket to the interior of drained and vented cavities.

.2 Steel Reinforcement: sheet steel to ASTM A653M, hot dip galvanized, minimum Z275 coating designation.

.3 Transition membrane: minimum1.6 mm thick SBS membrane sheet reinforced with non-woven polyester or glass fleece. Stripping to be a minimum 150mm wide. Approved products are:
- .1 Soprema – Sopraseal 60 F/F or Sopralene Flam Stick
- .2 Protectowrap Jiffyseal 140/60.

.3 Bakor Blueskin TG.

.4 Joint Sealants: as specified in Section 07 92 10, as recommended for substrates.

.5 Foam Backer Rod: extruded closed cell backer rod, oversize 30 to 50%.

.6 Screens: To CAN/CGSB-79.1.
- .1 Insect screening mesh: count 18 x 16.
- .2 Fasteners: tamper proof.
- .3 Screen frames: vinyl or aluminum, colour to match window frames.

2.10 FRAME AND SASH FINISHES

.1 Factory applied water-borne urethane finish.

2.10 AIR/VAPOUR RETARDER

.1 Ensure continuity of air/vapour retarder and seal from walls to window frame.

3.0 EXECUTION

3.1 FABRICATION

.1 Fabricate window units square and true with maximum tolerance of plus or minus 1.5 mm for units with a diagonal measurement over 1800 mm.

.2 Mitre and heat weld full length of fiberglass frame and sash joints at corners. All welding flash to be neatly removed.

.3 Fasten steel reinforcement to extruded vinyl mullions with concealed stainless steel fasteners at maximum 300 mm o/c.

.4 Continuously and uniformly compress length of gaskets during installation, to compensate for linear shrinkage.

3.2 GLAZING

.1 Clean sealing surfaces at perimeter of glass and sealing surfaces of rabbets and stop beads before applying tape, splines or gaskets. Use solvents and cleaning agents recommended by manufacturer of sealing materials.

.2 Install glazing gaskets uniformly with accurately formed corners and bevels. Ensure that proper contact is made with glass and rabbet interfaces.

.3 Support both lites of glass thermal units on levelled setting blocks, 4 or 6 mm minimum, spaced as recommended by glass manufacturer. Provide at least one setting block at quarter points from each corner. For casement windows, locate setting blocks closer to corners as recommended by manufacturer.

.4 Centre glass thermal units in glazing rabbet to maintain 6 mm minimum clearance between edges of glazing and plastic framing at sill or 4 mm minimum clearance between edges of glazing and plastic framing at sill if glazing bite incorporates a drainage channel with depth of 3 mm minimum.

.5 Size glass thermal units to ensure exposed face of spacer is in line with glazing stops.

.6 Use spacers and shims in accordance with glass manufacturer's recommendations.

.6 Immediately replace damaged or broken glass.

3.3 WINDOW INSTALLATION

.1 Install in accordance with CAN/CSA-A440 and reviewed shop drawings.

.2 Arrange components to prevent abrupt variation in colour.

.3 Erect and secure window units in prepared openings, plumb and square, free from warp, twist or superimposed loads.

.4 Secure work accurately to structure and in a manner not restricting thermal movement of materials.

.5 Transfer window dead load to wall construction by anchors alone or in combination with plastic shims. Wood shims are not acceptable.

.6 Place shims under sill frame at exact setting block locations, and as marked on frames by window frame manufacturer.

.7 Conceal all anchors and fitments. Exposed heads of fasteners are not permitted.

.8 Maintain dimensional tolerances after installation. Maintain alignment with adjacent work.

.9 Provide seal around interior perimeter of window frame using foam joint sealant or foam backer rod, size as required to lightly compress between frame and rough opening, and sealant. Ensure continuity of air/vapour retarder and seal to window frame.

.10 Provide seal at head and jamb of exterior perimeter of window frame using foam joint sealant or foam backer rod, size as required to lightly compress between frame and rough opening, and sealant. Do not seal sill at exterior.

.11 Install jamb extensions, casings, brick moulds and trim as indicated on drawings.

.12 Install sealant, in accordance with Section 07 92 10, and related materials as indicated on drawings.

.13 Adjust operable sash and hardware to operate smoothly.

.14 Temporary installations of windows if needed are to meet all requirements for occupant and public safety, such as but not limited to, operable unit restrictors, fastening, sharp edges etc.

3.5 CAULKING

.1 Seal joints between windows and window sills with sealant. Bed sill expansion joint cover plates in bedding compound. Caulk butt joints in continuous sills.

.2 Apply sealant in accordance with Section 07 92 00 - Sealants. Conceal sealant within window units except where exposed use is permitted by the Consultant.

3.6 PROTECTION AND CLEANING

.1 Do cleaning in accordance with Section 01 74 11 - Cleaning.

.2 Protect windows/doors from damage/staining during and after installation.

.3 Clean interior and exterior surfaces as soon as adjacent contaminating activities are completed, to recommendations of window manufacturer.

3.7 ENERGY CERTIFICATE

.1 Site certificates to be supplied in accordance with the British Columbia Energy Efficiency Act.

.2 Certificates to include the following information:

- .1 The whole-product U-value for each fenestration product provided on site (in W/m2K).
- .2 The overall average U-value for the whole project, averaged over every fenestration product in the scope of work (in W/m2K).
- .3 The name of the person or agency acting as verifier for the fenestration products.

.3 Certificates are to be posted in plain view at the project site for a period of at least 120 days after the last manufactured fenestration product is installed in the building.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Hardware for hollow and insulated steel doors, Flush wood doors

.2 Thresholds

.3 Weatherstripping, seals, and door gaskets.

1.2 RELATED SECTIONS

.1 Section 08 11 00 - Metal Doors and Frames.

.2 Section 08 14 16 - Flush Wood Doors

1.3 REFERENCES

.1 American National Standards Institute (ANSI).

- .1 ANSI/BHMA A156.1-2006, American National Standard for Butts and Hinges.
- .2 ANSI/BHMA A156.2-2003, Bored and Preassembled Locks and Latches.
- .3 ANSI/BHMA A156.4-2000, Door Controls - Closers.
- .4 ANSI/BHMA A156.13-2002, Mortise Locks and Latches Series 1000.
- .5 ANSI/BHMA A156.18-2006, Materials and Finishes.
- .6 ANSI/BHMA A156.31- 2013, Electric Strikes and Frame Mounted Actuators

.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 NBC, National Building Code of Canada (issue date listed in Section 01 41 00 - Regulatory Requirements).

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00: Submission procedures.

.2 Samples:

- .1 Provide hardware samples requested by Departmental Representative.
- .2 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.

.3 Shop Drawings:

- .1 Provide product data sheets to describe fully to Departmental Representative all products of this Section.
- .2 Include descriptions of materials, composition, cautions, installation requirements.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

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

.2 Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

.3 Special tools:

.1 Provide 2 sets of wrenches for each type of door closer and lock set installed, for project maintenance use.

.2 At completion of installations and adjustments turn over to Departmental Representative all tools supplied by hardware manufacturers with hardware items installed for later use in hardware maintenance. Seal tools together with respective hardware data/installation sheets supplied with hardware in clear plastic bags.

1.6 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 10 years documented experience.

.2 Regulatory Requirements:

.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification organization accredited by Standards Council of Canada.

1.7 DELIVERY, STORAGE, AND PROTECTION

.1 Deliver, store and handle materials in accordance with respective material manufacturer's 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.

.3 Store door hardware in locked, clean and dry area.

.4 Include hardware templates and full installation/adjustment information.

.5 Supply hardware complete with all factory supplied mounting fasteners required for installation.

.6 Replace defective or damaged materials with new.

1.8 WASTE DISPOSAL AND MANAGEMENT

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

1.9 WARRANTY

.1 For Work of this Section 08 71 00 - Door Hardware, 12 months warranty period is extended to:

.1 60 months for door closers of this Section will be free from manufacturing defects.

.2 Manufacturing defects will be deemed to occur if any of following conditions are noted.

.1 Defects of material and factory workmanship.

.2 Fluids leaks.

.2 Defective products to be corrected, replaced or maintained without cost to Canada as necessary to enable such products to perform as warranted.

.3 Start warranties at date of Final Certificate of Completion.

Part 2 Products

2.1 MANUFACTURERS

.1 Hardware items to be of the best grade, free from defect and of first line quality production suitable for this level of project.

.2 Use one hardware manufacturer product only for each similar hardware item.

.3 Acceptable manufacturers:

.1 Hinges: McKinney, Stanley, Ives.
.2 Locks: Schlage, Sargent, Corbin/Russwin.
.3 Closers: LCN, Sargent, Corbin/Russwin.
.4 Exit Device: Von Duprin, Sargent, Corbin/Russwin
.5 Door stops, Overhead: Glynn Johnson, Sargent, Corbin/Russwin.
.6 Other wall and floor stops: CBH, Gallery, Ives
.7 Thresholds and weatherstrip: Draft Seal, Pemko, National
.8 Pocket track: Kris Track, de Jong, K N Crowder
.9 Pocket Lock: KN Krowder, Baldwin, Emtek
.10 Electric strikes/power supply: Von Duprin, Sargent, RCI.

2.2 HARDWARE - GENERAL

.1 General: Refer to paragraph. **3.7 Hardware Schedule** for further description and finishes of following items.

.2 Locks and latches:

.1 Mortise locks and latches: to ANSI/BHMA A156.13, series 1000 mortise lock, grade 1, designed for functions scheduled and keyed as stated in Hardware Schedule.
.2 Lever handles, Plain design
.3 Escutcheons: round.
.4 Normal strikes: box type, lip projection not beyond jamb.
.5 Electric strikes to ANSI/BHMA A156.31- 2013 suitable for installation in hollow metal door frames. Fail secure. c/w power supply. Refer to Electrical
.6 Cylinders: keyed into keying system directed by Departmental Representative.
.7 Finishes: finished to 626

.3 Butts and hinges:

.1 Butts: to ANSI/BHMA A156.1, 5-knuckle, sizes x finishes scheduled, concealed bearing for scheduled doors, NRP for scheduled doors.

.4 Exit devices: to ANSI/BHMA A156.3 and as scheduled.

.5 Door closers and accessories:

.1 Door controls (closers): to ANSI/BHMA A156.4, designated by letter C, sizes as required by NBC and to provide following requirements.

.2 Maximum degree of opening required.

.3 Size to door.

.6 Architectural door trim: to ANSI/BHMA A156.6, designated by letter J and as scheduled.

.1 Door protection plates: Kick plate type1.27 mm thick stainless steel finish to 630

.2 Push plates: 1.27 mm thick finished to 630

.3 Pull units: stainless steel finished to 630

.7 Thresholds: 127 mm wide x full width of door opening, extruded aluminum mill finish, serrated surface.

.8 Weatherstripping:

.1 Head and Jamb seal:

.1 Extruded aluminum frame and solid closed cell nepoprene insert, clear anodized finish.

.2 Adhesive backed neoprene material

.2 Door bottom seal:

.1 Extruded aluminum frame with closed cell neoprene, vinyl sweep, clear anodized finish.

2.3 KEYING

.1 Obtain final keying from Departmental Representative before ordering.

.2 Prepare keying schedule in co-operation with Departmental Representative.

.3 Supply keys in duplicate for every lock in this contract.

.4 Supply 3 master keys for each master key or grand master key group.

.5 Stamp Keying code numbers on keys and cylinders.

.6 Supply construction cores

.7 Use a bonded locksmith for all keying work. Stamp all keys "Do Not Copy".

2.4 FINISHES

.1 Finishes: Stainless steel 630.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that doors and frames are ready to receive work and dimensions are as indicated on shop drawings.

3.2 FASTENINGS

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.

.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices to match finish of hardware.

.4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.

.5 Use fasteners compatible with material through which they pass.

3.3 INSTALLATION

.1 Install hardware in accordance with manufacturer's instructions.

.2 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.

.3 Use templates provided by hardware item manufacturer.

.4 Use only manufacturer supplied fasteners. Failure to comply may void manufacturer warranties and applicable licensed labels. Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

.5 Provide metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.

.6 Remove construction locks when directed by the Departmental Representative.

.1 Install permanent cores and ensure locks operate correctly

3.4 ADJUSTING

.1 Adjust hardware for smooth operation.

3.5 PROTECTION OF FINISHED WORK

.1 Do not permit adjacent work to damage hardware or finish.

3.6 CLEANING

.1 Do cleaning in accordance with Section 01 74 11 - Cleaning.

.2 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.3 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer instructions.

3.7 HARDWARE SCHEDULE

Hardware Sets

Set: 1.0

Doors: 102, 124

Description:

2	Hinge (heavy weight)	TA386xNRP 4-1/2" x 4-1/2"	US26D	MK
1	Hinge (heavy weight)	TA386xNRP QC12 4-1/2" x 4-1/2"	US26D	MK
1	Exit Device (classroom)	DG1 21 55 56 8813 ETMD	US32D	SA
1	Door Closer	351 CPS	EN	SA
1	Drop Plate	351D	EN	SA
1	Threshold	171A 36"		PE
1	Gasketing	312CR		PE
1	Sweep	18062CNB		PE
1	ElectroLynx Harness	QC-C1500		MK
1	ElectroLynx Harness	QC-C006		MK
1	Card Readers	Card Readers supplied and installed by others		OT
1	Power Supply	AQD3-1R		SU

Notes: Note: upon presenting valid credentials to reader , exit device latch will retract allowing entry. Exit device maybe left in passage mode by programming.

Set: 2.0

Doors: 103, 123

Description:

3	Hinge	TA714 4-1/2" x 4"	US26D	MK
1	Privacy Lock	49 8265 LNMD	US26D	SA
1	Kicklate	K1050 10 x 2" LDW	630	RO
1	Door Stop	442	US26D	RO

Notes:

Set: 3.0

Doors: 104a, 104b

Description:

6	Hinge	TA714 4-1/2" x 4"	US26D	MK
2	Roller Latch	592	US26D	RO
2	Single Dummy Trim	DLU93 LNMD	US26D	SA

Notes:

Set: 4.0

Doors: 105, 108, 113

Description:

6	Hinge	TA714 4-1/2" x 4"	US26D	MK
2	Flush Bolt	555	US26D	RO
1	Classroom Lock	DG1 21 8237 LNMD MK	US26D	SA
2	Surf Overhead Stop	10-X36	630	RF

Notes:

Set: 5.0

Doors: 106a, 106b

Description:

3	Hinge	TA714 4-1/2" x 4"	US26D	MK
1	Classroom Lock	DG1 21 8237 LNMD MK	US26D	SA
1	Surf Overhead Stop	10-X36	630	RF
1	Door Closer	DA 351 UO	EN	SA
1	Kicklate	K1050 10 x 2" LDW	630	RO
1	Threshold	151A		PE
1	Gasketing	S88W 17'		PE
1	Door Bottom	412CRL 36"		PE

Notes:

Set: 6.0

Doors: 109, 110

Description:

3	Hinge	TA714 4-1/2" x 4"	US26D	MK
1	Office Lock	DG1 21 8205 LNMD MK	US26D	SA
1	Kicklate	K1050 10 x 2" LDW	630	RO
1	Door Stop	442	US26D	RO

Notes:

Set: 7.0

Doors: 114, 216, 217

Description:

3	Hinge	TA714 4-1/2" x 4"	US26D	MK
1	Storeroom Lock	DG1 21 8204 LNMD MK	US26D	SA
1	Door Closer	DA 351 UO	EN	SA
1	Kicklate	K1050 10 x 2" LDW	630	RO
1	Door Stop	442	US26D	RO
1	Threshold	271A 36"		PE
1	Gasketing	S88W 17'		PE
1	Sweep	18062CNB		PE

Notes:

Set: 8.0

Doors: 115a, 115b

Description:

1	Sliding Door Hdwe	PF28200A6080		PE
1	Flush Pull	94Px94L	US26D	RO

Notes:

Set: 9.0

Doors: 116, 118, 205

Description:

3	Hinge	TA714 4-1/2" x 4"	US26D	MK
1	Passage Latch	8215 LNMD	US26D	SA
1	Door Closer	DA 351 UO	EN	SA
1	Kicklate	K1050 10 x 2" LDW	630	RO
1	Door Stop	442	US26D	RO

Notes:

Set: 10.0

Doors: 117, 119

Description:

3	Hinge (heavy weight)	TA386 4-1/2" x 4-1/2"	US26D	MK
1	Privacy Lock	49 8265 LNMD	US26D	SA
1	Door Stop	442	US26D	RO

Notes:

Set: 11.0

Doors: 120b, 120a, 204, 206

Description:

3	Hinge (heavy weight)	TA386 4-1/2" x 4-1/2"	US26D	MK
1	Passage Latch	8215 LNMD	US26D	SA
1	Door Stop	442	US26D	RO

Notes:

Set: 12.0

Doors: 121, 122

Description:

3	Hinge	TA714 4-1/2" x 4"	US26D	MK
1	Storeroom Lock	DG1 21 8204 LNMD MK	US26D	SA
1	Door Closer	351 UO	EN	SA
1	Door Stop	442	US26D	RO

Notes:

Set: 13.0

Doors: 125a

Description:

3	Hinge	TA714 4-1/2" x 4"	US26D	MK
1	Storeroom Lock	DG1 21 8204 LNMD MK	US26D	SA
1	Electric Strike	1006CS	630	HS
1	Door Closer	351 UO	EN	SA
1	Kicklate	K1050 10 x 2" LDW	630	RO
1	Door Stop	442	US26D	RO
1	Card Readers	Card Readers supplied and installed by others		OT

Notes: Note: Upon presenting valid credentials to reader , electric strike will release allowing entry. Strike may be left in a passage mode by programming.

Set: 14.0

Doors: Typical Bedrooms (207a, 208a, 209a, 210a, 211a, 212a)

Description:

3	Hinge	TA714 4-1/2" x 4"	US26D	MK
1	Office Lock	DG1 21 8205 LNMD MK	US26D	SA
1	Door Stop	442	US26D	RO
1	Threshold	271A 36"		PE
1	Gasketing	S88W 17'		PE
1	Sweep	18062CNB		PE

Notes:

Set: 15.0

Doors: 126b, 202

Description:

3	Hinge (heavy weight)	TA386xNRP 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom Lock	DG1 21 8204 LNMD MK	US26D	SA
1	Electric Strike	1006CS	630	HS
1	Door Closer	351 CPS	EN	SA
1	Kicklate	K1050 10 x 2" LDW	630	RO
1	Threshold	171A 36"		PE
1	Gasketing	312CR		PE
1	Sweep	18062CNB		PE
1	Card Readers	Card Readers supplied and installed by others		OT

Notes: Note: Upon presenting valid credentials to reader , electric strike will release allowing entry. Strike may be left in a passage mode by programming.

Set: 16.0

Doors: 126c

Description:

1	OH Door	Hardware supplied complete by door supplier		OT

Set: 17.0

Doors: Typical Bathrooms

Description:

3	Hinge	TA714 4-1/2" x 4"	US26D	MK
1	Privacy Lock	8265 LNMD	US26D	SA
1	Door Stop	442	US26D	RO

Notes:

Set: 18.0

Doors: 214b

Description:

3	Hinge	TA714 4-1/2" x 4"	US26D	MK
1	Passage Latch	8215 LNMD	US26D	SA
1	Surf Overhead Stop	10-X36	630	RF
1	Door Closer	351 UO	EN	SA
1	Threshold	271A 36"		PE
1	Gasketing	S88W 17'		PE
1	Sweep	18062CNB		PE

Notes:

Set: 19.0

Doors: 107

Description:

3	Hinge	TA714 4-1/2" x 4"	US26D	MK
1	Classroom Lock	DG1 21 8237 LNMD MK	US26D	SA
1	Surf Overhead Stop	10-X36	630	RF
1	Kicklate	K1050 10 x 2" LDW	630	RO
1	Door Stop	442	US26D	RO
1	Threshold	151A		PE
1	Gasketing	S88W 17'		PE
1	Door Bottom	412CRL 36"		PE

Notes:

Set: 20.0

Doors: 214a

Description:

3	Hinge	TA714 4-1/2" x 4"	US26D	MK
1	Passage Latch	8215 LNMD	US26D	SA
1	Door Stop	442	US26D	RO
1	Threshold	271A 36"		PE
1	Gasketing	S88W 17'		PE
1	Sweep	18062CNB		PE

Set: 21.0

Doors: 125b, 126a, 213

Description:

3	Hinge	TA714 4-1/2" x 4"	US26D	MK
1	Passage Latch	8215 LNMD	US26D	SA
1	Door Closer	351 UO	EN	SA
1	Door Stop	442	US26D	RO
1	Threshold	271A 36"		PE
1	Gasketing	S88W 17'		PE
1	Sweep	18062CNB		PE

Notes:

End of Section

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM D2240-05, Standard Test Method for Rubber Property - Durometer Hardness.

.2 ASTM E330-02, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

.3 ASTM F1233-08, Standard Test Method for Security Glazing Materials and Systems.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.

.2 CAN/CGSB-12.8-9, Insulating Glass Units.

.3 AAMA/WDMA/CSA101/I.S.2/A440-08-NAFS- North American Fenestration Standard/ Specification for windows, doors, and skylights

.4 CSA A440S1 – 09 “Canadian Supplement to AAMA/WDMA/CSA101/I.S.2/A440-08 – NAFS – North American Fenestration Standard/Specification for windows, doors, and skylights”

.5 British Columbia Energy Efficiency Act – Energy Efficiency Standards Regulation (BCEEA)

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for Glazing materials and sealants. Include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS - Material Safety Data Sheets.

.1 Indicate VOC for glazing materials during application and curing.

.3 Samples

.1 Submit minimum 305 x 305 mm size samples of glass requested by Departmental Representative.

.2 Manufacturers instructions

.1 Submit installation instructions.

1.3 QUALITY ASSURANCE

.1 Installer qualifications: company specializing in performing work of this section and approved by manufacturer. Provide such evidence upon Departmental Representative request.

1.4 DESIGN CRITERIA

.1 Provide continuity of building enclosure vapour and air barrier using glass and glazing materials as follows:

.1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.

.2 Size glass to withstand local positive and negative wind loads listed in NBC for location of building or identified on structural drawings, whichever more severe.

.3 Size glass to withstand seismic conditions for building location listed in NBC.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction Waste Management and Disposal.

1.7 WHMIS

.1 Comply with WHMIS requirements regarding use, handling and storage of glazing materials.

1.8 WARRANTY

.1 For Work of this Section 08 80 50 - Glazing, 12 months warranty period is extended to:

.1 120 months for insulating glass units of this Section to be free from manufacturing defects.

.2 Manufacturing defects will be deemed to occur if any of following conditions are noted.

.1 Appearance of condensation between panes.

.2 Obstruction of vision within unit perimeter.

.3 Measurable deterioration (more than 10%) of specified thermal transmission or shading coefficient performance ratings.

.4 Chipping, cracking or breakage of glass panes occurring due to manufacturing defects or under specified service conditions.

.5 Migration of edge spacer.

.2 Defective products to be corrected, replaced or maintained without cost to Canada as necessary to enable such products to perform as warranted.

.3 Start warranties at date of Final Certificate of Completion.

Part 2 Products

2.1 MATERIALS

.1 Flat Glass:

.1 Safety glass: to CAN/CGSB-12.1,

.1 Type 2-tempered.

.2 Class B-float.

.3 Transparent

.2 Wired glass: to CAN/CGSB-12.11

.1 Type 1-polished both sides (transparent)

.2 Wire mesh styles 3-square

.2 Insulating Glass Units:

.1 Refer to Section 08 53 13 Fiberglass Windows for sealed unit requirements.

.3 Counter Barrier:

.1 Laminated glass consisting of 5mm tempered glass interior and exterior sheets laminated to .09mm clear PVB interlayer. Provide cut outs for speaker and pass through as detailed.

2.2 ACCESSORIES

.1 Setting blocks: neoprene, EPDM or silicone, 80-90 durometer hardness to ASTM D2240, to suit each application.

.2 Spacer shims: neoprene, EDPM or silicone, 50-60 durometer hardness to ASTM D2240, Sized to suit each application

.3 Glazing tape: Glazing tapes: pre-formed macro-polyisobutylene tape with continuous integral neoprene shim (to prevent "pumping out" of tape under glass load conditions), paper release, black colour, width x thickness to suit installations.

.4 Primers, sealers, cleaners: to glass manufacturer standards and compatible with framing system material/finish.

.5 Glazing sealant: purpose-made for glazing use, compatible with insulating glass units.

.6 Weather sealant: polyurethane, non-sag, 1-part formulation, colours selected by Departmental Representative.

.7 Insulation: to ASTM C612 Type IVB, non-combustible, 70 kg/m^3 density mineral wool fibre board, zero flame spread and smoke development in accordance with CAN/ULC-S102, maximum water absorption of 0.03% in accordance with ASTM C1104/C1104M, minimum 5 year "aged" thermal resistance value RSI 0.74 per 25 mm thickness, of thicknesses or total RSI values detailed/indicated.

Part 3 Execution

3.1 MANUFACTURERS INSTRUCTIONS

.1 Compliance: comply with manufacturer written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions and data sheets.

3.2 GENERAL GLAZING REQUIREMENTS

.1 Clean sealing surfaces at perimeter of glass and sealing surfaces of rabbets before applying glazing tapes and sealant. Use solvent and cleaning agents recommended by manufacturer of sealing materials. Wipe dry.

.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.3 Install glazing tapes uniformly with accurately formed corners and bevels. Ensure that proper contact is made with glass and rabbet interfaces.

.4 Set glass on setting blocks, spaced as recommended by glass manufacturer. Place at least one block at quarter points from each corner.

.5 Centre glass in glazing rabbet to maintain required clearances at perimeter on all 4 sides.

.6 Use glazing sealant for heel beads to seal glazing vapour tight to frames.

.7 Install wired glass with wire parallel to sash members and aligned in adjacent panels.

.8 Make door glass installations rattle-free.

3.3 INSTALLATION

.1 Install glass and insulating glass units to metal doors and frames:

.1 Use glazing tape, on both sides. Butt tape tight at corners. Use full length pieces of glazing tape, from corner to corner.

.2 Install removable stops without displacing glazing tape.

.3 For interior exposure applications:

.4 Set glazing tape flush with glass sight line.

.5 Trim off glazing tape protruding above top of stops.

.6 For exterior exposure applications:

.7 Set glazing tape approximately 2 mm below glass sight line to allow cap bead of sealant.

.8 Place cap bead of weather sealant to exterior side full perimeter of glass.

.9 Apply sealant to uniform and level line, flush with sight line.

.10 Tool sealant to a smooth concave appearance.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.1 Remove traces of primer, caulking.

.2 Remove glazing materials from finish surfaces.

.3 Remove labels.

.4 Clean glass and mirrors using approved non-abrasive cleaner in accordance with manufacturer's instructions.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.5 PROTECTION

.1 After installation, mark each light with an "X" by using removable plastic tape or paste.

.2 Remove markings when directed by Departmental Representative

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Gypsum board and joint treatment.

1.2 RELATED SECTIONS

.1 Section 06 10 00 - Rough Carpentry.

.2 Section 07 92 00 - Joint Sealers

.3 Section 07 84 00 - Firestopping.

.4 Section 08 11 00 - Metal Doors and Frames.

.5 Section 09 90 00 – Painting.

1.3 REFERENCES

.1 ASTM C36 - Standard Specification for Gypsum Wallboard.

.2 ASTM C475 - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.3 ASTM C514 - Standard Specification for Nails for the Application of Gypsum Wallboard.

.4 ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.

.5 ASTM C630 - Standard Specification for Water-Resistant Gypsum Backing Board.

.6 ASTM C840-04a - Standard Specification for Application and Finishing of Gypsum Board.

.7 ASTM C1002-01 - Steel Self-Piercing, Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.8 ASTM C1396/C1396M-04 - Standard Specification for Gypsum Board.

.9 ASTM C 1177 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing

.10 ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

.11 Association of the Wall and Ceilings Industries International (AWCI).

1.4 REGULATORY REQUIREMENTS

.1 Conform to applicable code for fire rated assemblies.

.1 Fire Rated Partitions: Listed assembly by ULC .

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

.2 Divert unused gypsum from landfill to gypsum recycling facility for disposal.

Part 2 PRODUCTS

2.1 GYPSUM BOARD MATERIALS

.1 Fire rated gypsum board: to ASTM C1396/C1396M Type X, thicknesses detailed/indicated on drawings x widths to suit framing centres x maximum practical lengths, wrapped tapered edges, square cut ends, bearing ULC fire rating labels.

.1 Paper facing: no less than 75% recycled.

.2 Gypsum core: no less than 10% recycled content.

.2 Fire rated paperless face gypsum board: in compliance with applicable parts of ASTM C1396 and ASTM C1658, Type X.

.1 Composition: dense moisture-resistant gypsum core and fibreglass mats that replace paper facings on both sides to resist mould growth to ASTM D3273.

.2 Format: thicknesses detailed/indicated on drawings x widths to suit framing centres x maximum practical lengths, wrapped tapered edges, square cut ends, bearing ULC fire rating labels.

.3 Steel drill screws: to ASTM C1002, designed for use with wood framing.

.4 Casing beads/j-beads, corner beads: to ASTM C1047, all metal construction without paper flanges, zinc-coated by hot-dip process or zinc-coated by electrolytic process 0.5 mm base thickness, perforated flanges, one piece length per location.

.5 Joint compound: to ASTM C475, asbestos-free.

.6 Tape:

.1 Paper face gypsum board applications: spark perforated paper tape.

.2 Paperless face gypsum board applications: self-adhesive glass fibre mesh tape to further reduce risk of mould growth on face of board surfaces.

Part 3 EXECUTION

3.1 GYPSUM BOARD INSTALLATION

.1 Ensure that insulation is installed and inspected prior to installation of gypsum board.

.2 Install gypsum board in accordance with ASTM C840.

.3 Erect single layer fire rated gypsum board horizontally, with edges and ends occurring over firm bearing.

.4 Use screws when fastening gypsum board to wooden furring or framing.

.5 Double Layer Applications: Secure second layer to first with adhesive and sufficient support to hold in place. Apply adhesive in accordance with manufacturer's instructions.

.6 Place second layer parallel to first layer. Offset joints of second layer from joints of first.

.7 Place control joints consistent with lines of building spaces as directed, but not more than 10 m o.c.

3.2 ACCESSORY INSTALLATION

.1 Install straight and ridged with joints butted tight. Use longest practical length.

.2 Place corner beads at external corners Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials and at openings where board edge is not obscured by building trim.

3.3 JOINT TREATMENT

.1 Finish gypsum board surfaces to following levels in accordance with AWCI Recommended Specification on Levels of Gypsum Board Finish.

.2 Levels of finish:

.1 Level 1: embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable.

.1 Use: where assembly will be completely concealed from view such as in attic spaces and behind solid wall finishes.

.2 Level 4: embed tape for joints and interior angles in joint compound and apply 3 separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

.1 Use: where assembly will receive paint finish

3.4 CLEANING

.1 Do cleaning in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM F137 - 08(2018) - Standard Test Method for Flexibility of Resilient Flooring Materials with Cylindrical Mandrel Apparatus.

.2 ASTM E662 - 17a - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

.3 ASTM F970 – 17 - Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading.

.4 ASTM F1861-08(2012)e1 - Standard Specification for Resilient Wall Base.

.5 Scientific Certification System (SCS)

.1 FloorScore Standard.

.6 UL Environment

.1 Green Guard Certification.

.7 Cradle to Cradle Product Innovation Institute:

.1 Cradle to Cradle Certified Product Standard.

.8 South Coast Air Quality Management District (SCAQMD), California State.

.1 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.

1.2 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data on specified products, describing performance, physical characteristics, sizes, patterns and colours available.

.1 Indicate conformance with low emitting materials requirements for this project.

.2 Provide Floor Score certification.

.3 Provide documentation indicating Greenguard Gold certification.

.4 Provide documentation indicating Cradle 2Cradle Silver certification.

.3 Shop Drawings: Indicate seaming plan.

.4 Samples:

.1 Submit samples of manufacturer’s standard colour range to Departmental Representative, for colour selection.

CLOSEOUT SUBMITTALS

.5 Section 01 78 00: Submission procedures.

.6 Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Section 01 78 00: Maintenance and extra material requirements.

.2 Extra Stock Materials: Provide 5 sq.m of flooring, 15 lin m of base material specified.

1.4 QUALITY ASSURANCE

.1 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented.

1.5 WARRANTY

.1 Manufacturers 10 year limited warranty.

1.6 DELIVERY, STORAGE, AND PROTECTION

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Protect roll materials from damage by storing on end.

1.7 ENVIRONMENTAL REQUIREMENTS

.1 Store materials for three (3) days prior to installation in area of installation to achieve temperature stability.

.2 Maintain ambient temperature required by adhesive manufacturer three (3) days prior to, during, and twenty-four (24) hours after installation of materials.

Part 2 Products

2.1 MATERIALS - SHEET FLOORING

.1 Sheet Flooring: Bio Based, Polyurethane homogeneous vinyl sheet flooring:

- .1 Colour and pattern through total thickness.
- .2 Total Thickness: 2.5 mm.
- .3 Sheet Width: 2.01 m.
- .4 Installation method:
  - .1 Glue down.
- .5 Maintenance: No wax, no polish, no finish for the life of the product.
  - .1 Exoguard+ finish.
- .6 Colour: to be selected from manufacturers standard colour range.
- .7 Flooring systems installed in the building interior shall meet the requirements of the following standards
  - .1 Green Guard Certification.
  - .2 Floor Score.
  - .3 Cradle to Cradle Silver.
- .8 Static load to ASTM F970.
- .9 Flexibility to ASTM F137.
- .10 Smoke density to ASTM E662 - 17a.

2.2 MATERIALS - BASE

.1 Base: ASTM F1861, Type TV thermoplastic vinyl; coved profile; top set; premoulded end stops and external corners:

.1 Thickness: minimum 3 mm.

.2 Heights: 102 mm, unless noted otherwise.

.3 Lengths: roll.

.4 Colours: selected by Departmental Representative from standard colour range.

2.3 ACCESSORIES

.1 Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

.2 Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.

.1 Adhesives to SCAQMD Rule 1168-05, Adhesives and Sealants Applications.

.3 Edge Strips: Metal.

Part 3 Execution

3.1 EXAMINATION

.1 Verify floor and lower wall surfaces are free of substances that may impair adhesion of new adhesive and finish materials.

3.2 PREPARATION

.1 Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

.2 Prohibit traffic until filler is cured.

.3 Ensure wall to receive base is smooth, level, free from waves and other defects, and ready for base installation, refer to section 09 21 16 – Gypsum Board Assemblies.

.4 Vacuum clean substrate.

3.3 INSTALLATION - SHEET FLOORING

.1 Install sheet flooring to manufacturers written instructions.

.2 Spread only enough adhesive to permit installation of materials before initial set.

.3 Set flooring in place, press with heavy roller to attain full adhesion.

.4 Lay flooring with joints and seams to produce minimum number of seams.

.5 Install sheet flooring parallel to length of room. Provide minimum of one third (1/3) full roll width. Double cut sheet; provide butt joint.

.6 Terminate flooring at centreline of door openings where floor finish is dissimilar.

.7 Install edge strips at unprotected or exposed edges, and where flooring terminates.

.1 Secure metal strips after installation of flooring with stainless steel screws.

.8 Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.4 INSTALLATION - BASE

.1 Fit joints tight and vertical. Maintain minimum measurement of 450 mm between joints.

.2 Mitre internal corners. At external corners and exposed ends, use premoulded units.

.3 Install base in full bed of adhesive using full spread notched trowel. Cut and fit base neatly at corners, to tight fitting tolerances.

.4 Install base straight and level to maximum variation of 1:1000.

.5 Install base on toe kick of cabinets which occur in rooms and areas where resilient flooring is scheduled.

.6 Scribe and fit to door frames and other interruptions.

.7 Keep joints tight and well fitted.

3.5 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 Remove access adhesive from floor, base, and wall surfaces without damage.

.3 Clean and seal floor in accordance with manufacturers written instructions.

3.6 PROTECTION OF FINISHED WORK

.1 Prohibit traffic on floor finish for forty-eight (48) hours after installation.

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 Master Painters Institute (MPI)

.1 MPI Architectural Painting Specifications Manual, 2004.

.3 National Fire Code of Canada – 1995

.4 Green Seal Environmental Standards

.1 Standard GC-03-97, Anti-Corrosive Paints.

.2 Standard GS-11-93, Architectural Paints.

.3 Standard GS-36-00, Commercial Adhesives

.5 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1113-04, Architectural Coatings.

.2 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit product data and instructions for each paint and coating product to be used.

.2 Submit product data for the use and application of paint thinner.

.3 Submit copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOCs during application.

.3 Samples:

.1 Submit duplicate 200 x 300 mm draw down samples of each scheduled paint colour with specified paint colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards.

.2 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.

.3 Manufacturer's Instructions:

.1 Submit manufacturer's installation application instructions.

.4 Closeout Submittals: submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include following:

.1 Product name, type and use.

.2 Manufacturer's product number.

.3 Colour numbers.

1.3 MAINTENANCE

.1 Extra Materials:

.1 Deliver to extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 01 78 00 - Closeout Submittals.

.2 Quantity: provide one four litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

.3 Delivery, storage and protection: comply with Departmental Representative requirements for delivery and storage of extra materials.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Pack, ship, handle and unload materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.

.2 Acceptance at Site:

.1 Identify products and materials with labels indicating:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Storage and Protection:

.1 Provide and maintain dry, temperature controlled, secure storage.

.2 Store materials and supplies away from heat generating devices.

.3 Store materials and equipment in well ventilated area.

.5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.

.7 Remove paint materials from storage only in quantities required for same day use.

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

1.5 WASTE MANAGEMENT AND DISPOSAL:

.1 Separate waste materials for recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

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

.3 Unused coating materials must be disposed of at official hazardous material collections site as approved by Departmental Representative.

1.6 SITE CONDITIONS

.1 Surface and Environmental Conditions:

- .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
- .2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.
- .3 Apply paint when previous coat of paint is dry or adequately cured.

.2 Additional interior application requirements:

- .1 Apply paint finishes when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

Part 2 Products

2.1 MATERIALS

.1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

.2 Provide paint materials for paint systems from single manufacturer.

.3 Conform to latest MPI requirements for painting work including preparation and priming.

.4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.

.5 Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.

.6 Paint materials to conform to the requirements of:

- .1 Green Seal Environmental Standards.
  - .1 Standard GS-11-93, Architectural Paints.
- .2 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1113-04, Architectural Coatings.

2.2 COLOURS

.1 Departmental Representative to provide interior colour schedule after Contract award

.2 Selection of colours from manufacturers full range of colours.

.3 Where specific products are available in restricted range of colours, selection based on limited range.

2.3 GLOSS/SHEEN RATINGS

.1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

	Gloss @ 60 degrees	Sheen @ 85 degrees

Gloss Level 1 - Matte Finish (flat)	Max. 5	Max. 10
Gloss Level 2 - Velvet-Like Finish	Max.10	10 to 35
Gloss Level 3 - Eggshell Finish	10 to 25	10 to 35
Gloss Level 4 - Satin-Like Finish	20 to 35	min. 35
Gloss Level 5 - Traditional Semi-Gloss Finish	35 to 70	
Gloss Level 6 - Traditional Gloss	70 to 85	
Gloss Level 7 - High Gloss Finish	More than 85	

2.4 PAINTING SYSTEMS

.1 Exterior Galvanized metal: Exterior doors and frames.

.1 EXT 5.3J- W.B. Light industrial coating: G5 gloss level finish.

.2 Interior Galvanized metal: Doors, frames, railings, misc. steel, pipes.

.1 INT 5.3M - High performance architectural latex gloss level 3 finish.

.3 Dressed lumber: including, doors, and interior wall panels:

.1 INT 6.3E - Polyurethane varnish finish.

.4 Interior running trim and window sills:

.1 INT 6.3A - High Performance Architectural Latex, gloss level 4.

.5 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:

.1 INT 9.2A - Latex –gloss level 3 finish (over latex sealer).

.6 Electrical room Backboards:

.1 INT 6.3R – Fire retardant pigmented.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 EXAMINATION

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

3.4 PREPARATION

.1 Protection:

- .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Departmental Representative
- .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .3 Protect factory finished products and equipment.
- .4 Protect building occupants and general public in and about the building.

.2 Surface preparation: clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements.

.3 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

- .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
- .2 Apply wood filler to nail holes and cracks.
- .3 Tint filler to match stains for stained woodwork.

.4 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

.5 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Touch up of shop primers with primer as specified.

3.5 APPLICATION

.1 Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

- .1 Apply paint in uniform layer using brush and/or roller type suitable for application.
- .2 Work paint into cracks, crevices and corners.
- .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
- .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.
- .5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray application:

.1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

.3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.

.4 Brush out immediately all runs and sags.

.5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.

.5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects.

.8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

3.6 SITE TOLERANCES

.1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.7 CLEANING

.1 Do cleaning in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 ASTM B456-03, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.3 ASTM A653/A653M-09, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM A924/A924M-09, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).

.2 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.81-M90, Air Drying and Baking Alkyd Primer for Vehicles and Equipment.

.2 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.

.3 CGSB 31-GP-107MA-90, Non-inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.

.4 CSA International

.1 CAN/CSA-B651-04, Accessible Design for the Built Environment.

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

1.2 SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop drawings

.1 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame requirements.

.4 Provide maintenance data for toilet and bath accessories for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Tools:

.1 Provide special tools required for assembly, disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 01 78 00 - Closeout Submittals.

.2 Deliver special tools to Departmental Representative.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's recommendations.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/ Waste Management and Disposal.

1.6 WARRANTY

.1 For framed mirrors of this section, 12 month warranty period is extended to 120 months against failure of the silver mirror finish.

Part 2 Products

2.1 MATERIALS

.1 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

2.2 COMPONENTS

.1 Main Floor Washrooms and Shower Rooms

.1 Toilet tissue dispenser: Single roll type, surface mount, chrome plated steel frame, capacity of 500 double ply roll, roll under spring tension for controlled delivery.

.2 Combination Paper towel dispenser /Waste receptacle: Semi flush or surface mount as indicated. Satin finish stainless steel. Door conceals mounting flange. Dispenses multiple styles of paper towels. Removable leak proof 24 L waste container. Barrier free construction. All units keyed alike.

.3 Soap Dispenser: Surface mount with concealed fixing. Horizontal tank with refill window. Stainless steel construction, satin finish. Corrosion resistant valve for dispensing lotions or soaps. Capacity 1.2L. Filler top requires special key.

.4 Mirror: One piece stainless steel channel frame. Bright polished finish. Mirror: 6mm silvered float glass. Galvanized steel back. Concealed wall hanger with theft resistant screws. Size: 762 x1070.

.5 Shower curtain rod: 304 Stainless steel construction, satin finish, 26mm diameter. Mounted with wall brackets concealed by snap fitted stainless steel escutions.

.6 Shower curtain: Opaque, matte white vinyl, 0.2mm thick, contains antibacterial and flame retardant agents. Nickel-plated brass grommets along top, one every 150mm. Hemmed bottom and sides. Sized to suit shower stall. Complete with stainless steel shower curtain hooks.

.7 Robe hooks: surface mount with concealed fixing, No. 4 satin stainless steel construction, maximum 50 mm projection with blunted end.

.2 Second Floor Residence Washrooms:

.1 Toilet tissue dispenser: Single roll type, surface mount, chrome plated steel frame, capacity of 500 double ply roll, roll under spring tension for controlled delivery.

.2 Mirror: One piece stainless steel channel frame. Bright polished finish. Mirror: 6mm silvered float glass. Galvanized steel back. Concealed wall hanger with theft resistant screws. Size: 762 x1070.

.3 Shower curtain rod: 304 Stainless steel construction, satin finish, 26mm diameter. Mounted with wall brackets concealed by snap fitted stainless steel escutions.

.4 Shower curtain: Opaque, matte white vinyl, 0.2mm thick, contains antibacterial and flame retardant agents. Nickel-plated brass grommets along top, one every 150mm. Hemmed bottom and sides. Sized to suit shower stall. Complete with stainless steel shower curtain hooks.

.5 Robe hooks: surface mount with concealed fixing, No. 4 satin stainless steel construction, maximum 50 mm projection with blunted end.

.3 Mop Rail (For Janitors room). Wall hung, 610mm long, stainless steel construction. Spring loaded rubber cams to grip mop handles. Accommodates 3 mops.

2.3 FABRICATION

.1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.

.2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.

.3 Brake form sheet metal work with 1.5 mm radius bends.

.4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

.5 Back paint components where contact is made with building finishes to prevent electrolysis.

.6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CAN/CSA-G164.

.7 Shop assemble components and package complete with anchors and fittings.

.8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.

.9 Provide steel anchor plates and components for installation on studding and building framing.

Part 3 Execution

3.1 MANUFACTURERS INSTRUCTIONS

.1 Compliance: comply with manufacturer written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions and data sheets.

3.2 INSTALLATION

.1 Do not install accessories until wall have been painted, inspected and accepted.

.2 Install and secure accessories rigidly in place as follows:

.1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.

.2 Hollow masonry units, existing plaster or drywall: use toggle bolts drilled into cell or wall cavity.

.3 Use tamper proof screws/bolts for fasteners.

.4 Fill units with necessary supplies shortly before final acceptance of building.

3.3 ADJUSTING

.1 Adjust toilet and bathroom accessories components and systems for correct function and operation in accordance with manufacturer's written instructions.

.2 Lubricate moving parts to operate smoothly and fit accurately.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by toilet and bathroom accessories installation.

3.5 SCHEDULE

.1 Refer to drawings for approximate locations.

.2 Main floor Washrooms:

.1 Toilet paper roll holders: one adjacent each toilet.

.2 Paper towel dispensers: one per washroom.

.3 Soap dispensers: one per washroom basin.

.4 Mirrors: one per washroom basin.

.5 Shower Curtain and Rod: Shower rooms 117 and 119.

.6 Robe Hooks: one per shower stall.

.3 Second Floor Residence Washrooms:

.1 Toilet paper roll holders: one adjacent each toilet.

.2 Mirrors: one per washroom basin/vanity.

.3 Shower Curtain and Rod: one per shower stall.

.4 Robe Hooks: one per shower stall.

.4 Final locations directed by Departmental Representative.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials and requirements for fire extinguishers and cabinets.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings for each type of fire extinguisher and cabinet.

.2 Closeout Submittals

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

Part 2 Products

2.1 CABINETS (FE1)

.1 Semi-recessed with Bubble Canopy - 100 mm [4” wall]:

.1 Cabinet constructed of 1.19 mm [18 ga] steel tub and 2 mm [14 ga] steel door with transparent bubble canopy and trim with 25 mm [1”] return frame, full length semi-concealed piano hinge and flush stainless steel door latch. Front section to have a full 50mm [2”] adjustment to wall. Baked enamel finish, colour to Architect’s choice.

.2 4.5 kg [10 lbs] extinguisher.

2.2 SURFACE MOUNTED (FE2)

.1 4.5 kg [10 lbs] extinguisher.

.2 Wall mounting bracket.

2.3 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS

.1 4.5 kg [10 lbs] Extinguisher: Multipurpose stored pressure rechargeable fire extinguisher, squeeze grip positive on/off operation, heavy duty glossy enamel finish steel cylinder, pull pin safety lock, forged valve, rating for 4-A, 60-B, C with universal wall mounting bracket..

2.4 EXTINGUISHER BRACKETS

.1 Universal wall mounting bracket as recommended by extinguisher manufacturer.

2.5 IDENTIFICATION

.1 Identify extinguishers in accordance with the recommendations of NFPA 10.

.2 Attach a tag or label to extinguishers, indicating the month and year of installation, which provides space for subsequent service date recording.

Part 3 Execution

3.1 INSTALLATION

.1 Install or mount extinguishers in cabinets or on brackets as indicated.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Refrigerator.

.2 Range.

.3 Range hood

.4 Microwave oven.

.5 Dishwasher.

.6 Stacking Washer and Dryer.

1.2 RELATED SECTIONS

.1 Division 26 – Electrical Power.

1.3 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data on equipment and accessories.

1.4 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements.

1.5 CLOSEOUT SUBMITTALS

.1 Section 01 78 10: Submission procedures.

.2 Warranty and Maintenance Documentation: Include warranty and maintenance information on regular servicing.

1.6 QUALITY ASSURANCE

.1 All electric appliances to be energy efficient models bearing Energy Star designations.

Part 2 Products

2.1 APPLIANCES

.1 Refrigerator:

- .1 Style: Free Standing, top mount freezer, frost free
- .2 Capacity .58 cu. meter.
  - .1 Fresh food section .43 cu meter
  - .2 Freezer section .14 cu meter
- .3 Overall dimensions 750mm wide x 825mm deep x 1750mm high

.4 Doors: 2, reversible hinging one each for refrigerator and freezer sections. Hinge to be on side away from the counter.

.5 Shelves: Cantilevered, adjustable, spill proof glass.

.6 Vegetable Crispers: 2, pull-out design drawers, humidity controlled

.7 Meat keepers: 1, Pull out design drawer.

.8 Door Bins: 3 adjustable, covered butter-keeper.

.9 Controls: Refrigerator section temperature and moisture, Freezer section temperature.

.10 Accessories: 2 ice cube trays.

.11 Finish /Colour: Textured sheet steel.

.12 Colour to be selected by Departmental Representative.

.2 Range:

.1 Electric, free standing type, single oven, width 762 mm.

.1 Self-clean oven, with concealed bottom element and interior oven light.

.2 Ceramic range top.

.3 Four top burners.

.4 Vision panel.

.5 Timed convenience outlet.

.6 Colour to be selected by Departmental Representative.

.3 Range hood

.1 762 mm wide.

.2 Outdoor venting with all venting adapters included.

.3 2 speed fan.

.4 Filter element.

.5 Integral light fixtures-2.

.6 Colour to be selected by Departmental Representative.

.4 Dishwasher:

.1 Under countertype, nominal width 600 mm depth to suit counter depth.

.1 Two level wash cycle.

.2 Two rubber coated pull out dish racks with adjustable top rack.

.3 One loose utensil bin.

.4 Colour to be selected by Departmental Representative.

.5 Microwave Oven:

.1 Countertop type, interior space .22 cu m, electronic timed cooking and interior light.

.1 Rotating glass platform.

.2 Removable shelf.

.3 Motorized rotisserie.

.4 Colour to be selected by Departmental Representative.

.6 Washer:

.1 Free standing, stacking , high efficiency front loading type, nominal width 762 mm.

.1 2 required- Refer to drawings for locations.

.2 Variable water level control.

.3 Loose small wash bin.

.4 Dispenser for liquid softener, liquid soap, bleach, powder soap.

.5 Colour to be selected by Departmental Representative.

.7 Dryer:

.1 Electric, Stacking type, nominal width 762 mm with interior light and removable lint screen.

.1 2 required- Refer to drawings for locations.

.2 Of same manufacture, size and capable of stacking with washing machine.

.3 Colour to be selected by Departmental Representative.

2.2 ACCESSORIES

.1 Appliances: Pipe and fittings to connect to utilities.

.2 Power cord to connect to utilities.

.3 Fasteners and Anchors: Galvanized or stainless steel type, anchors, screws, bolts, expansion shields, set screws; required by the type of construction to which they are attached.

Part 3 Execution

3.1 PREPARATION

.1 Verify that prepared openings are ready to receive work and opening dimensions are as indicated on shop drawings and instructed by the manufacturer.

.2 Verify that proper power supply is available.

3.2 INSTALLATION

.1 Prior to installation, ensure that finished flooring is protected from indentation of doly wheels, crates.

.2 Install appliances to manufacturer's written instructions requirements.

.3 Set and adjust units level and plumb.

.4 Activate units to confirm correct operation.

.5 Turn refrigerators on to moderate temperature setting

.6 Connect to utilities and make units operational.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 00- Rough Carpentry: Wood blocking.

1.2 REFERENCES

.1 ASTM International

.1 ASTM D1784-11, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

1.3 DESIGN REQUIREMENTS

.1 Design blinds to following requirements:

.1 Be designed in manner that allows wear susceptible parts to be replaceable by either user or manufacturer.

.2 Guarantee of at least 5 years of available replacement parts following discontinuation of product manufacture.

.3 Be accompanied by instructions for replacing or repairing worn parts, including inventory numbers for parts and procedures for ordering replacement parts.

.4 Program that allows for the refurbishing or return of used blinds.

.5 Designed in manner that permits effective disassembly of components in order to permit recycling of materials for which recycling markets exist.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature and data sheets for horizontal louver blinds and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings dimensions in relation to window jambs, operator details, head anchorage details, hardware and accessories details.

.4 Samples:

.1 Submit one representative working sample of horizontal louver blind, if requested by Departmental Representative.

.2 Submit duplicate samples of manufacturer's standard colours for selection by Departmental Representative.

.3 Samples will be returned after approval if requested.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Packaging Waste Management: remove for recycling as specified in Section 01 74 19 – Construction Waste Management and Disposal.

Part 2 Products

2.1 DESIGN CRITERIA

.1 Design horizontal louvre blinds to following requirements:

.1 Allow wear susceptible parts to be replaceable by either user or manufacturer.

.2 Guarantee of at least five-years of available replacement parts following discontinue of products manufacture.

.3 Include instructions for replacing or repairing worn parts, including inventory numbers for parts and procedures for ordering replacement parts.

.4 Allow for refurbishing or return of used vertical louvre blinds.

.5 Permit effective disassembly of components in for recycling of materials.

.6 Include stamps on major plastic components indicating composition code to facilitate recycling efforts.

2.2 MATERIALS AND FABRICATION

.1 Slats: 25 mm wide with rounded corners and rough edges removed.

.1 Aluminum construction.

.2 Colour and finish: as selected by Departmental Representative.

.2 Ladders:

.1 Braided polyester yarn designed for full tilting action while retaining same level and position of each slat.

.2 Ladders spaced not more than 150 mm from end of slats and 550 mm on centre.

.3 Headrails:

.1 One piece steel channel with rolled edges, formed to provide sufficient strength to support blind without sagging, twisting or distorting.

.2 Metal minimum 0.50 mm thick.

.4 Bottom rails:

.1 Lock seam tubular steel section.

.2 0.36 mm thick.

.5 Bottom rail end caps:

.1 Soft moulded plastic fitted snugly over ends of rails.

.2 Colour to match slats.

.6 Tilt rods: solid steel.

.7 Tassels:

.1 Soft moulded plastic.

.2 Colour to match slats.

.8 Pulleys: designed to permit ease of operation with minimum wear to cord.

.9 Valance: sufficient width the conceal headrail, same material colour and finish as slats.

.10 Tilters:

.1 Fully enclosed and lubricated, with positively locked to drum to prevent slippage and ensure accurate timing.

.2 Use anti-friction materials for worm and gear.

.11 Cord locks: designed to provide smooth operation with feature to prevent accidental dropping of blinds.

.12 Ladder cap: designed to provide sufficient retention when snapped onto bottom rail to hold ladders in proper position.

.13 Installation brackets: end and centre if recommended by manufacturer type complete with safety locking caps to secure headrail and valance.

.14 Lift cords: 1.98 mm diameter, minimum tensile strength 689 kPa, with tassels.

.15 Hold down clips: jamb mountings, to engage bottom rail end caps.

.16 Tilter controls: transparent wand, minimum 8 mm diameter.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates and surfaces to receive horizontal louvre blinds previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's instructions prior to horizontal louvre blinds installation.

.1 Visually inspect substrate.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Install blinds on interior and exterior windows.

.2 Include centre brackets where necessary to prevent deflection of headrail.

.3 Adjust to provide for operation without binding.

.4 Use non corrosive metal fasteners for installation, concealed in final assembly.

3.3 ADJUSTING

.1 Adjust horizontal louvre blinds components for correct function and operation in accordance with manufacturer's written instructions.

.2 Lubricate moving parts to operate smoothly and fit accurately.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by horizontal louvre blinds installation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Manual, chain-operated, horizontal window roller shades for installation on bedroom windows.

1.2 RELATED SECTIONS

.1 Section 09 21 66 – Gypsum Board Assemblies.

1.3 SYSTEM DESCRIPTION

.1 Provide for infinite positioning of window shade.

.2 Noise reduction seals for sound isolation and absorption of mechanism noise.

.3 Shade Orientation: Shade cloth to roll at window side of roller.

.4 Degree of Openness: 0%, blackout.

.5 Provide for smooth and quiet operation.

1.4 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide manufacturer's data sheets describing components, accessories, dimensions, tolerances for window openings required, colours and textures.

.3 Shop Drawings: Indicate dimensions in relation to window jambs, operator details, top rail, corner conditions, anchorage details, hardware and accessories details, electrical operating mechanisms, connections and required clearances.

.4 Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the drawings and include opening sizes, key to typical mounting details.

.5 Samples:

.1 Submit one (1) samples of manufacturer’s standard fabric colour range for colour selection.

.2 Submit one (1) 300 mm long samples of each visible-to-view component indicating colour, surface texture and sheen.

1.5 WARRANTY

.1 Provide a five (5) year warranty to include coverage for failure to meet specified requirements.

1.6 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Obtain roller shades system through one source from a single manufacturer with a minimum of five (5) years documented experience.

.2 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience.

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Closeout Submittals.

Part 2 Products

2.1 COMPONENTS

.1 Horizontal Shade Band:

.1 Assembly: Fabric, internal bottom bar, roller tube, attachment of shade bands to roller tube.

.2 Fabric: Single thickness, opaque, 0.76 mm thick, non-ravelling vinyl fabric, woven from 0.46 mm diameter extruded vinyl/polyester yarn.

.1 Openness Factor: 0%, blackout.

.2 Colour: Selected from manufacturer's available range.

.2 Concealed Hembar: Continuous extruded aluminum bar for the entire width of shade.

.1 Hembar shall be heat sealed on all sides.

.2 Open ends will not be accepted.

.3 Shade Roller Tube: Extruded aluminum, diameter and wall thickness required to support shade fabric, with reinforced internal ribs to provide maximum span without tube deflection.

.4 Internal Tension Idler: Adjustable, to automatically control the amount of torque generated for constant smooth operation of the shade system, with automatic release during down-travel, and automatic engage during up-travel.

.5 Chain Drive: Heavy duty, commercial grade sprocket, a planetary gear assembly for increased performance, speed ratio, smoothness, and balance to the chain and shade assembly.

.1 Drive Mechanism: Provide positive mechanical engagement to shade roller tube. Friction fit connectors are not acceptable.

.2 Shade Hardware: Constructed of minimum 3.18 mm thick plated steel or heavier as required to support 150 percent of the full weight of each shade.

.3 Brake: shall be an over running clutch design which disengages to 90 percent during the raising and lowering of a shade. The brake shall withstand a pull force of 22 kg in the stopped position.

.4 Assembly shall be permanently lubricated. Products that require externally applied lubrication, or are not permanently lubricated are not acceptable.

.5 Operating Chain: No.10, heavy duty stainless steel bead chain, rated to minimum 40 kg load test.

.6 Chain Hold Down: To fully secure shade to chain holder.

.6 Mounting Brackets: 15 mm galvanized steel, snap on brackets for ceiling, wall, or recessed mount in ceiling, capable of supporting roller tube and fascia panel.

.7 Fascia: Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.

.1 Shall be able to be installed across two or more shade bands in one piece.

.2 Shall fully conceal brackets, shade roller and fabric on the tube.

.3 Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.

.4 Finish: Anodized.

.5 Size: Fascia to extend full width of window opening.

.1 If multiple lengths of fascia required breaks to occur at divisions of blinds.

2.2 FABRICATION

.1 Provide manual shade chain drive window shade, of:

.1 Tension activated lifting mechanism with multi-layer concentric constant tension.

.2 Lifting mechanism with a memory tension lock.

.3 Shade to not require re-tensioning after removal for cleaning.

.4 Internally free-floating mechanism along grooved non-corrosive shaft, and reversible for future alterations and maintenance.

.2 Factory assemble in a one piece container, closed on all four sides, with top, back, sides and bottom return of plastic injected-moulded end caps.

.3 Lifting mechanism to accommodate tension modules for maximum shade performance. Provide memory lock for tension modules to retain torque.

.4 Mounting detail: Head/jamb mounted within window frame.

Part 3 Execution

3.1 EXAMINATION

.1 Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

.2 Examine substrate and conditions for installation.

.3 Beginning of installation means acceptance of substrate and project conditions.

3.2 INSTALLATION

.1 Install blackout roller shades in bedroom windows.

.1 Refer to schedule.

.2 Install units and their accessories to manufacturer's instructions.

.3 Securely screw end plugs to conceal exposed cut aluminum of exterior hem bar.

.4 Securely anchor units plumb and level, using hardware and accessories to provide smooth operation without binding.

3.3 INSTALLATION TOLERANCES

.1 Maximum gap at window opening perimeter: 3.18 mm at opening perimeter, 6.35 mm between shades.

.2 Maximum offset from level: 3 mm over 1200 mm.

.3 Use manufacturer's edge clearance requirements for shades where the width-to-height ratio exceeds 1:3.

3.4 ADJUSTING

.1 Adjust units for smooth operation.

.2 Adjust shade and shade cloth to hang flat without waves, folds, or distortion.

.3 Replace any units or components which do not hang properly or operate smoothly.

3.5 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 Touch up damaged finishes and repair minor damage in a manner to eliminate evidence of repair. Remove and replace work that cannot be satisfactorily repaired.

.3 Clean exposed surfaces and edges/ends, including metal and shade cloth, using non-abrasive materials and methods recommended by manufacturer. Remove and replace work which cannot be satisfactorily cleaned.

3.6 CLOSEOUT ACTIVITIES

.1 Demonstration: Demonstrate operation method and instruct Owner's personnel in the proper operation and maintenance of the window shade assembly.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes common work results for fire suppression systems.

1.2 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.

1.3 DESCRIPTION OF WORK

.1 This Section pertains to the fire protection systems from the point of connection to the water main at the backflow prevention unit, including the backflow prevention unit.

.2 All equipment, elbows, fittings, nipples, drains, test connections and all accessory pipework for a complete and operational fire protection system is included in this Section of the work within the basic Tender price.

.3 No extra cost will be considered based on failure of Contractor to allow for all required equipment, piping and fittings. This shall include extra fittings and pipework as required during construction to avoid existing structure, ductwork or other obstacles whether shown on drawings or not.

1.4 SYSTEM DESIGN

.1 Arrange and pay for the services of a BC registered Professional Engineer. This Engineer shall provide all required engineering services related to the fire protection systems as indicated below.

.2 The Fire Protection Engineer shall:

.1 Produce the fire protection working shop drawings in CAD format. Drawings shall be of the same size as the Contract Drawings.

.2 Perform hydraulic calculations. Software shall meet NFPA calculation requirements.

.3 Seal all documents submitted for construction and permits.

.4 Assume full responsibility for the detailed fire protection system design, and submit Schedules for Detailed Design.

.5 Provide assistance to the Fire Protection Contractor as required.

.6 Witness sprinkler testing.

.7 Inspect the completed installation.

.8 On project completion, submit a sealed statutory declaration to the Departmental Representative stating that the fire protection system is installed in accordance with the fire protection engineer drawings, instructions and the regulatory requirements.

1.5 SUBMITTALS

.1 Shop Drawings:

.1 Shop drawings shall indicate all the information required by NFPA, and the Authority Having Jurisdiction.

.2 Indicate essential building construction features such as direction and size of concrete beams, partitions and lighting.

.3 Bring to the attention of the Departmental Representative any sprinkler head, pipe, valve or system component in a location different from where specifically shown on the project Fire Protection Drawings. These alternate locations shall be reviewed during the shop drawing review.

.4 Indicate piping and sprinkler head elevations, the sprinkler temperature rating, the spacing and types of hangers; seismic bracing details; drain test and flushing connections; type of sprinkler alarm; location and type of sprinkler control valve; and all other essential features of the piping system.

.5 Submit shop drawings to the Departmental Representative, which have been approved and stamped by the Authority Having Jurisdiction and sealed by the Fire Protection Engineer. Allow a minimum of three weeks for review by Departmental Representative. Submit a minimum of six [6] copies. Allow for resubmission(s) of drawings to reflect the Departmental Representative's review comments.

.6 Submit a copy of the sprinkler shop drawings for review to the Owner's insurance agency.

.7 Submit shop drawings for the following items:

.1 General:

.1 Fire protection sprinkler system.

.2 Fire department connections.

.3 Flow switches.

.4 Pressure switches.

.5 Supervisory switches.

.6 Valves, fittings and couplings.

.2 Wet sprinklers:

.1 Sprinkler heads and escutcheon plates.

.2 Riser manifolds.

.3 Alarm Valves.

.2 Record Drawings

.1 Provide Record Drawings. Record Drawings shall include revised CAD electronic drawings files and PDF electronic copies on CD, DVD, or flash drive.

.3 Closeout Submittals

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

1.6 SEISMIC PROTECTION

.1 The system shall be designed to post-disaster requirements.

.2 Supply and install sway-bracing hangers on fire protection systems in accordance with NFPA requirements. Generally, this shall apply to:

.1 All cross mains 50 mm [2"] and larger.

.2 All feed mains.

.3 Horizontal piping shall be 2-way bracing and vertical piping shall include 4-way bracing at the tops of all risers.

.4 On floor loops, sway-braces are also required at the corners of all loops.

Part 2 Products

2.1 HANGERS AND SUPPORTS

.1 All hangers and supports shall conform to the appropriate NFPA standards.

.2 Toggle hangers are unacceptable.

2.2 MISCELLANEOUS METALS RELATED TO FIRE PROTECTION SYSTEM

.1 All miscellaneous metal related to the fire protection systems including all metal back up plates and supports for all ceiling or wall supported equipment is part of this section of the work.

2.3 BACKFLOW PREVENTION STATIONS

.1 Backflow prevention stations for fire service shall be listed by Underwriters' Laboratories Canada (ULC).

.2 Double check valve (DCV) assembly complete with OS&Y Inlet and outlet valves.

Part 3 Execution

3.1 ACCESS DOORS

.1 Install at concealed sprinkler heads, unions, expansion joints, valves, control valves and special equipment.

.2 Locate access doors so that all concealed items are readily accessible for adjustment, operation and maintenance.

.3 Do not locate access doors in feature wall or ceiling construction without the prior approval of the Departmental Representative. Locate in service areas wherever possible.

.4 In concealed ceiling spaces containing upright heads and exposed supply piping below the ceiling, a hole around the sprinkler head riser large enough to allow passing the entire sprinkler head through the ceiling with an oversized escutcheon plate to cover the hole is an acceptable alternative to providing an access panel.

3.2 GRADING AND DRAINING OF PIPING

.1 Grade all fire protection piping so that it can be drained through drain cocks.

.2 All main drains shall be directed to the outside of the building wherever possible.

3.3 PIPING EXPANSION

.1 All piping systems, including all take-offs shall be so installed within the building that the piping and connected equipment will in no way be distorted by expansion, contraction or settling.

.2 If circumstances on the job require additional changes in direction from those shown on the drawings, the configuration shall be adjusted to suit at no extra cost.

.3 Anchors shall be installed where necessary to control expansion.

3.4 PIPE SLEEVES AND ESCUTCHEONS

.1 Supply and installation of pipe sleeves is included in this section of the specification. Refer to Section 23 0505 - Installation of Pipework.

3.5 BACKFLOW PREVENTION STATIONS

.1 Installation shall comply with CSA B64.10.

.2 Test all backflow prevention devices and submit signed declarations to that effect prior to Substantial Completion.

3.6 MISCELLANEOUS METALS RELATING TO FIRE PROTECTION SYSTEMS

.1 Prime coat after fabrication with two coats of red primer.

.2 See separate division of specification for finish painting requirements.

3.7 TESTS AND INSPECTION

.1 Furnish all labour, materials, instruments, etc. necessary for all required tests. All work shall be subject to inspection by the local plumbing inspector or design authority. At least forty-eight (48) hours notice shall be given in advance of making the required tests.

.2 Tests on Fire Protection systems shall consist of pressure tests and shall conform to standards of Inspection Authority as listed in separate clauses of this section of specification. Test connections for fire pumps and siamese connection lines shall also be hydrostatically tested.

.3 Responsibility for completing "Contractor's Materials and Test Certificate" in accordance with inspection authority test procedure is included in this section.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials and installation for wet pipe fire protection and sprinkler systems for heated areas.

.2 This is a performance specification clarified in this Section and on the Project sprinkler drawings to establish a minimum standard of equipment, design and installation.

.3 The specification describes the basic system and design required but not all of the details or components.

.4 This Trade shall have the experience to design the sprinkler system. Materials and work necessary to achieve the specification requirements will not be considered an extra to the Contract.

.5 The system design shall meet the requirements of the building, based on the Contract Drawings and Specifications.

.6 Provide hydraulically calculated suppression systems for the entire building project to NFPA 13.

1.2 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.

1.3 ENGINEERING DESIGN CRITERIA

.1 The design criteria for the building shall be:

.1 Make water distribution uniform throughout the area in which sprinkler heads will open.

.2 The design criteria for the building shall be:

.1 Make water distribution uniform throughout the area in which sprinkler heads will open.

.2 Light hazard occupancy with a density of 4.1 (L/min)/m2 [0.10 gpm/ft2] for the most remote 278 m2 [3000 ft2] in all unless indicated otherwise.

.3 Ordinary Hazard Group 2 occupancy with a density of 8.2 (L/min)/m2 [0.2 gpm/ft2] for the most remote 139 m2 [1500 ft2] in the following areas.

.4 Include allowance in hydraulic calculations for outside hose streams.

.3 Include with each system materials, accessories, and equipment inside and outside building to provide each system complete and ready for use.

.4 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings. Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.

Part 2 Products

2.1 GENERAL

.1 Devices and equipment for fire protection service shall be to NFPA 13, ULC listed, FM approved for use in wet pipe sprinkler systems.

.2 All piping shall be to NFPA 13.

2.2 PIPE

.1 Black steel pipe to ASTM A53 and ANSI Standard B36.10:

.1 Schedule 40 standard wall pipe for pressure to 2070 kPa [300 psi].

.2 Schedule 30 pipe in sizes 200 mm [8"] and larger for pressure to 2070 kPa [300 psi].

.3 "Light wall" pipe for welded or roll grooved pipe only shall conform to the following wall thicknesses:

.1 Up to 125 mm [5"]: Schedule 10.

.2 150 mm [6"]: 3.40 mm [0.134"].

.3 200 to 250 mm [8” to 10"]: 4.78 mm [0.188"].

.2 High strength low carbon steel Tube: to ASTM A795, grade A, type E. Pipe with mechanical roll grooved or locking lug type fittings.

.3 Steel tubing: to ASTM A135, A795 or A53. Schedule 5 pipe with cold drawn steel fittings with integral "O" rings.

.4 Copper tube, drawn, seamless to ASTM B75, seamless water tube to ASTM B88, wrought seamless and alloy type to ASTM B251, brazing filler metal (Classification BcuP-3 or BcuP-4) to AWS A5.8 and solder 95/5 (tin/antimony grade 95TA) solder to ASTM B32 of wall thickness type ‘K’, ‘L’, or ‘M’.

2.3 FITTINGS AND JOINTS

.1 Compatible with piping material.

.2 Suitable for maximum pressures in system but not less than 1210 kPa [175 psi] working pressure.

.3 Welding fittings shall comply with the latest edition of the following standards: ANSI B16.9 and B16.25 and ASTM A234.

.4 All grooved end fittings shall be of one manufacturer.

.5 Flexible connections shall be ULC listed.

2.4 VALVES

.1 Gate - 1210 kPa [175 psi]: Open by counter-clockwise rotation.

.2 Butterfly - 1210 kPa [175 psi]:

.1 12 mm [1/2”] - 50 mm [2”]: Slow closing with indicator and integral supervisory switch.

.2 50 mm [2”] - 75 mm [3”]: Groove end with integral supervisory switch.

.3 100 mm [4”] - 200 mm [8”]: Groove end with integral supervisory switch.

.3 Check - 1210 kPa [175 psi]: Provide spool piece to ensure full check valve opening where adjacent an alarm or gate valve.

.4 Drain Valve: 25 mm [1”] complete with hose end adaptor, cap and chain.

.5 Solenoid valves shall be ULC listed.

.6 Groove end valves shall be used wherever groove end pipe is employed. All groove end valves shall be of one manufacturer.

2.5 SPRINKLER HEADS

.1 Sprinkler heads shall be ULC listed for use in occupancies and hazard type for which they are installed.

.2 Temperature rating on fusible links shall suit the specific hazard they serve.

.3 Provide wire guards on sprinkler heads in the Workshop, Mechanical and Electrical Rooms and in areas susceptible to mechanical damage.

.4 Provide sheet metal sheets, to prevent cold soldering of sprinkler head, as indicated on drawings and as required by NFPA 13. Colour of shields as per Architect’s direction. Size and install as per NFPA 13 requirements.

.5 Sprinkler deflector elevations shall be within 12 mm [1/2"] of each other in the same room.

.6 All sprinklers except where noted shall be in satin chrome finish with polished chrome escutcheons except natural bronze finish may be used in the following areas:

.1 Mechanical rooms

.2 Electrical rooms

.3 Concealed spaces

.4 Service spaces

.7 Escutcheons used on T-bar ceilings shall allow ceiling panel removal without removing the sprinkler head.

.8 Escutcheons shall be provided by the sprinkler manufacturer to suit the model of sprinkler and maintain the approvals.

.9 Wet System sprinkler head finishes:

.1 Pendent Concealed: - Concealed glass bulb, brass body, custom painted cover plate, T-bar White.

.2 Horizontal Sidewall (finished areas) - Glass bulb, chrome plate finish.

.3 Horizontal Sidewall (unfinished areas) - Glass bulb, brass body.

.10 Baffles: Baffles to be located and installed as per NFPA 13 requirements.

2.6 ALARM CHECK VALVES

.1 1210 kPa [175 psi]:

.2 Manufacturers alarm check valve trim.

2.7 WATER MOTOR ALARMS

.1 Provide alarms approved weatherproof and guarded type, to sound locally on flow of water in each corresponding sprinkler system.

.2 Mount alarms on outside of outer walls of each building at location as directed.

.3 Provide separate drain piping directly to exterior of building.

.4 20 mm [3/4”] inlet connections, 25 mm [1”] drain.

.5 Red enamel finish.

2.8 SUPERVISORY SWITCHES

.1 Mechanically attached to valve body.

.2 24V DC contact rating unless noted otherwise.

.3 Two sets of SPDT contacts or one set normally open and one set normally closed contacts.

.4 Looped cable devices are not acceptable

.5 Approved valves with integral supervisors are acceptable alternatives.

2.9 FLOW SWITCHES

.1 ULC listed for mounting pipe size in sprinkler system.

.2 24V DC contact rating unless noted otherwise.

.3 Two sets of SPDT contacts or one set normally open and one set normally closed contacts.

.4 Time delay feature and paddle indicator.

.5 Provide a sight glass in accordance with NFPA with drain connection.

2.10 PRESSURE SWITCHES

.1 24V DC contact rating unless noted otherwise.

.2 Two sets of SPDT contacts or one set normally open and one set normally closed contacts.

2.11 FIRE DEPARTMENT CONNECTION (SIAMESE CONNECTION)

.1 Flush mount type with double clapper valves.

.2 Integral ball drip.

.3 Escutcheon marked "sprinklers" with plugs and chains.

.4 Bronze finish.

.5 Confirm threads with local fire department.

2.12 PIPE HANGERS

.1 All hangers and supports shall be ULC listed for fire protection services.

.2 Toggle hangers are unacceptable.

2.13 PRESSURE GAUGES

.1 Maximum limit of not less than twice normal working pressure at point where installed.

2.14 ESCUTCHEONS AND PLATES

.1 Provide on pipes passing through walls, partitions, floors and ceilings in finished areas.

.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. 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.

2.15 SPARE SPRINKLERS AND PARTS CABINET

.1 Provide metal cabinet with extra sprinkler heads and sprinkler head wrench in the Mechanical Room.

.2 Spare Sprinkler Heads

.1 Number and types of extra sprinkler heads as specified in NFPA 13 (minimum 6 heads).

.2 Provide a minimum of two spare sprinklers for each type installed.

.3 Provide a special sprinkler wrench to be kept in the cabinet for maintenance use in the removal and installation of sprinklers.

2.16 SIGNS

.1 Attach properly lettered and approved metal signs to each valve and alarm device to ANSI/NFPA 13.

.2 Permanently fix hydraulic design data nameplates to riser of each system.

Part 3 Execution

3.1 DESIGN

.1 Perform on site flow tests to obtain required water data.

.2 Hydraulically calculate the sprinkler systems in accordance with this specification and NFPA 13 requirements.

.3 Hydraulic calculations shall be based upon the flow test data, which has been reduced by 10%.

.4 Hydraulic calculations shall not be based on the largest room area as indicated in NFPA 13.

.5 Confirm with the Departmental Representative any interpretive aspects of the listed Codes, Standards or approvals that differ from the Contract Documents. Such interpretations shall not be used without the Departmental Representative's approval.

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 datasheet.

3.3 INSTALLATION

.1 Install, inspect and test to acceptance in accordance with NFPA 13.

.2 All grooved end valves, fittings and couplings etc. shall be of one manufacturer.

.3 Pipe Installation:

- .1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.
- .2 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.
- .3 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.
- .4 Inspect piping before placing into position.
- .5 All welding shall be performed off site using welding fittings. Field welding is not permitted.
- .6 Adjust sprinkler piping up or down if conflicts occur between structure, lighting, electrical, plumbing piping or ductwork.

.7 Arrange piping routing to provide sufficient access to mechanical and electrical equipment.

.8 A wrap around hanger or other approved means shall be provided at the end of each branch sprinkler line to prevent excessive movement.

.4 Flow Switches:

.1 Install flow switches with a tight pipe drain connection to open discharge outside the building at grade level or other acceptable discharge point as approved by the Departmental Representative.

.2 Install a 25 mm [1"] flow switch test drain valve with a 25 mm [1"] brass ball plug. Immediately downstream of flow switch for each flow switch. This is in addition to the normal inspector's test connections required by NFPA.

.3 Locate flow switches where shown.

.5 Supervisory Switches - Valves:

.1 Install supervisory switches on all valves supplying the sprinkler and standpipe system inside the building. Switches shall be compatible with the valve supervised.

.6 Sprinkler Heads:

.1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13.

.2 All sprinkler head locations shall be coordinated with the Architectural and Electrical ceiling plans and with existing site conditions.

.3 Do not install any sprinkler heads until all piping systems have been flushed of all contaminants.

.4 Provide dry pendent or sidewall heads on all wet sprinkler systems where heads are piped into cold areas.

.7 Provide inspector's test valves and pipes at all remote points in the system.

.8 Flanged fittings shall be used at valve stations and at fire department connections.

.9 Install monitored valves and flow switches for all zones. Electrical Division shall wire monitored valves and flow switches to the central fire alarm system. Identify which portion of the system each valve controls.

.10 Protection of Electrical Equipment from Water:

.1 Responsibility for water damage to electrical equipment from the sprinkler system installation whether due to testing or leakage shall be the responsibility of this section.

.2 Provide and install in this section of the work minimum 20 gauge metal protective hoods, individually located over all electrical equipment susceptible to water damage upon release of sprinkler heads in electrical areas. Such electrical equipment shall include all transformers and all equipment with ventilation grilles that will allow water entry into the electrical equipment. Protective hoods shall be sloped to allow shedding for water, shall project horizontally beyond the equipment perimeter and shall not be mounted on the equipment unless prior approval is obtained from the electrical authorities. Holes through protective hoods shall be sealed watertight.

3.4 FLUSHING

.1 Provide flushing connections on all sprinkler systems.

.2 Flush all underground mains and Siamese supply lines before connecting to sprinkler systems.

.3 Flush all pipelines so effluent is clear and free of debris.

.4 Rate of flushing flows shall be as per NFPA 13 requirements.

.5 Provide proper drainage for this flushing operation.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials, requirements and installation for plumbing pumps.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings for all pumps and accessories.

.2 Indicate, at minimum, the following:

.1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.

.2 Wiring and schematic diagrams.

.3 Dimensions and recommended installation.

.4 Pump performance and efficiency curves showing point of operation.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

Part 2 Products

2.1 DOMESTIC HOT WATER RECIRCULATION PUMP (P-DHWR)

.1 CSA approved, in-line circulator pump suitable for a maximum working pressure of 860 kPa [125 psig] and maximum temperature of 107°C [225°F].

.2 Suitable for domestic water.

.3 Casing: Stainless steel or bronze construction radially split, with Flanged or union connections. Supplied with matching companion flanges.

.4 Maintenance-free construction.

.5 Impellor: Stainless steel or bronze construction.

.6 Shaft: Stainless steel with bronze sleeve bearing, integral thrust collar.

.7 Seal Assembly: Mechanical.

.8 Motor: Resilient mounted, drip proof, sleeve bearing.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Recirculation Pump:

.1 Coordinate the manual disconnect requirement with the Electrical Division.

3.3 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Check power supply.

.2 Check starter protective devices.

.2 Start-up, check for proper and safe operation.

.3 Check settings and operation of hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials, requirements and installation for copper domestic water service used in the following:

.1 Hard drawn copper domestic hot and cold water services inside building.

.2 Plastic incoming domestic water service.

.3 This section applies to domestic hot water, domestic cold water and domestic hot water recirculation systems inside the building to a point 900 mm [36"] upstream of the point where the water service passes through or under the perimeter foundation of the building.

.4 Refer to Section 21 0505 - Common Work Results for Fire Protection as the domestic water supply and the supply to the fire protection systems are combined into one incoming supply service.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit a list of all valves, manufacturer and model number, of all types used.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

Part 2 Products

2.1 PIPING

.1 Pipe and fittings below ground:

.1 75 mm [3”] and smaller.

.1 Type 'K' seamless soft copper tubing to ASTM B88.

.2 Copper pipe to ASTM B42.

.3 Piping shall be protected in a polyethylene sleeve.

.2 100 mm [4”] and larger.

.1 PVC Pressure Water Pipe, elastomeric seal gasket joints, working pressure 1380 kPa [200 psi] to AWWA C900 and CSA B137.

.2 Pipe and fittings above ground:

.1 Copper tubing type 'L' hard drawn, seamless, CSA or Warnock Hersey certified to ASTM B88.

.2 Copper pipe type ‘L’ to ASTM B42.

.3 Ductile iron pipe (min. Class 54) to AWWA C151 for cut grooved fittings.

2.2 FITTINGS

.1 Bronze pipe flanges and flanged fittings to ANSI/ASME B16.24.

.2 Cast bronze threaded fittings to ANSI/ASME B16.15.

.3 Cast copper, solder type to ANSI/ASME B16.18.

.4 Wrought copper and copper alloy, solder type to ANSI/ASME B16.22.

.5 All below ground fittings shall be provided with integral tie lugs. Weld on lugs are not acceptable.

.6 Cast bronze or wrought copper roll grooved pressure fittings with grooved mechanical pipe connector couplings complete with angle bolt pad to provide a rigid joint, with Victaulic style of ‘flush seal’ gaskets to CSA B242.

.7 Compression fittings shall conform to ANSI B16.

.8 Mechanical formed tee fittings to ASME, ANSI B31.5C.

.9 Ductile iron pressure coupling to ANSI/AWWA C-606 for cut grooved ductile iron pressure pipe with synthetic rubber gasket, plated carbon steel bolts, alkyd phenolic primer and protective enamel finish.

2.3 PIPE JOINTS

.1 All flanged adaptors used on copper to iron connections shall be brass.

.2 Rubber gaskets, latex-free 1.6 mm thick: to AWWA C111.

.3 Bolts, nuts, hex head and washers to ASTM A307, heavy series.

.4 Solders and fluxes shall not contain lead.

.5 Teflon tape for threaded joints.

.6 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket.

2.4 VALVES - GENERAL

.1 All valves shall be rated for 860 kPa [125 psi] service unless noted otherwise.

2.5 GLOBE VALVES

.1 50 mm [2”] and smaller: Bronze body with bronze or stainless steel trim, bronze bevel or composition disc.

.2 65 mm [2-1/2”] and larger: Rising stem, outside screw and yoke, flanged ends, cast iron body, bronze or cast iron bevel-type disc, bronze trim or stainless steel.

.3 Balance Type: 30 mm [1-1/4”] and smaller:

.1 Domestic hot water recirculation applications

.2 Locksheild type for maximum system temperature, bronze body and trim, Teflon or PTFE disc, union connection, 690 kPa 100psi rating.

.4 Balance Type: 40 mm [1-1/2”] and larger:

.1 Plug type for maximum system temperature, wrench adjustable stop, semi-steel body, resilient plug seals, EPT or RS 55.

.2 Threaded ends, flanged on 65 mm [2-1/2”] and larger.

2.6 BALL VALVES

.1 50 mm [2”] and smaller: Lever handle, class 150, brass two piece body, blow-out proof stem, PTFE seats, brass ball chrome plated.

2.7 AUTOMATIC FLOW CONTROL VALVES

.1 Domestic hot water recirculation mains applications.

.2 Piston in a housing type.

.3 Factory set all stainless steel cartridge.

.4 Body Material: forged or cast brass.

.5 Seals: BPDM O-rings.

.6 Body Tappings: 1/4” NPT with P/T test valves.

.7 Flow control to within plus/minus five percent.

.8 Five year manufacturers warranty

2.8 DRAIN VALVES

.1 Ball type with bronze body and trim, suitable for maximum system operating pressure, c/w cap and chain.

2.9 SWING CHECK VALVES

.1 50 mm [2”] and smaller: Bronze body, bronze or stainless steel disc holder and Teflon disc.

.2 65 mm [2-1/2”] and larger: Cast iron body, bronze or cast iron swing disc, bronze or stainless steel trim to MSS-SP-71, Class 125, 860 kPa.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Building Code and local Authority Having Jurisdiction.

.2 Install pipe work in accordance with Section 23 05 05, Installation of Pipework, supplemented as specified herein.

.3 Assemble piping using fittings manufactured to ANSI standards.

.4 Install DCW piping below and away from DHW and DHWR and other hot piping so as to maintain temperature of cold water as low as possible.

.5 Concealed water piping to plumbing fixtures and fittings shall utilize cast brass drop ear elbows and tees as required to rigidly secure the piping. Provide blocking within the concealed space and secure the drop ear fittings using brass screws.

.6 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

.7 Pipe Joints:

.1 Install dielectric couplings at copper piping connections to plumbing equipment of dissimilar material.

.2 At the water service entry to the building provide a flexible standard sleeve transition coupling with stainless steel nuts and bolts, below grade at the building perimeter excavation.

.8 Buried tubing:

.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.

.2 Bend tubing without crimping or constriction. Minimize use of fittings.

3.2 VALVES

.1 Disassemble all sweat end valves prior to soldering. Where disassembly is not feasible special attention shall be given not to damage valve during soldering.

.2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

.3 Isolation Valves:

.1 Install isolation valves as indicated on the drawings and in the following locations:

.1 At each main branch supply point.

.2 At each group of plumbing fixtures.

.3 At each plumbing fixture individually.

.4 At each piece of equipment.

.5 As required by the Codes and Bylaws governing this project.

.4 Balancing Valves:

.1 Install balancing valves as indicated on the drawings and on the hot water recirculating branch connections to return mains.

.5 Automatic Flow Control Valves:

.1 Install automatic flow control valves as indicated on the drawings and in the hot water recirculating mains.

.2 Valve flows shall be set as follows:

.1 12 mm [1/2”] - 0.14 l/sec [2.18 gpm]

.2 20 mm [3/4”] - 0.29 l/sec [4.53 gpm]

.3 25 mm [1”] - 0.49 l/sec [7.72 gpm]

.3 All valves shall operate with a nominal control range differential of 6.9 kPa [1 psi]

.6 Drain Valves:

.1 Provide a hose-end adapter with cast brass cap and chain on all drain valves not piped directly to drain.

.2 Drain valves shall be 20 mm [3/4”] minimum but line size up to 40 mm [1-1/2”] unless noted otherwise.

3.3 PRESSURE TESTS

.1 Perform a hydrostatic test on all domestic water piping at 1380 kPa [200 psi] for 8 hours.

.2 Comply with all requirements of the Building Code and local Authority Having Jurisdiction.

3.4 FLUSHING AND CLEANING

.1 Flush entire system for 8 hours. Ensure outlets flushed for 2 hours.

.2 Let stand for 24 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean to potable water guidelines.

.3 Let system flush for additional 2 hours, then draw off another sample for testing.

3.5 DISINFECTION

.1 Flush out, disinfect and rinse system to the Building Code and local Authority Having Jurisdiction

.2 Upon completion, provide laboratory test reports on water quality for Departmental Representative’s review.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes the installation of drainage waste and vent piping.

.2 Building perimeter drainage system.

.3 Building sanitary waste and vent piping to 1 m [3 ft] beyond the foundation of the building.

.4 Building storm drainage piping and rainwater leaders to 1 m [3 ft] beyond the foundation of the building.

1.2 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.

Part 2 Products

2.1 PERIMETER DRAINS

.1 Pipe and Fittings:

- .1 Polyvinyl Chloride (PVC) series 100 perforated building sewer pipe and fittings conforming to CSA-B137.3.
- .2 Perimeter drainage shall be nominal diameter 150 mm [6”] unless noted otherwise on the contract drawings.

.2 Cleanouts:

- .1 Cleanouts shall be 100 mm [4”] minimum on pipe up to 150 mm [6”].
- .2 For exterior cleanouts in traveled areas: Heavy-duty epoxy coated cast iron construction with a 12 mm [1/2"] thick cover, terminated at grade.
- .3 For exterior cleanouts in landscaped areas:
  - .1 Cleanouts shall be 100 mm [4”] minimum.
  - .2 ABS or PVC cleanout terminated at grade.
- .4 For interior cleanouts refer to Section 22 4201 - Plumbing Specialties and Accessories.

.3 Drain Gravel: 100% granular material of 14 mm to 17 mm [9/16" to 11/16"] diameter.

.4 Pea Gravel: 100% granular material of 12 mm to 25 mm [1/2" to 1"] diameter.

.5 Filter Cloth: 2.2 mm [0.0866”] thick polyester filter cloth.

2.2 DRAIN, WASTE AND VENT PIPE AND FITTINGS

.1 Below ground:

.1 Class 4000 cast iron mechanical joint pipe to CAN/CSA-B70.

.1 Mechanical joints: Neoprene or butyl rubber compression gaskets to ASTM C564 or CAN/CSA-B70.

.2 Stainless steel clamps.

.2 Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Drain Waste and Vent Pipe Fittings.

.1 Conforming to CSA/CAN 3-B181.1 and ASTM F628.

.2 Joints: solvent weld to ASTM D2235.

.3 Additional requirements:

.1 Plastic (ABS) piping where used underground shall adapt to approved non-plastic material prior to penetration above the building slab; where such above slab piping will not be concealed within drywall or a non-flammable plumbing fixture.

.2 Pressure waste piping from pumping stations and other equipment shall be pressure piping and fittings as specified for domestic water.

.2 Above ground:

.1 DWV copper drainage pipe to ASTM B306

.1 Cast brass or wrought copper drainage pattern fittings to CAN/CSA-B125.

.2 Solder: 50/50 Sn/Pb recessed solder joints to ASTM B32.

.2 Class 4000 cast iron mechanical joint pipe to CAN/CSA-B70.

.1 Mechanical joints (up to 200 mm [8"]): Neoprene or butyl rubber compression gaskets to ASTM C564 or CAN/CSA-B70.

.2 Stainless steel clamps.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Building Code and local Authority Having Jurisdiction.

.2 Install pipe work in accordance with Section 23 05 05, Installation of Pipework, supplemented as specified herein.

3.2 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

.3 Tests on the sanitary waste and storm drainage systems shall consist of hydraulic pressure testing of 3000 mm [118"] for 8 hours.

□

3.3 PERIMETER DRAINS

.1 Any unstable areas or unsatisfactory conditions i.e. poor compaction slopes shall be reported to the Departmental Representative.

.2 Ensure foundation wall waterproofing has been inspected and approved by the Departmental Representative.

.3 Installation of perimeter drainage shall not begin until subgrade and foundation wall deficiencies have been corrected.

.4 Pipe and Fitting Installation:

- .1 Prior to pipe placement ensure sub-grade complies with the required drainage pattern.
- .2 Pipe joints spigots shall face downstream of flow.
- .3 Install so perforations are on the bottom half of the pipe.
- .4 Use manufacturer's recommended fittings only.
- .5 Shims to establish pipe slope is not acceptable.
- .6 Pipe bedding shall be drain gravel to 150 mm [6"] minimum below pipe, 300 mm [12"] minimum above pipe and 500 mm [20"] wide. Backfill above the drain gravel shall be 300 mm [12”] minimum above the drain gravel.
- .7 Perforated pipe and drain gravel shall be covered with filter cloth.
- .8 Connect drainage piping to the sediment sump.
- .9 Take note that the water from the dewatering of the site by pumping or gravity shall not be permitted to drain directly into the permanent sewers. Only clear, clean water may be discharged and only into the storm sewer.
- .10 Pipe and fittings cast in walls shall be schedule 40 ABS or cast iron.
- .11 Prior to backfilling, the Departmental Representative shall approve the piping installation.

.5 Cleanouts:

- .1 Provide cleanouts as indicated on the contract drawings, at the start of all runs and at 15 m [50 ft] intervals.
- .2 Cleanouts will be rejected if not accessible for maintenance.
- .3 Location of all cleanouts shall be clearly recorded on the as-built drawings.
- .4 Cleanouts shall be brought to grade and set in an irrigation type box in landscaped areas or in traveled areas anchored in a concrete collar.
- .5 Cleanouts on interior piping shall be as specified under Section 22 4201 - Plumbing Specialties and Accessories.

.6 Excavation and Backfill:

- .1 Excavation for perimeter drainage shall be a minimum of 150 mm [6"] below invert of pipe unless otherwise stated in the contract document.
- .2 Backfill material above the pipe shall be drain gravel and above drain gravel shall be pea gravel.

□

.7 Inspection:

.1 Do not backfill until pipe grade and alignment is inspected and accepted by the Departmental Representative.

.2 Provide a minimum of 2 working days notice to the Departmental Representative for field inspections prior to backfilling.

END OF SECTION

□

Part 1 General

1.1 SUMMARY

.1 Section includes the installation of domestic water heaters.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings for all domestic water heaters and tanks.

.2 Closeout Submittals

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

1.4 WARRANTY

.1 Provide an extended warranty for the Work of this Section, over and above the 12 month warranty period, to the number of years specified for each product.

Part 2 Products

2.1 TANKS - DOMESTIC HOT WATER - ELECTRIC (T-DHW)

.1 Commercial grade porcelainized glass-lined tank, electric hot water heater, CSA certified, maximum hydrostatic working pressure 1034 kPa [150 psi].

.2 Rigid R-16 polyurethane foam, mineral wool or fibreglass insulation.

.3 Enamelled steel jacket.

.4 Fully automatic controls, manually adjustable thermostat, 120 volt control circuit with fused transformer.

.5 3 year extended warranty certificate.

2.2 EXPANSION TANK (ET-DHW)

.1 Provide an expansion tank for protection of the hot water tank complete with dielectric coupling on connections.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's recommendations, Building Code and local Authority Having Jurisdiction.

.2 Install the domestic hot water tank in the location shown on the drawings.

.3 Provide design and install seismic restraint of tanks to post-disaster requirements.

.4 Install a drain valve in the tank drain connection and pipe to drain.

.5 Pipe relief valve at full size to drain.

.6 Provide vacuum relief valve on cold water supply.

.7 Provide isolating valves at tank connections.

.8 Provide a drain pan piped to drain for installations other than slab on grade.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials and installation for plumbing specialties and accessories.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings for all plumbing specialties and accessories.

.2 Closeout Submittals

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

Part 2 Products

2.1 FLOOR DRAINS

.1 All floor drains to CSA B79 and shall be complete with:

.1 Trap primer connections.

.2 Other than slab-on-grade drains: Flashings, 300 mm [12"] beyond edge of cast iron fittings, securely fix to membrane clamp.

.2 Floor Drain FD1 (surface membrane floors):

.1 Cast iron floor drain with surface clamping ring and grate and 175 mm [7"] diameter nickel bronze strainer. Cast iron non-plated parts to be epoxy coated.

.3 Floor Drain FD2 (funnel):

.1 Cast iron floor drain with secondary drainage flange and 130 mm [5"] diameter adjustable nickel bronze strainer with 102 mm x 230 mm [4 " x 9"] nickel bronze oval funnel. Cast iron non-plated parts to be epoxy coated.

2.2 TRENCH DRAIN

.1 Pre-sloped trench drain system, 160 mm [6-1/4”] wide.

.2 Sections of polymer concrete with tongue-and-groove ends to allow for precise fit and straight channel runs.

.3 Minimum Slope: 0.65 percent.

.4 Grate locking devices.

□

.5 Systems shall be complete with installation chairs or integral rebar supports.

.6 Each trench section shall be complete with end caps and drainage sump (bottom outlet).

.7 Trench Drain TD1:

.1 Load rating: DIN C - Heavy duty vehicular traffic - distributed loading of 250 kN [56,200 lbs].

.2 Depth: Shallow as possible drain at one end.

.3 Grate: Cast iron slotted.

2.3 CLEANOUTS

.1 Cleanouts shall be full size for pipe sizes up to 100 mm [4"] and not less than 100 mm [4"] on larger sizes complete with a clamping collar other than outside or slab on grade type.

.2 Cleanouts in inside finished areas shall all be round. Covers shall be scoriated.

.3 All interior of building covers shall be nickel bronze.

.4 Pipe manufacturers' cleanouts are acceptable for vertical installation at the base of soil and waste stacks or rainwater leaders only.

.5 Make cleanouts with Barrett type fitting that has a bolted cover plate and gasket, fitting that has a threaded plug, or a cleanout ferrule that is installed in a wye or extended wye.

.6 Outside area cleanouts shall be of heavy duty construction, with scoriated cast iron covers.

.7 Unfinished concrete area cleanouts shall be of heavy duty construction and have a fully exposed scoriated cover.

.8 Lino or lino tiled area cleanouts shall have the centre portion of cover recessed to receive a piece of tile that matches the adjoining tile.

.9 Tile floor area cleanouts shall have a fully exposed nickel bronze scoriated cover.

2.4 WALL HYDRANTS AND HOSE BIBBS

.1 Hose Bibb (HB1) - Interior Use:

.1 Faucet with hose end spout in chrome plate finish.

.2 Removable "T" type lockshield handle.

.3 Chrome plated vacuum breaker on outlet.

.2 Hose Bibb (HB2) - Exterior Non-freeze:

.1 Encased non-freeze self-draining wall hydrant with integral vacuum breaker. Nickel bronze box and cover.

□

2.5 WATER HAMMER ARRESTORS

.1 Piston style with stainless steel casing or bellows style with welded stainless steel nesting bellows, ANSI approved and PDI certified.

2.6 BACKFLOW PREVENTION STATIONS

.1 Backflow preventers shall meet the requirements of the latest edition of CAN/CSA - B64.10-01/CAN/CSA-B64.10.1-01 Manual for the Selection and Installation of Backflow Prevention Devices/Manual for the Maintenance and Field Testing of Backflow Prevention Devices.

.2 Double check valve (DCV), factory assembled station complete with inlet and outlet isolation valves to CSA B64.

.3 Reduced pressure principle device (RPPD) c/w inlet and outlet isolation valves, double check valve, differential relief outlet to CSA B64.10.

2.7 PRESSURE REGULATORS

.1 12 mm to 50 mm [1/2" to 2"], 860 kPa [125 psi] rating.

2.8 VACUUM BREAKERS

.1 For atmospheric applications provide a unit size to match the pipe size it serves.

.2 Pressure Applications:

.1 12 mm [1/2"] unit on pipe sizes up to 25 mm [1"].

.2 20 mm [3/4"] unit on pipe sizes up to 40 mm [1-1/2"].

.3 25 mm [1"] unit on pipe sizes up to 75 mm [3"].

.4 Vacuum breakers shall meet the requirements of the latest edition of CAN/CSA B64.

.3 Atmospheric Applications:

.1 Unit size to match the pipe size it serves.

.2 Vacuum breakers shall meet the requirements of the latest edition of CAN/CSA B64.

2.9 VACUUM RELIEF VALVES

.1 20 mm [3/4"] and smaller: Domestic hot water tank relief.

2.10 TEMPERATURE AND PRESSURE RELIEF VALVES

.1 All water exposed parts shall be stainless steel or copper.

.2 A.S.M.E. rated.

□

2.11 WATER METERS

.1 Solid state, digital, electromagnetic flow measurement system with a hermetically sealed, glass covered, electronic register.

.2 Thermal plastic external casing. The systems shall have the size and direction of water flow through the system imprinted on the external housing.

.3 The measuring element shall be made of a noncorrosive, lead-free glass fiber reinforced, composite alloy material. The measuring element will have no moving parts and will be specific for each size.

.4 Provide an interface with the meter so that it may be monitored by the EMCS (Energy Monitoring and Control System).

2.12 TRAP SEAL PRIMING DEVICES - EMCS

.1 Provide trap priming stations as required to properly prime all traps. Coordinate requirements with the Controls Contractor.

.2 Trap priming stations shall be located in the Mechanical Room or Janitor’s Room and be composed of:

.1 Isolation valve connected to the domestic cold water system.

.2 RPBD piped to drain.

.3 12 mm [1/2”] solenoid valve.

.4 Distribution header with needle valves connected to the traps of the floor drains.

.3 Solenoid Valves:

.1 Slow closing solenoid valve, forged brass body, buna "N" disc, stainless steel parts, enclosure to suit environmental conditions, UL and CSA approved, 24 volt.

.4 Open the solenoid valve on a regular schedule to provide trap priming to the drains. Refer to Division 25, EMCS.

2.13 STRAINERS

.1 50 mm [2”] and smaller: Threaded ends, bronze body, 'Y' pattern, 304 stainless steel screen, 1034 kPa [150 psi] rating.

Part 3 Execution

3.1 INSTALLATION

.1 Comply and install to manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

.2 Install in accordance with Building Code and local Authority Having Jurisdiction.

□

3.2 FLANGES AND UNIONS

.1 Provide an all bronze union with ground seat for pipe sizes 50 mm [2”] and smaller.

.2 Provide grooved or flanged connections for pipe sizes 65 mm [2-1/2”] and larger.

.3 Union and flanges shall be 1035 kPa [150 psi] rated.

.4 Provide on connections to all fixtures and appliances, at pumps, control valves and reducing valves.

3.3 FLOOR DRAINS

.1 Install floor drains set low to provide proper drainage.

.2 Water piping from trap primer to floor drain to be protected in a polyethylene sleeve where buried below slab.

3.4 CLEANOUTS

.1 Install cleanouts at the following locations:

.1 Building drain leaving building on the upstream side of exterior wall.

.2 Changes of direction of more than 45 degrees in drainage piping.

.3 Nominally horizontal branch or building drain at intervals of not more than 15 m [50 ft] for 100 mm [4"] and smaller and 30 m [100 ft] for 150 mm [6"] and larger.

.4 Fixture drain of a sink, kitchen piping or grease waste piping at intervals not exceeding 7.5 m [25 ft] for pipe all sizes.

.5 Base of soil or waste stacks and rainwater leaders.

.6 As called for by the Building Code.

.2 Cleanouts which are located low on walls shall be located 75 mm [3"] minimum above the top of the baseboard or minimum 200 mm [8"] above finished floor level where there is no baseboard.

.3 Cleanouts shall be coordinated with all millwork and with all other obstructions, shall be placed in readily accessible locations and shall have sufficient clearance for rodding and cleaning.

.4 Extend cleanouts to the finished floor or wall unless exposed in a basement room, pipe tunnel or accessible crawlspace.

.5 Cleanouts in wet floor areas shall extend above the floor in walls or be provided with gasketted waterproofed tops.

.6 Cleanouts passing through a waterproofed floor or a slab on grade shall possess a clamping collar which shall be clamped to the floor membrane or lead flashing.

.7 Cleanouts on outside drains shall be brought to grade and anchored in a concrete collar or in a plastic box in landscaped areas.

□

3.5 SAFES, FLASHING AND VENT TERMINALS

.1 All cleanouts passing through walls or floors subject to hydrostatic pressure and waterproofed by means other than a membrane shall be provided with clamping collars and flashings of 25 kg/m2 [5 lb/ft2] lead.

.2 Supply and fix 25 kg/m2 [5 lb/ft2] sheet lead flashings to all cleanouts and floor drains. Securely fix to flashing clamps and extend 300 mm [12"] beyond edge of cast iron fittings.

.3 Vent flashing minimum 450 x 450 mm [18" x 18"] base dimension shall terminate flush with the top of 300 mm [12"] high vent pipe and the gap between the flashing and pipe shall be closed to a 25 kg/m2 [5 lb/ft2] separate lead cap 75 mm [3"] high. The main flashing shall not be turned over the pipe.

.4 Coordinate with the Roofing Contractor.

3.6 WALL HYDRANTS AND HOSE BIBBS

.1 Provide operating keys to the Departmental Representative prior to substantial completion.

.2 Provide an accessible isolation valve upstream of hose bibbs.

.3 Provide access panel as required.

3.7 WATER HAMMER ARRESTORS

.1 Comply with the Plumbing and Drainage Institute PD1-WH-201 sizing procedures.

.2 Install on branch lines serving all quick closing devices i.e. flush valves, solenoid valves, self-closing faucets and appliances.

3.8 BACKFLOW PREVENTION STATION

.1 Installation shall comply with the manual "Cross Connection Control" First Edition, published by the BC Section of the American Water Works Association.

.2 Provide backflow preventers at each fixture or appliance where domestic water contamination can occur.

.3 Locate at suitable height to allow maintenance.

.4 Test all backflow prevention devices and submit a signed declaration to that effect prior to substantial completion.

.5 A Certified Backflow Preventer Tester shall submit a test report to the CRD Cross Connection Control Officer.

.6 Locate the Backflow Preventer Test Report tag on or immediately adjacent to the backflow prevention assembly. The Test Report shall indicate the required details of the assembly and initial testing information.

□

3.9 PRESSURE REDUCING VALVES

.1 Pressure reducing valve stations minimum requirements:

.1 Pressure reducing valve, strainer, shut off valve on the inlet and outlet.

.2 A bypass around the pressure reducing valve with a globe valve at one size less than the incoming service size and pressure gauges upstream and down stream of the valve.

.2 Set the pressure-reducing valve serving the main incoming water service to an initial setting of 415 kPa [65 psi].

3.10 VACUUM BREAKER

.1 Installation shall comply with the manual "Cross Connection Control" First Edition, published by the BC Section of the American Water Works Association.

.2 Provide vacuum breakers at each fixture or appliance where domestic water contamination can occur.

.3 Atmospheric vacuum breakers shall be installed a minimum of 300 mm [12”] above the flood level rim of the fixture or appliance served.

.4 Pressure vacuum breakers shall be installed with a drain pan and enclosure piped to drain.

.5 Test all vacuum breakers and submit a signed declaration to that effect prior to substantial completion.

3.11 TRAP SEAL PRIMING DEVICES - EMCS

.1 In the Mechanical Room provide a solenoid control valve(s) (CV-TRAP PRIME1, CV-TRAP PRIME2, etc.) off the domestic cold water main. Install manifold(s) and solenoid valve(s) in an area that are readily accessible.

.2 Pipe from the control valve(s) to priming manifold(s).

.3 Pipe from the priming manifold(s) to all sanitary floor drains. Provide isolation valves on all piping to trap seal primers.

.4 Refer to Section 25 9001 EMCS: SEQUENCE OF OPERATION for trap priming control.

3.12 WATER METERS

.1 Install water meter as indicated.

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3.13 TESTING AND ADJUSTING

.1 General:

.1 Tests on the sanitary waste and storm drainage systems shall consist of hydraulic pressure testing of 3000 mm [118"] for 8 hours.

.2 Floor Drains:

.1 Verify operation of trap seal primer.
.2 Prime, using trap primer. Adjust flow rate to suit site conditions.
.3 Check operations of flushing features.
.4 Check security, accessibility, and removability of strainer.
.5 Clean out baskets.

.3 Vacuum Breakers, Backflow Preventers:

.1 Test tightness, accessibility for O&M of cover and of valve.
.2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
.3 Verify visibility of discharge from open ports.

.4 Access Doors:

.1 Verify size and location relative to items to be accessed.

.5 Cleanouts:

.1 Verify covers are gas-tight, secure, yet readily removable.

.6 Water Hammer Arrestors:

.1 Verify proper installation of correct type of water hammer arrester.

.7 Hose Bibbs:

.1 Verify complete drainage, freeze protection.
.2 Verify operation of vacuum breakers.

.8 Pressure regulators, PRV assemblies:

.1 Adjust settings to suit locations, flow rates, pressure conditions.

END OF SECTION

□

Part 1 General

1.1 SUMMARY

.1 Section includes the supply and installation of plumbing fixtures and trim.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings for all plumbing fixtures.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

1.4 FINISHES

.1 Stainless steel fixtures shall be satin and/or mirror finish or a combination thereof.

.2 Exposed plumbing fittings and metal work shall be extra heavy chrome plated.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Provide brand new fixtures and fittings, CSA approved, free from flaws and blemishes. All surfaces shall be clear, smooth, bright and be dimensionally stable.

.2 Accessible fixtures and fittings shall comply with the Building Code, Building Requirements for Persons with Disabilities, unless otherwise noted.

.3 Fixtures of the same type shall be the product of one manufacturer.

.4 Fittings of the same type shall be the product of one manufacturer.

.5 Protect all fixtures and fittings against use and damaged during construction.

.6 Be responsible for plumbing rough-in of appliances or equipment supplied by others.

.7 Provide an individual stop or valve on each domestic water service serving a plumbing fixture.

2.2 SINKS

.1 S1 - Single Compartment, Ledge-Back, 200 mm [8”] Deep

.1 Stainless steel single compartment sink with undercoating, basket strainer, tail piece, clamps, confirm punchings. Compartment size: 410 x 460 x 200 mm [16" x 18" x 8"], overall size: 520 x 510 mm [20-1/2" x 20"].

.2 Singe lever handle, 2-function pull-down kitchen faucets for deck mounting, solid brass fabricated body. 400mm [15-11/16"] high, 240 mm [9 1/2"] gooseneck spout that swings 360°, quick connect hoses. Pull-down wand operates in an aerated or spray mode. Integral check valves in sprayer. 6.8 L/min at 414 kPa [1.80 gpm at 60 psi].

.3 40 mm [1-1/2”] cast brass P-trap. Provide dishwasher trap.

.4 12 mm [1/2”] hot and cold supplies with stops.

.2 S2 - Double Compartment, Ledge-Back, 200 mm [8”] Deep

.1 Stainless steel double compartment sink with undercoating, basket strainer, tail piece, clamps, confirm punchings. Compartment size: 410 x 360 x 200 mm [16" x 14" x 8"], overall size: 520 x 790 mm [20-1/2" x 31-1/4"].

.2 Singe lever handle, 2-function pull-down kitchen faucets for deck mounting, solid brass fabricated body. 400mm [15-11/16"] high, 240 mm [9 1/2"] gooseneck spout that swings 360°, quick connect hoses. Pull-down wand operates in an aerated or spray mode. Integral check valves in sprayer. 6.8 L/min at 414 kPa [1.80 gpm at 60 psi].

.3 40 mm [1-1/2”] cast brass P-trap. Provide dishwasher trap.

.4 12 mm [1/2”] hot and cold supplies with stops.

.3 S3 - Single Compartment, Ledge-Back, 250 mm [10”] Deep

.1 Stainless steel single compartment sink with undercoating, basket strainer, tail piece, clamps, confirm punchings. Compartment size: 410 x 460 x 220 mm [16" x 18" x 10"], overall size: 520 x 510 mm [20-1/8" x 20-9/16"].

.2 Singe lever handle, 2-function pull-down kitchen faucets for deck mounting, solid brass fabricated body. 400mm [15-11/16"] high, 240 mm [9 1/2"] gooseneck spout that swings 360°, quick connect hoses. Pull-down wand operates in an aerated or spray mode. Integral check valves in sprayer. 6.8 L/min at 414 kPa [1.80 gpm at 60 psi].

.3 40 mm [1-1/2”] cast brass P-trap.

.4 12 mm [1/2”] hot and cold supplies with stops.

2.3 DISHWASHER

.1 Install each dishwasher.

.2 Pipe 12 mm [1/2”] hot with stop to dishwasher.

.3 Pipe drain to sink dishwasher drain connection.

2.4 JANITORS SINKS

.1 SS1 - Mop Sink

.1 609 x 609 mm [24”x24”] moulded stone mop service basin with stainless steel drain.

.2 Wall faucets with stops, vacuum breakers, cross handles.

.3 Fiat vinyl bumper guards, mop holder, hose and holder.

.4 Provide hot hose bibb above basin for service cart.

.5 12 mm hot and cold water supply.

2.5 CLOTHES WASHER

.1 CW1

.1 Automatic washing machine valve with supply and drain

.2 Duplex protector valve with 50 mm [2”] drain. Unit shall be recessed and mounted to facilitate easy access.

.3 50 mm [2”] P-trap with standpipe.

.4 12 mm [1/2”] hot and cold with stops.

2.6 CHAIR CARRIERS

.1 Factory manufactured floor-mounted carrier systems for all wall-mounted fixtures.

Part 3 Execution

3.1 FIXTURE INSTALLATION

.1 Provide all hangers, supports, brackets, reinforcement, steel back-up plates and floor flanges to set fixtures level and square. Mount fixtures so that 90 kg [200 lb.] mass will not loosen or distort mounting.

.2 Sinks

.1 Double waste fittings for sinks shall be a double sanitary tee.

.2 Control handles for all two handle mixing faucets shall be positioned with the cold control on the right and the hot control on the left.

.3 Faucets shall be complete with nuts and tailpieces.

.4 Plastic control handles and spouts are unacceptable.

.5 Sink P-traps shall be complete with either a cleanout or possess slip joint connections.

3.2 FIXTURE TRIM HOLES OR PUNCHINGS

.1 Fixtures shall not contain more trim holes or punchings than necessary for the specified trim.

.2 Drilling holes and cutting cutouts for the installation of plumbing fixture trim and faucets including the forming of recesses or grooves in the underside of countertops or the provision of extension pieces for faucet nipples is the responsibility of the General Contractor.

3.3 WALLS AND FLOORS

.1 Fixtures mounted on glazed tile surfaces shall have ground faces to finished surface.

.2 Where plumbing fixtures come in contact with walls and floors, joints shall be sealed with anti-mildew building sealant, made watertight and beaded smooth in a neat and workmanlike manner.

3.4 ACCESSIBLE FIXTURES

.1 Confirm mounting heights with the Architect.

3.5 CLEAN-UP

.1 All fixtures and trim shall be left in a clean and polished condition.

3.6 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:

- .1 Adjust water flow rate to design flow rates.
- .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Checks:

- .1 Aerators: operation, cleanliness.
- .2 Vacuum breakers, backflow preventers: operation under all conditions.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes the supply and installation of washroom fixtures and trim.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings for all washroom fixtures.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

1.4 FINISHES

.1 Vitreous china fixtures shall be white unless otherwise noted.

.2 Exposed plumbing fittings and metal work shall be extra heavy chrome plated.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Provide brand new fixtures and fittings, CSA approved, free from flaws and blemishes. All surfaces shall be clear, smooth, bright and be dimensionally stable.

.2 Accessible fixtures and fittings shall comply with the Building Code, Building Requirements for Persons with Disabilities, unless otherwise noted.

.3 Fixtures of the same type shall be the product of one manufacturer.

.4 Fittings of the same type shall be the product of one manufacturer.

.5 Protect all fixtures and fittings against use and damaged during construction.

.6 Be responsible for plumbing rough-in of appliances or equipment supplied by others.

.7 Provide an individual stop or valve on each domestic water service serving a plumbing fixture.

2.2 WATER CLOSETS

.1 WC1 - Floor Mounted, Tank Ultra-low Flush

.1 Close coupled, vitreous china, 4.8 lpf [1.28 gpf].

.2 White open front seat less cover. Seat shall be compatible with the fixture.

.3 12 mm [1/2”] cold water chrome plated supply with stop.

.2 WC2 - Floor Mounted, Tank Ultra-low Flush, Accessible

.1 Close coupled, vitreous china, ADA accessible model complete with bolt down lid, 4.8 lpf [1.28 gpf].

.2 White open front seat less cover. Seat shall be compatible with the fixture.

.3 12 mm [1/2”] cold water chrome plated supply with stop.

2.3 LAVATORY BASINS

.1 LB1 - Counter Mounted

.1 Counter mounted, self-rimming, oval, vitreous china lavatory basin with front overflow, mounting assembly, punching to suit trim. Basin size: 394 x 289 mm [15-1/2" x 11-1/4"], overall size: 518 x 286 mm [20-3/8" x 17-3/4"].

.2 Singe lever handle, chrome plated metal construction, 5.7 l/min at 414 kPa [1.5 gpm at 60 psi].

.3 Chrome plated open grid strainer.

.4 Chrome plated P-trap.

.5 12 mm [1/2”] hot and cold water chrome plated supplies with stop.

.2 LB2 - Wall Mounted

.1 Wall hung, vitreous china lavatory basin with rear overflow, floor-mounted carrier, punching to suit trim. Basin size: 588 x 374 mm [23-1/8" x 14-3/4"], overall size: 660 x 545 mm [26" x 21-1/2"].

.2 Singe lever handle, chrome plated metal construction, 5.7 l/min at 414 kPa [1.5 gpm at 60 psi].

.3 Chrome plated open grid strainer.

.4 Chrome plated P-trap.

.5 12 mm [1/2”] hot and cold water chrome plated supplies with stop.

.3 LB3 - Wall Mounted, Accessible

.1 Wall hung, accessible, vitreous china lavatory basin with front overflow, floor-mounted carrier, punching to suit trim. Basin size: 380 x 388 mm [15" x 15-1/4"], overall size: 520 x 685 mm [20-1/2" x 27"].

.2 Singe lever handle, chrome plated metal construction, 5.7 l/min at 414 kPa [1.5 gpm at 60 psi].

.3 Chrome plated offset waste cast brass P.O. plug.

.4 Chrome plated P-trap with P-trap insulation.

.5 12 mm [1/2”] hot and cold water chrome plated supplies with stop.

2.4 P-TRAP INSULATION

.1 Provide P-trap insulation to all offset wastes include also supply covers.

2.5 CHAIR CARRIERS

.1 Factory manufactured floor-mounted carrier systems for wall-mounted fixtures.

Part 3 Execution

3.1 FIXTURE INSTALLATION

.1 Provide all hangers, supports, brackets, reinforcement, steel back-up plates and floor flanges to set fixtures level and square. Mount fixtures so that 90 kg [200 lb.] mass will not loosen or distort mounting.

.2 Water Closets:

.1 Provide brass or cast iron floor flanges with lead stub or mechanical joint connections and wax seals.

.3 Lavatories:

.1 Faucets shall be complete with nuts and tailpieces.

.2 Plastic control handles and spouts are unacceptable.

.3 Lavatory P-traps shall be complete with either a cleanout or possess slip joint connections.

3.2 FIXTURE TRIM HOLES OR PUNCHINGS

.1 Fixtures shall not contain more trim holes or punchings than necessary for the specified trim.

3.3 WALLS AND FLOORS

.1 Fixtures mounted on glazed tile surfaces shall have ground faces to finished surface.

.2 Where plumbing fixtures come in contact with walls and floors, joints shall be sealed with anti-mildew building sealant, made watertight and beaded smooth in a neat and workmanlike manner.

3.4 ACCESSIBLE FIXTURES

.1 Offset P-traps shall be installed with the run of the P-trap parallel to and close to wall.

.2 Supplies on accessible lavatories shall be offset to accommodate the offset P-trap.

.3 Offset waste lines and P-traps at all accessible fixtures shall be insulated with 12 mm [1/2"] of fiberglass insulation and finished with a polyvinyl chloride jacket in a neat and workmanlike manner.

3.5 CLEAN-UP

.1 All fixtures and trim shall be left in a clean and polished condition.

3.6 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:

.1 Adjust water flow rate to design flow rates.

.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Checks:

.1 Water closets: flushing action.

.2 Aerators: operation, cleanliness.

.3 Vacuum breakers, backflow preventers: operation under all conditions.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes the supply and installation of showers.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings for all showers.

.2 Closeout Submittals

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

1.4 FINISHES

.1 Exposed plumbing fittings and metal work shall be extra heavy chrome plated.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Provide brand new fixtures and fittings, CSA approved, free from flaws and blemishes. All surfaces shall be clear, smooth, bright and be dimensionally stable.

.2 Accessible fixtures and fittings shall comply with the Building Code, Building Requirements for Persons with Disabilities, unless otherwise noted.

.3 Fixtures of the same type shall be the product of one manufacturer.

.4 Fittings of the same type shall be the product of one manufacturer.

.5 Protect all fixtures and fittings against use and damaged during construction.

.6 Be responsible for plumbing rough-in of appliances or equipment supplied by others.

.7 Provide an individual stop or valve on each domestic water service serving a plumbing fixture.

2.2 SHOWERS

.1 SH1 - Shower Stall

.1 Acrylic shower stall with high gloss surface, upper and lower toiletry shelves, clear acrylic grab bar, 114 mm [4.5”] high threshold, light kit. 2286 mm high x 1308 wide x 927 mm deep [90” x 51-1/2” x 36-1/2”]. Confirm handing.

.2 Pressure balance shower valve with lever handle, showerhead, integral stops and checks. 0.95 l/s at 414 kPa [1.5 gpm at 60 psi].

.3 Stainless steel or brass drain. P-trap.

.4 12 mm [1/2”] hot and cold supply.

Part 3 Execution

3.1 FIXTURE TRIM HOLES OR PUNCHINGS

.1 Fixtures shall not contain more trim holes or punchings than necessary for the specified trim.

.2 Drilling holes and cutting cutouts for the installation of plumbing fixture trim and faucets including the forming of recesses or grooves in the underside of countertops or the provision of extension pieces for faucet nipples is the responsibility of the General Contractor.

3.2 WALLS AND FLOORS

.1 Where plumbing fixtures come in contact with walls and floors, joints shall be sealed with anti-mildew building sealant, made watertight and beaded smooth in a neat and workmanlike manner.

3.3 CLEAN-UP

.1 All fixtures and trim shall be left in a clean and polished condition.

3.4 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:

.1 Adjust water flow rate to design flow rates.

.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Thermostatic controls: Verify temperature settings, operation of control, limit and safety controls.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes common work results for Divisions 21, 22, 23 and 25.

1.2 RELATED SECTIONS

.1 These common works apply for Divisions 21, 22, 23 and 25. Should there be any conflict between any requirement of this Section and the General Conditions, Supplements and Amendments, the more stringent shall apply.

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

1.3 DEFINITIONS

.1 Provide means supply and install.

.2 Work means material and labour.

.3 PSPC means Public Services and Procurement Canada (Public Works and Government Services Canada).

.4 Departmental Representative means PSPC or their designate.

.5 DFO means Fisheries and Oceans Canada.

.6 The specification sections are titled and divided under the headings of General, Products and Execution and under clause headings. These titles and headings are for general organization only and shall in no way limit or restrict the specification requirements.

1.4 GENERAL SCOPE

.1 Provide the work indicated in the Contract Documents and as required to provide complete, tested and fully operational systems including all work not normally indicated but necessary for a complete and operational installation.

.2 The Contractor is expected to be experienced and competent and knowledgeable about the trades and applicable codes, ordinances and industry standards and shall perform the work accordingly, on schedule and fully coordinated with all other trades.

.3 Except where precisely indicated, the Contract Documents are diagrammatic and generally indicating the scope of work, general arrangement, and establishing minimum quality and performance requirements. Where there are conflicting requirements the Contractor shall allow for and provide the better quality and/or greater quantity unless the conflicting requirements are interpreted otherwise in writing by the Departmental Representative.

.4 The Contract Documents for this Division are an integral part of the complete Contract Documents for the project and will be interpreted in conjunction with all other Divisions.

1.5 CODES, REGULATIONS AND STANDARDS

.1 Mechanical work shall conform to the latest versions of the following Codes, Regulations and Standards, and all other Codes in effect at the time of award of Contract, and any others having jurisdiction. The revision of each Code and Standard and their amendments

which are adopted by the Authority Having Jurisdiction shall apply unless otherwise specified in the Contract Documents:

.1 Bylaws
  .1 Local Building Bylaws.
.2 Canadian Standards Association
  .1 CSA Standard B52 Mechanical Refrigeration Code.
.3 National Fire Codes
  .1 NFPA 10 Portable Fire Extinguishers.
  .2 NFPA 13 Sprinkler System Installation.
.4 National Research Council of Canada
  .1 National Building Code of Canada (2015).
  .2 National Fire Code of Canada (2015).
.5 Province of British Columbia
  .1 BC Industrial Health & Safety Regulations, WorkSafeBC.
.6 SMACNA Publications
  .1 HVAC Duct Construction Standards.
  .2 Fire, Smoke and Radiation Damper Installation Guide.
  .3 Guidelines for seismic restraints of mechanical systems.

.2 All specification references to the Building Code refer to the National Building Code.

1.6 PERMITS AND FEES

.1 Obtain all required permits and pay all fees including service connection fees as applicable to the mechanical work. Comply with all Provincial, Municipal and other legal regulations and bylaws applicable to the work.

.2 Arrange for inspection of all Work by the Authorities Having Jurisdiction. On completion of the Work, furnish final unconditional certificates of approval by the inspecting authorities.

1.7 DRAWINGS AND MEASUREMENTS

.1 Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of work. They are not detailed installation drawings.

.2 Do not scale the drawings.

.3 Obtain accurate dimensions from the Architectural and Structural Drawings.

.4 Consult the Architectural drawings for exact locations of fixtures and equipment. Obtain this information from the Departmental Representative where not obtainable from the drawings.

.5 Field measure as required to size and locate services and equipment.

1.8 SITE VISIT

.1 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 where the necessary information could have reasonably been obtained by an examination of the site.

1.9 PRICE BREAKDOWN

.1 Within ten [10] days of award of the Contract provide to the Departmental Representative a price breakdown in the following categories as applicable. This information is for the Departmental Representative's use in evaluating progress claims. All work shall be included and the component prices shall add up to the total Contract price.

.2 Price breakdown categories:

- .1 Start-Up
- .2 Site Work:
  - .1 Material
  - .2 Labour
- .3 Building Underground Services:
  - .1 Material
  - .2 Labour
- .4 Plumbing Piping Systems:
  - .1 Material
  - .2 Labour
- .5 Plumbing Fixtures
  - .1 Material
- .6 Fire Protection Systems
  - .1 Material
  - .2 Labour
- .7 HVAC Piping Systems:
  - .1 Material
  - .2 Labour
- .8 Piping Systems Equipment
  - .1 Material
- .9 Piping Insulation
- .10 Ductwork
  - .1 Material
  - .2 Labour
- .11 Air Handling Equipment
  - .1 Material
- .12 Ductwork Insulation
- .13 Controls:
  - .1 Material
  - .2 Labour
- .14 Commissioning, Testing, Balancing
- .15 Contract Close Out (Record Drawings, Maintenance Manuals, Submissions).
- .16 Total Mechanical Contract Price.

1.10 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 and submit written information for any extended warranties specified.

1.11 WORKMANSHIP

.1 Workmanship shall be in accordance with well-established practice and with standards accepted and recognized by the Departmental Representative and the Trade.

.2 The Departmental Representative may reject any work not conforming to the Contract Documents or to accepted standards of performance, quietness of operation, finish or appearance.

.3 Employ only tradesmen with valid Provincial Trade Qualification Certificates. Tradesmen shall perform only work permitted by their certificates. Certificates shall be available for review by the Departmental Representative.

1.12 ACCESSIBILITY

.1 All work shall be readily accessible for adjustment, operation and maintenance. Supply access doors where required in building surfaces for installation by building trades.

1.13 SUBMITTALS

.1 Shop Drawings:

.1 Process:

.1 Shop drawings/product data shall be submitted as elsewhere specified.

.2 Shop drawings/product data shall be reviewed, signed and processed as described in the General Conditions and as further described by the Mechanical Contractors Association of British Columbia.

.2 Content:

.1 Shop drawings submitted title sheet (Mechanical Contractors Association of British Columbia).

.2 Data shall be specific and technical.

.3 Identify each piece of equipment.

.4 Information shall include all scheduled data.

.5 Advertising literature will be rejected.

.6 The project shall be identified on each document.

.7 Information shall be given in S.I. units consistent with the system of units in the Contract Documents.

.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 Capacity and performance characteristics indicated on performance curves for fans and pumps.

.4 Sound Power Data, where requested.

.5 Detailed drawings of bases, supports and anchor bolts.

.6 Control explanation and internal wiring diagrams for packaged equipment.

.7 Electrical control system drawings.

.8 Interlock wiring control schematic diagrams including details of all component parts in order that the function of each is displayed.

.9 A written description of control sequences relating to the schematic diagrams.

.9 Clearly indicate selected options and accessories. Cross out any items that do not apply. Add any additional specified features such as finishes, high temperature seals, etc.

.3 Format:

.1 Black line print 216 mm x 280 mm [8-1/2" x 11"] or 280 mm x 430 mm [11" x 17"].

.2 An assembly of related components, e.g. grilles, registers and diffusers or radiation with sheet metal cabinets, etc. between covers with the contents [identified by model number] listed on the front cover with item identification numbers.

.3 A brochure for plumbing fixtures between covers with the contents named with model numbers listed on the front cover with item identification numbers

.4 Number of copies: Provide a minimum of 3 copies for the Departmental Representative.

.5 Coordination: Where mechanical equipment requires electrical connections, power or other services, the shop drawings shall also be circulated through the Electrical Contractor prior to submission to the Departmental Representative.

.6 Keep one (1) copy of shop drawings and product data, on site, available for reference

.7 Review or non-review of shop drawings does not alter the requirements of the equipment and materials provided to conform to the specification.

.2 Closeout Submittals:

.1 Operation and Maintenance Manuals

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

.2 Employ the Balancing Agency to prepare the manuals.

.3 Allow sufficient time to provide the final reviewed manuals to the Departmental Representative before Substantial Performance.

.4 Provide one draft copy of the manuals to the Departmental Representative for review. Make all required changes and resubmit to the Departmental Representative. Repeat until accepted. Then submit the following, identical to the accepted copy, to the Departmental Representative:

.1 Four (4) hard copies – organized in binders, refer to below.

.2 Two (2) PDF electronic copies of full binder contents on CD, DVD, or flash drive.

.5 Obtain a receipt and send a copy to the Departmental Representative. Allow ten days for the first submittal review by the Departmental Representative and seven days for each subsequent review.

.6 If the manuals are not accepted and submitted to the Departmental Representative by the time of Substantial Performance, submit at

Substantial Performance a draft copy to the Departmental Representative with clear indication that it is a draft copy, not a final copy, for interim use by the Departmental Representative. When the final copies are submitted to the Departmental Representative, retrieve the draft copy and modify it to match the other final copies.

.7 Manual hard copies in suitably sized 3-ring binder with suitable label with all required materials inside.

.8 Provide an index and tab each section.

.9 The manual shall include:

.1 Layman's description of all systems and their operation.

.2 List of local source of supply.

.3 Maintenance, lubrication and filter schedules.

.4 Air balance report.

.5 Water balance report.

.6 Commissioning report.

.7 Copy of any required approvals, certifications, acceptance by Authorities Having Jurisdiction.

.8 All shop drawings.

.9 Manufacturer’s operating and maintenance literature and wiring and control diagrams.

.2 Site Records:

.1 Keep a set of contract prints on site for the sole purpose of keeping an up-to-date record marked in red of the installation of the mechanical work and site services where they vary from the drawings.

.2 Changes for all mechanical work and piped site service trades, including sketches for Change Orders and Site Instructions shall be kept on this set of drawings.

.3 For all buried new services and all existing services exposed by the work indicate the inverts and dimensioned locations at all connections and changes in direction.

.4 Services shall not be buried or concealed until the Record Drawings are up-to-date for the services.

.5 All inaccessible concealed services shall be accurately located.

.6 Minor changes in the routing of services within a space which are readily observable and obvious after all construction is complete, need not be recorded.

.7 Identify each drawing in lower right hand corner in letters at least 10 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" and under this add the Contractor’s name, an authorized signature and the date.

.8 Submit the prints for review by the Departmental Representative. Make any additional changes identified by the Departmental Representative including returning to the site if necessary to make measurements and/or to confirm installation locations and details. Resubmit to the Departmental Representative.

.3 Record Drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Upon completion of the Departmental Representative's review, submit final Record Drawings to the Departmental Representative. Final record drawings shall include revised CAD files and one set of PDF files to be prepared by a qualified draftsperson to the same standards as the original drawings.

1.14 DIMENSIONS AND UNITS

.1 The Contract Documents are generally in metric units and in places are followed by non-metric equivalents in square brackets.

.2 Generally the conversions for the equivalents are not exact but close enough that both are sufficiently accurate to be used.

.3 Many sizes or capacities shown are an indication of a nominal size, not an exact dimension, and these are as generally understood by the trade.

.4 Pipe sizes are nominal pipe sizes. Neither the metric size in mm or the often used Imperial sizes in inches are either equal to the inside or outside diameter of the pipe; they are used as follows to be equivalent to the NPS sizes (Nominal Pipe Size).

.5 Duct sizes are intended to be the actual size shown. However, some duct products are premanufactured in standard sizes or a sheet metal shop may be set up to work in standard sizes (generally Imperial based sizes) in which case a size shown in metric shall be soft converted to the Imperial inch size which is slightly larger.

.6 Sheet metal thickness is shown in gauges (ga) only as it is not generally referred to in its metric or Imperial thickness.

.7 Equipment dimensions are nominal sizes but are close to actual size. A 600 x 600 diffuser shall be close to 600 x 600 mm in overall dimension but where it is in a T-bar grid ceiling it shall be sized to lay in the grid whether it is a metric grid at 600 mm centres or an Imperial grid at 609 mm centres. A 600 x 600 mm surface mounted diffuser will be larger overall than 600 x 600 mm depending on the flange width.

1.15 DESIGN FOR SEISMIC EVENTS

.1 This building is a post-disaster building. All hangers and supports for mechanical systems shall be designed by the Seismic Engineer to maintain the systems and equipment in service after a seismic event. Refer to Section 23 05 48 Vibration and Seismic Controls for HVAC Piping and Equipment.

.2 The Seismic Engineer shall design all supports and hangers to withstand seismic events of the magnitude prescribed for the area in the Building Code for a post-disaster building.

Part 2 Products

2.1 MAINTENANCE

.1 Obtain signed receipt from the Departmental Representative when spare parts are handed over.

.2 Provide the following spare parts:

.1 One set of matched V-belts for each V-belt drive.

.2 Provide two (2) sets of filter media (for each filter) or filter bank installed - one for installation and one for hand over to the Departmental Representative as a spare.

2.2 PRODUCT QUALIFICATION

.1 Multiple items of equipment material of the same type shall be of the same manufacturer.

.2 Install and test all equipment and material in accordance with the detailed instructions and recommendations of the manufacturer.

.3 A visible nameplate shall indicate manufacturer's name, model number, serial number, capacity data, electrical characteristics and approval stamps.

2.3 ASBESTOS

.1 All material/products provided shall be free of asbestos.

2.4 ACCESS DOORS

.1 Provide in accordance with Section 08 31 00 - Access Doors and Panels.

2.5 MISCELLANEOUS METAL

.1 Be responsible for all miscellaneous steel work relative to the mechanical work of the Specifications, including but not limited to:

.1 Support of equipment.

.2 Hanging, supporting, anchoring, guiding and related work as it applies to piping, ductwork and mechanical equipment.

.3 Earthquake restraint devices.

.2 All exterior miscellaneous steel shall be hot-dipped galvanized.

.3 All steelwork not galvanized shall be prime and undercoat painted ready for finish under Painting Division. On galvanized materials that are subsequently welded apply galvicon. Refer to drawings for details.

2.6 ELECTRIC MOTORS

.1 Provide premium efficiency motors for mechanical equipment as specified. Motors efficiencies shall be as measured by IEEE Standard 112 Method B.

.2 Unless noted otherwise, provide open drip-proof, ball bearing, continuous duty motors of EEMAC class B, suitable for 40°C [104°F] ambient and for 40°C [72°F] temperature rise, for all mechanical equipment.

.3 Motors shall have standard voltage ratings consistent with the project distribution voltages. Motors less than 1/2 HP to be 120 volt, 60 cycle, single-phase power. Motors 1/2 HP and larger to be 3 phase power and for the scheduled voltage.

.4 All motors to be standard 1800 RPM unless specifically scheduled otherwise.

.5 Provide all motors with terminal boxes, suitable for power connections.

.6 Provide screw adjustable bases on all belt connected motors.

.7 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.

.8 Motors exposed to outdoor temperature to be lubricated with lubricants suitable for operation at 6°C [11°F] below the lowest temperature recorded by ASHRAE or the Climatic Information (Building Code), for the location in which they are installed.

.9 Motor bearings shall be factory lubricated suitable for two years continual operation without additional lubricant.

.10 Submit data of test method used, with shop drawings, when motor efficiencies are called for.

.11 Unless otherwise noted starters and protection devices will be included under the Electrical Division of the Specification.

.12 Assist Electrical Division to ensure proper connection, correct thermal overload protection and correct motor controls.

.13 Where starters are included in this Division as an integral part of packaged equipment, they shall contain thermal overload protection in all ungrounded lines.

.14 Equipment, which has more than one voltage rating, shall be fed from a single power source through a disconnect switch.

.15 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.

Part 3 Execution

3.1 COORDINATION

.1 Examine all Contract Drawings to verify space and headroom limitations for the required work. Coordinate the work with all trades and modify without changing the design intent to facilitate a satisfactory installation. Make no changes to the design intent involving extra cost without the Departmental Representative's prior 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 are only shown diagrammatically, the pipes and ductwork shall be installed in such a way as to conserve headroom 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 unless indicated otherwise.

.3 Work out jointly all interference problems on the site and coordinate all work before fabricating, or installing any material or equipment. No consideration of payment will be made for additional work due to fabricating or installing materials before a coordination issue was identified and resolved. Where necessary produce interference drawings showing exact locations of mechanical equipment within service areas, shafts and the ceiling space. Ensure that all materials and equipment fit into the allotted spaces and that all equipment can be properly serviced and replaced, if and when required. Advise the Departmental Representative of space problems before fabricating, or installing any material or equipment. Demonstrate to the Departmental Representative on completion of

the work that all equipment installed can be properly, safely serviced and replaced, if and when required.

3.2 CONCEALMENT

.1 Conceal all tubing, piping, ductwork and conduit in partitions, walls, crawlspaces, and ceiling spaces, unless otherwise noted.

.2 Do not install tubing, piping and conduit in outside walls or roof construction unless specifically directed, in which case, make provision to ensure that the building insulation is between them and the outside face of the building.

3.3 PROTECTION OF WORK

.1 Protect equipment and materials, stored or installed, from the weather, moisture, dust and physical damage.

.2 Mask machined surfaces. Secure temporary covers over equipment openings and open ends of piping, ductwork and conduits, as required to keep them clean.

.3 Rusting, pitting or physical damage will be cause for rejecting equipment.

.4 Make good damaged or marred factory finish.

.5 Air systems must have air filters installed before fans are operated. Air filters must be clean at Substantial Completion.

3.4 EQUIPMENT INSTALLATION

.1 Provide unions and flanges to permit equipment maintenance, disassembly or removal, to minimize disturbance to piping and duct systems and to avoid 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 Align equipment, rectangular cleanouts and similar items with building lines wherever possible.

.5 Ensure that equipment does not transmit noise or vibration to other parts of the building as a result of poor installation practices.

3.5 PIPING EXPANSION

.1 Install piping with all necessary changes of direction, expansion loops, anchors and guides to prevent overstressing the piping and equipment piping connections from thermal expansion and contraction.

.2 Expansion loops shall be of all welded construction with long radius elbows and be located between anchors. Cold spring 50% of maximum calculated expansion.

.3 Anchors shall be fabricated from mild steel plate and structural steel sections, in accordance with ANSI B.31.

3.6 ANCHORS AND TEMPLATES

.1 Supply anchors and templates for installation by other Divisions.

3.7 CUTTING, PATCHING, DIGGING, CANNING AND CORING

.1 Lay out all cutting, patching, digging, canning and coring required to accommodate the mechanical services. Coordinate with other Divisions. The performance of actual cutting, patching, digging, canning and coring is specified under other Divisions. Be responsible for correct location and sizing of all openings required under the mechanical work, including pipe sleeves and duct openings. Allow oversized openings for fire dampers and for pipe penetrations where continuous insulation is specified.

.2 Verify the location of existing service runs and structural components within existing concrete floors and walls prior to core drilling and/or cutting. The Contractor is responsible to repair existing services and structural components damaged as a result of core drilling and cutting.

.3 Openings through structural members of the building shall not be made without the approval of the Departmental Representative.

3.8 FIRESTOP MATERIALS

.1 Firestopping and Smoke Seal Systems: Install assembly capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of ULC CAN4-S115-M85, or ULI 1479 and ASTM 814, and not to exceed opening sizes for which they are intended.

.2 Fire resistance rating of installed firestopping assembly shall be not less than the fire resistance rating of surrounding floor and wall assembly.

3.9 SERVICE PENETRATIONS IN RATED FIRE SEPARATIONS

.1 All piping, tubing, ducts, wiring, conduits, etc. passing through rated fire separations shall be smoke and fire proofed with ULC approved materials in accordance with CAN4-S115 and ASTM E814 standards and which meet the requirements of the Building Code in effect. This includes new and existing services passing through existing rated separations and new and existing services passing through new rated separations or existing separations whose rating is being upgraded.

.2 Fire resistance rating of installed firestopping assemblies shall not be less than fire resistance rating of the surrounding assembly.

.3 All smoke and fire stopping shall be installed by a qualified Contractor who shall submit a letter certifying that all work is complete and in accordance with this specification.

.4 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions in formed, sleeved or cored penetrations.

.5 Submit shop drawings for each type of pipe and separation type combination showing the approved materials and installation data.

3.10 SERVICE PENETRATIONS OF NON-RATED SEPARATIONS

.1 All piping, tubing, ducts, wiring, conduits, etc. passing through non-rated fire separations and non-rated walls and floors shall be tightly fitted and sealed on both sides of the separation with silicon sealant to resist the passage of smoke and/or transmission of sound.

3.11 DUCT AND PIPE MOUNTED CONTROL EQUIPMENT

.1 Automatic control dampers will be supplied by the controls trade but installed by the appropriate trade sections of mechanical work.

3.12 LUBRICATION OF EQUIPMENT

.1 Lubricate all new and re-used 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 checklist, showing that all operated equipment has been lubricated prior to and during any operation.

3.13 START-UP

.1 Before starting the plant, provide confirmation in writing to the Departmental Representative that the plant is ready for start-up and the following conditions have been met. These include:

.1 All safety controls are installed and fully operational.

.2 Qualified personnel will be provided to operate the plant.

.3 Permanent electrical connections have been made to all equipment.

.4 All air filters are installed.

.5 All mechanical equipment rooms, including plenums, have been vacuum cleaned.

3.14 CLEANING AND FINAL ADJUSTMENT

.1 Clean mechanical systems daily.

.2 Clean interior and exterior of all systems including strainers and vacuum the interior of air handling units and ductwork.

.3 Clean and refurbish all equipment and leave in first class operating condition including replacement of all filters in all air and piping systems.

.4 Balance and adjust all systems and each piece of equipment to operate efficiently.

3.15 PAINTING REPAIRS AND RESTORATION

.1 Apply a coat of rust inhibiting primer to all exposed, bare steel provided under the mechanical work. Clean and prepare the surfaces first in accordance with the paint manufacturer’s recommendations.

.2 Apply the primer before or immediately after installation where the steel will be exposed to moisture.

.3 Make good any damage to factory finishes on equipment supplied under the mechanical work.

.4 Any finish painting of the equipment and materials provided under the mechanical work is by Painting Division (except where specifically indicated otherwise). Coordinate with Painting Division including identifying the various mechanical services for painting.

.5 Colours for equipment and materials in finished areas and outdoors shall be as directed by the Departmental Representative.

3.16 DEMONSTRATION AND INSTRUCTION TO OWNER

.1 Provide certified personnel to demonstrate plant operation and to instruct operating staff on operation of mechanical equipment. Provide maintenance specialist personnel to instruct operating staff on maintenance and adjustment of mechanical equipment and any changes or modification in equipment made under terms of guarantee.

.2 The demonstration shall include:

.1 Operation and sequencing of all automatic control dampers and automatic temperature control devices.

.2 Operability of randomly selected fire/smoke dampers.

.3 Operation and maintenance requirements of all equipment and systems under each mode of operation including:

.1 Automatic controls.

.2 Fans.

.3 Fire protection systems.

.4 Heat pump systems.

.5 Heat recovery systems.

.6 Plumbing Systems.

.3 Provide instruction during regular work hours prior to acceptance and turnover to operating staff for regular operation.

.4 Use Operating and Maintenance manuals for instruction purposes.

.5 Submit the proposed instructional agenda for approval.

.6 Finalize demonstration and instructions by obtaining a signed statement from the Departmental Representative that the demonstration and instructions have been given satisfactorily.

3.17 SUBSTANTIAL PERFORMANCE REQUIREMENTS

.1 Before the Departmental Representative is requested to make an inspection for substantial performance of the work:

.1 Commission all systems.

.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.

.2 The work will not be considered to be ready for use or substantially complete until the following requirements have been met:

.1 All reported deficiencies have been corrected.

.2 Testing and balancing completed.

.3 Operation and Maintenance Manuals completed.

.4 Record Drawings ready for review.

.5 System Commissioning has been completed and verified.

.6 All demonstrations to the Owner have been completed.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials and requirements for installation of mechanical pipework systems in Divisions 21, 22 and 23.

1.2 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.

1.3 DESIGN FOR SEISMIC EVENTS

.1 This building is a post-disaster building. All hangers and supports for plumbing and mechanical systems shall be designed by the Seismic Engineer to maintain the systems and equipment in service after a seismic event. Refer to Section 23 05 48 Vibration and Seismic Controls for HVAC Piping and Equipment.

.2 The Seismic Engineer shall design all supports and hangers to withstand seismic events of the magnitude prescribed for the area in the Building Code for a post-disaster building.

Part 2 Products

.1 Not Used.

Part 3 Execution

3.1 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.2 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.3 DRAINS

.1 Install piping with grade in direction of flow except as indicated.

.2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to above floor drain. Discharge to be visible.

.4 Drain valves: 20 mm [3/4”] gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.4 DIELECTRIC COUPLINGS

.1 Compatible with system, to suit pressure rating of system.

.2 Provide dielectric couplings on all systems except closed loop systems wherever pipes of dissimilar metals are joined.

.3 Provide insulating unions for pipe sizes 50 mm [2”] and under and flanges for pipe sizes over 50 mm [2”].

.4 Provide felt or rubber gaskets to prevent dissimilar metals contact.

3.5 PIPEWORK INSTALLATION

.1 Screwed fittings jointed with Teflon tape.

.2 Protect openings against entry of foreign material.

.3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.4 Assemble piping using fittings manufactured to ANSI standards.

.5 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.6 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.7 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.8 Install, except where indicated, to permit separate thermal insulation of each pipe.

.9 Group piping wherever possible.

.10 Ream pipes, remove scale and other foreign material before assembly.

.11 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.12 Provide for thermal expansion as indicated.

.13 Valves:

.1 Install in accessible locations.

.2 Remove interior parts before soldering.

.3 Install with stems above horizontal position unless otherwise indicated.

.4 Valves accessible for maintenance without removing adjacent piping.

.5 Install globe valves in bypass around control valves.

.6 Use ball valves at branch take-offs for isolating purposes except where otherwise specified.

3.6 ESCUTCHEONS AND PLATES

.1 Provide on pipes passing through walls, partitions, floors and ceilings in finished areas.

.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. 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.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes hangers and supports for mechanical piping, ducting and equipment.

.2 It is the entire responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of the mounting points and internal components of the equipment exceeds the force level used to restrain and anchor the unit to the supporting structure during a seismic event of code design magnitude.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Shop drawings shall be stamped and signed by Professional Engineer registered or licensed British Columbia for seismically rated hangers and supports.

.2 Submit shop drawings and product data for:

.1 Hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

.3 Submit manufacturer’s name and model number for all hanger components.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

1.4 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Fabricate and construct pipe hangers, supports and sway braces to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipe work or connected equipment and to maintain grade.

.3 Provide for vertical adjustments after erection and during commissioning.

.4 Support from structural members, not from metal decking.

.2 Design for Seismic Events

.1 This building is a post-disaster building. All hangers and supports for mechanical systems shall be designed by the Seismic Engineer to maintain the systems and

equipment in service after a seismic event. Refer to Section 23 05 48 Vibration and Seismic Controls for HVAC Piping and Equipment.

.2 The Seismic Engineer shall design all supports and hangers to withstand seismic events of the magnitude prescribed for the area in the Building Code for a post-disaster building.

Part 2 Products

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: electroplated galvanized, cadmium plated or painted with zinc-rich paint after manufacture in corrosive locations and in all mechanical rooms and trenches.

.2 All steel hangers in contact with copper piping shall be copper plated or plastic dipped.

.2 Attachments:

.1 All attachments shall be designed and detailed by the Seismic Engineer to post-disaster requirements.

.3 Shop and field-fabricated assemblies:

.1 Supports and sway braces may be shop or field fabricated but must be in accordance with the requirements of ANSI B31.1 and MSS-SP58.

.2 Sway braces for seismic restraint systems: to Section 23 0548 - Vibration and Seismic Controls for HVAC Piping and Equipment.

.4 Hanger rods: threaded rod material to MSS-SP58.

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.3 Spacing and sizing of the rods by the Seismic Engineer to post-disaster requirements.

2.3 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping: Insulation with uninterrupted vapour barrier plus insulation protection shield to: MSS-SP69, galvanized sheet carbon steel. Insulation shall be high-density type for 65 mm [2-1/2”] and larger.

.2 Insulated hot piping 100 mm [4”] and larger: Curved plate 300 mm [12"] long, with edges turned up, carbon steel to comply with MSS-SP69. Insulation fitted between saddle and pipe.

2.4 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: allow steel to ASTM A125, shot peened, magnetic particle inspected, with +/- 5% spring rate tolerance, tested for free height, spring rate, laded height and provided with Certified Mill Test Report (CMTR).

.2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm [1"] minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.5 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.6 EQUIPMENT SUPPORTS

.1 Provide supports for equipment and materials supplied.

.2 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel.

.3 Submit calculations with shop drawings.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with the Seismic Engineer’s instructions and recommendations.

3.3 HANGER SPACING

.1 Plumbing piping: most stringent requirements of Seismic Engineer, Building Code or Authority Having Jurisdiction.

.2 Fire protection: to applicable Fire Code (no toggle hangers).

.3 Flexible joint roll groove pipe: in accordance with designed specified, but not less than one hanger at each joint.

.4 Within 300 mm [12"] of each horizontal elbow.

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 12 mm [1/2”], offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.
.2 Equalize loads and provide grades.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanging performance.
.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer’s recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes vibration isolation materials and components, seismic control measures and their installation.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings and product data for all vibration isolators and of all seismic restraint components, assemblies, and attachments.

.2 Shop drawings of seismic restraint devices including those integral with vibration isolators shall either bear a pre-approval number by an independent testing agency (tested to OSHPD pre-approval standards) with certification to meet the application, location requirements and they shall be reviewed, signed and sealed by the Seismic Engineer. This includes all components and instructions for set-up and attachment to the equipment and building structure. Include the maximum seismic rated load, the maximum calculated actual seismic load, the materials of construction, and the magnification factor.

.3 Vibration isolation drawings shall include for each isolator, the location, the load, the calculated actual static deflection, the deflection to solid, the lateral to axial stiffness, spring colour, dimensions, spring constant, neoprene durometer. For each vibration isolator with integral seismic restraint also include the maximum rated seismic load, the maximum calculated actual seismic load, the materials of construction, the magnification factor.

.4 Shop drawings shall include the colour coding for all seismic anchor bolts for installation in concrete.

.5 Shop drawings shall include the Seismic Engineer’s requirements for any members required for attachment to the structure.

.6 Shop drawings shall indicate the calculated maximum forces at the points of attachment to the building structure during a seismic event.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

1.4 REGULATORY CODES, GUIDELINES

.1 SMACNA “Seismic Restraint Manual Guidelines for Mechanical Systems” referred to in this section as SMACNA Guidelines.

1.5 DEFINITIONS

.1 Actual static deflection is the difference in height of the isolation between its free (unloaded) height and its installed height under the normal operating conditions and loads of this project.

.2 Seismic event means a seismic event of any magnitude up to the Building Code design magnitude for post-disaster in the project's specific location.

1.6 GENERAL SCOPE

.1 Provide vibration isolation for the equipment specified in Mechanical Division as required to prevent unacceptable levels of vibration isolation or noise from being transmitted to the building structure or to services attached to the equipment.

.2 Provide post-disaster seismic restraints for the piping and ductwork systems and all equipment specified in Mechanical Division to meet the requirements of the Building Code, to keep the equipment in place during a seismic event, to minimize damage to the systems and equipment from a seismic event, to prevent systems and equipment from causing personal injury during a seismic event and to maintain the systems and equipment in service after a seismic event.

1.7 VIBRATION ISOLATION - GENERAL

.1 Unless the equipment manufacturer certifies that the vibration isolators may be directly attached to the equipment, provide a structural steel base for each piece of equipment designed:

.1 For mounting the equipment on it.

.2 To be rigid under the design operating and seismic loads.

.3 Wide and long enough for the distance between any two corner isolators to be greater than the height of the centre of gravity above the bottom of the isolators.

.4 For the attachment of the vibration isolators and any required seismic snubbers.

.2 Provide a minimum of four isolators for a piece of equipment as a designed set. The average actual static deflection under load must be at least 90% of the specified static deflection and no individual isolator may have an actual static deflection less than 75% of specified. Each isolator shall be colour coded to easily cross-reference with the shop drawings its location on the equipment.

.3 All neoprene elements used in or in conjunction with vibration isolators shall be bridge bearing quality. Elastomers shall not exceed 60 durometer.

.4 Springs shall be stable. The lateral spring constant shall be between 1.0 and 1.5 times the axial spring constant.

.5 Actual static deflection shall be between 0.4 and 0.65 times solid deflection.

.6 Provide durable protective finish on all vibration isolator components located where conditions may cause corrosion.

.7 Coordinate with relevant trades to ensure that pipe, duct and electrical connections to equipment are sufficiently flexible to prevent stressing the connections and to prevent transmission of vibration back along the service.

.8 The equipment installed on the vibration isolators shall not have a natural frequency higher than one third of the lowest disturbing frequency generated by the operating equipment.

.9 Ensure that the vibration isolation is not “short-circuited” or bridged.

1.8 SEISMIC RESTRAINT - GENERAL

.1 Seismic restraint may either be factory manufactured assemblies or custom field fabricated assemblies. All factory manufactured assemblies shall be tested and pre-approved by an independent testing agency to OSHPD test and pre-approval standards and bear the pre-approved number.

.2 Arrange and pay for the services of a Structural Professional Engineer registered in British Columbia referred to here as the Seismic Engineer. The Seismic Engineer shall review, seal and sign all submittals required for all components, assemblies, attachments and installation procedures for the seismic restraint of all piping, ductwork and equipment installed under Mechanical Division. The Seismic Engineer shall provide all necessary direction to the contractor during installation of the seismic restraint installation and submit a statutory declaration that the final seismic restraint installation conforms to the submittal documents sealed by the Seismic Engineer and satisfies all regulatory requirements.

.3 The Seismic Engineer shall submit Letters of Assurance for the seismic restraint of the Mechanical Division installation.

.4 The Seismic Engineer shall coordinate attachment to the equipment with the equipment manufacturer to ensure the method and location of attachment of the seismic restraint to the equipment does not compromise the structural integrity of the equipment.

.5 The Seismic Engineer shall be responsible for coordinating all attachments for seismic restraint to the building structure with the structural documents and as necessary with the structural consulting engineer responsible for the design of the building structure. Ensure that the method and location of attachment of seismic restraint to the structure does not compromise the structure and that the structure can withstand the connected design seismic forces. The Seismic Engineer’s responsibility includes clear instructions as to the point of attachment (e.g., top cord of OWSJ, concrete wall, bottom of joist, bottom of beam, etc). Where additional members are required for attachment the Seismic Engineer shall designate their size, location and method of attachment (e.g., 40 x 40 x 3 steel angle with three anchors (sized) to concrete wall) and they shall be provided under this Section.

.6 For piping and ductwork, the Seismic Engineer shall indicate the maximum spacing between slack cables of SMACNA design. Depending on the Code design seismic magnitudes, the space between restraints may need to be shorter than the SMACNA Guidelines.

.7 Seismic anchor bolts for concrete shall be colour coded and so identified on the shop drawings to allow inspection to confirm the correct anchors have been installed without requiring removal to check bolt lengths.

.8 Seismic restraints shall provide restraint from seismic forces in all directions.

.9 All seismic restraints shall be provided with suitably selected connectors and anchors for attaching to the equipment and building structure. They shall meet or exceed the requirements for restraining the Code prescribed force through the centre of gravity of the isolated equipment.

.10 The greater the range of unrestricted motion, the longer the equipment will accelerate in a seismic event. The longer the acceleration and the "harder" the interface between the equipment and seismic restraint, the higher the deceleration (and therefore the forces) will be. Limit the range of unrestricted motion without causing interference with the operation of any vibration isolators and optimize the contact area and stiffness of the restraint padding to minimize the magnification (deceleration rate divided by seismic acceleration rate) of forces. Coordinate with the equipment fragility levels to ensure they are not exceeded during a seismic event.

1.9 COMBINATION VIBRATION ISOLATION AND SEISMIC RESTRAINT

.1 A single supplier shall supply all vibration isolation equipment and all seismic restraint equipment for vibration isolated equipment.

.2 Where available and where capable of meeting the required level and performance of seismic restraint, vibration isolators with integral seismic restraint may be provided.

.3 Where vibration isolators do not have any or adequate integral seismic restraint, separate seismic restraints shall be provided.

.4 Seismic restraints shall not interfere with the operation of the vibration isolators under all normal operating conditions.

1.10 EQUIPMENT REQUIREMENTS

.1 The requirements of this section shall apply to vibration isolation and seismic restraint that are factory supplied integral with the equipment.

.2 The requirements of this section shall apply to vibration isolation and seismic restraints that are factory supplied integral with the equipment.

.3 It is the responsibility of the manufacturer of equipment which is to be vibration isolated and/or for seismically restrained to ensure that:

.1 The equipment is designed to internally withstand without damage the increased forces on the equipment due to its being vibration isolated

.2 The attachment points for vibration isolators and seismic restraints will withstand without damage the forces generated by vibration isolation and seismic restraint or else ensure that notification is given to provide a suitable structural steel base.

.3 The equipment shall remain functional after a seismic event. The equipment manufacturer shall provide the fragility level of the equipment to the vibration isolation/seismic restraint designer before the isolation/restraint is designed.

Part 2 Products

2.1 GENERAL

.1 Size and shape of bases type and performance of vibration isolation as indicated.

.2 Except for factory installed isolators supplied integral with equipment and except for field constructed seismic restraints, all vibration isolation and seismic restraints shall be supplied by a single supplier.

2.2 TYPE 1 ISOLATORS - ELASTOMER PADS

.1 Neoprene-steel-neoprene. Select and size for an actual static deflection of 2.0 mm to 3.0 mm [0.08" to 0.125"]. Use Type 7 neoprene grommets for anchor bolts through the pads.

2.3 TYPE 2 ISOLATORS - ELASTOMER MOUNTS

.1 Rubber or neoprene-in-shear in seismically rated casing designed to prevent short-circuiting of equipment mounting bolt to casing. Select for 5 mm [3/16"] minimum actual static deflection. Protect any rubber element from contact with oil.

2.4 TYPE 3 ISOLATORS - SPRING MOUNT

.1 Type 3A spring isolator with leveling capability and minimum 6 mm [1/4"] thick ribbed neoprene pad. Spring enclosed in seismically rated housing designed to meet the seismic requirements and including built-in resilient seismic stops and designed to avoid short-circuiting. Anchor bolts and neoprene grommets.

.2 Type 3B Where Type 3A can not meet the required seismic restraint provide spring isolator with leveling capacity and minimum 6 mm [1/4"] thick ribbed neoprene pad. (Seismic snubbers are required in conjunction with these isolators.) Anchor bolts and neoprene grommets

2.5 TYPE 4 ISOLATORS - HANGERS

.1 Type 4A - Neoprene-shear element in hanger box designed to avoid short-circuiting with rod misalignment up to 15°.

.2 Type 4B - Stable spring with minimum 6 mm [1/4"] thick neoprene pad in hanger box designed to avoid short-circuiting with rod misalignment up to 15°.

2.6 TYPE 7 ISOLATORS - GASKETS, GROMMETS

.1 12 mm [1/2"] thick closed cell foam plastic.

.2 Select for nominal 21 kPa [3 psi] loading.

.3 Isolate anchor bolts with neoprene hemi-grommets sized for snug fit.

2.7 SEISMIC SNUBBERS - POST DISASTER

.1 All directional interlocking steel components with minimum 19 mm [3/4"] thick replaceable one-piece neoprene. Design impact shall not exceed 7000 kPa [1000 psi]. Air gap of 3 mm to 6 mm [1/8" to 1/4"] (factory set).

2.8 SEISMIC RESTRAINTS

.1 Rigid restraints or slack cable restraints may be used as detailed by the Seismic Engineer.

.2 SMACNA Guidelines restraints modified by the Seismic Engineer.

.3 Custom restraints designed by the Seismic Engineer.

Part 3 Execution

3.1 GENERAL

.1 All work shall be in accordance with the Seismic Engineer’s instructions, manufacturer’s instructions and recommendations and shall be done by workers experienced in the installation of vibration isolation and seismic restraint.

.2 Ensure 50 mm [2"] clearance all around vibration isolated equipment.

.3 Ensure flexible service connections are not stressed and operate freely when vibration isolated equipment is operated.

.4 Fill any space between anchor bolt and the attachment bolt hole with epoxy putty to prevent movement.

.5 Where threaded nuts secure vibration isolators or seismic restraints use double nuts, locking nuts or lock tight product.

.6 Ensure vibration from piping and ductwork does not transfer to floors, structure or walls. Provide resilient protection as required.

.7 Slack cables shall be as tight as possible without supporting the weight of the pipe, duct or equipment and, where used on vibration isolated pipe, duct or equipment, shall be as tight as possible without transmitting vibration.

3.2 PIPING AND DUCTWORK ISOLATION AND RESTRAINT

.1 Provide flexible pipe and ductwork connectors where indicated in other Sections and/or on drawings.

.2 Restraint of fire protection piping where included in NFPA-13 is not included in this Section of the specification.

.3 Provide transverse and longitudinal restraints as per Seismic Engineer’s requirements. Note requirements of restraints for pipes or ducts to act as restraints for smaller branch pipes. Provide restraints as close as practical to vertical changes of direction.

.4 Where ducts or pipes are grouped in trapeze hangers, restraints shall be sized for the combined weight and all ducts and pipes shall be secured to the trapeze.

.5 A duct penetration of a wall or partition may act as transverse brace. For stud walls provide framed opening.

3.3 RESTRAINT OF NON-ISOLATED EQUIPMENT

.1 Floor or wall mounted equipment shall be anchored to the structure. Anchors shall be designed for seismic acceleration in all directions acting through the centre of gravity.

.2 Suspended equipment may have rigid or slack cable restraints.

.3 Vertical tanks shall be anchored at the bottom and have restraint for horizontal movement in all directions located above the centre of gravity.

3.4 EQUIPMENT ISOLATION AND RESTRAINT

.1 Unless otherwise specifically indicated provide vibration isolation on all motor driven equipment with motors of 1/2 hp and greater. For motor driven equipment with motors less than 1/2 hp, provide isolating neoprene grommets or neoprene-in-shear at all supports.

.2 Arrange seismic cable restraints to be approximately 90° to each other in plan, to rise at about 30° to 45° from horizontal and so that their projected extension passes through the centre of gravity of the restrained equipment.

.3 Each grille and diffuser shall be secured directly to sheet metal ductwork with a minimum of three sheet metal screws or shall be secured to the structure with a minimum of two 12 ga. galvanized steel wires connected to opposite corners of the grille or diffuser.

3.5 INSPECTION

.1 Refer to clause in this Section, SEISMIC RESTRAINT GENERAL, for inspection, certification and submittals required from the Seismic Engineer.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.

1.2 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.

1.3 SUBMITTALS

.1 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

.2 Samples:

.1 Samples to include nameplates, labels, tags, lists of proposed legends.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Each piece of manufactured equipment shall have a metal nameplate, with embossed letters, mechanically fastened to the equipment.

.2 Manufacturer's nameplates shall indicate:

.1 Manufacturer’s name.
.2 Equipment.
.3 Model, size.
.4 Serial number.
.5 Electrical characteristics.
.6 Motor: voltage, Hz, phase, power factor, duty, frame size.
.7 Other services characteristics.

.3 Include ULC, CSA and other agency registration logos that apply.

.4 Nameplates shall be easily read.

2.2 SYSTEM NAMEPLATES

.1 Painted identification letters shall be 50 mm [2"] high black letters on a white background.

.2 Lamicoid labels (black background white letters) shall be 35 x 200 mm [1-1/2"x 8"] with 20 mm [3/4"] high letters or proportionally smaller as appropriate to fit equipment.

.3 Identify systems, and areas or zones of building being serviced.

2.3 PIPING SYSTEMS GOVERNED BY CODES

.1 Sprinklers: to NFPA 13.

2.4 IDENTIFICATION OF PIPING SYSTEMS

.1 Each system shall be labelled including directional flow arrows in accordance with the Pipe Identification Schedule and to CAN/CGSB 24.3 except where specified otherwise.

.2 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm [3”]: 100 mm long x 50 mm high [4” long x 2” high].

.2 Outside diameter of pipe or insulation 75 mm [3”] and greater: 150 mm long x 50 mm high [6” long x 2” high].

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

.3 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

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

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

.1 Adhesive labels:

.1 Identification labels may be stencilled or be vinyl cloth or vinyl film, with adhesive compatible with the surface temperature.

.2 Identification colour bands shall overlap a minimum of 150 mm [6"]. Ends to be stapled.

.2 Coiled plastic pipe labels:

.1 Printed coiled vinyl identification strips.

.2 Material: 0.508 mm [0.020”] vinyl service suitable for service temperatures of -40°C [-40° F] to 71° C [160° F].

.3 Attachment:

.1 10mm – 145mm pipe OD: self-adhering tight-fitting coil

.2 150mm pipe OD and larger: cable tie fastening.

.5 Colours and Legends:

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

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

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

.6 Pipe Identification Schedule:

Service	Identification Lettering	Primary Colour	Secondary Colour
Domestic Cold Water Service	DCW	Green	--
Domestic Hot Water Supply	DHWS	Yellow	Black
Domestic Hot Water Recirc.	DHWR	Yellow	Black

Service	Identification Lettering	Primary Colour	Secondary Colour
Fire lines - Sprinkler (Wet)	SPR	Red	White

2.5 VALVES AND CONTROLLERS

.1 Provide valve identification tags appropriately secured.

.2 Tags may be of brass, aluminum, metalphoto, lamicoid or fibreglass, stamped or engraved, 25 mm [1"] minimum diameter.

.3 Valves to be tagged include:

.1 Valves on all main piping circuits.

.2 Valves on all major branch lines.

.3 Valves on minor branch lines in horizontal service spaces, vertical service spaces and mechanical equipment rooms.

.4 Do not tag valves on fixture stops, system drains valves or any isolating valves for individual pieces of equipment where in clear sight of that equipment.

.4 Schedule the valve numbers using a sequential numbering system.

.5 Provide a valve tag list indicating valve number, system, location, normal operating position (open or closed) and the area it serves.

2.6 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this Section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

Part 3 Execution

3.1 TIMING

.1 Provide identification only after painting has been completed.

3.2 NAMEPLATES

.1 Locations:

.1 Each piece of equipment shall be identified with its equipment schedule identification, e.g. EF-1.

.2 In conspicuous location, on cool surfaces, to facilitate easy reading and identification from operating floor.

.2 Standoffs: Provide for nameplates on hot and/or insulated surfaces.

.3 Protection: Do not paint, insulate or cover.

3.3 LOCATION OF IDENTIFICATION ON PIPING SYSTEMS

.1 Identify piping adjacent to valves. Identify piping at least once in each room and at 15 m [50 ft.] maximum spacing in open areas

.2 Identify piping both sides where piping passes through walls, partitions and floors.

.3 Identify piping at each access opening.

.4 Adjacent to each change in direction.

.5 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

.6 At beginning and end points of each run and at each piece of equipment in run.

.7 At point immediately upstream of major manually operated or automatically controlled dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.8 Identification easily and accurately readable from usual operating areas and from access points. Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

.9 Ceiling Access: 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:

Equipment	Colour
Concealed equipment and cleaning access.	Yellow
Control equipment, including control dampers.	Black
Fire, smoke and sprinkler equipment.	Red
Pipe mounted equipment, other than fire, smoke and sprinkler equipment.	Green

.1 When T-bar ceilings are installed adhere coloured dots to T-bar framing, adjacent to panel to be removed.

3.4 VALVES AND CONTROLLERS

.1 Valves and operating controllers: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Number valves in each system consecutively.

3.5 IDENTIFICATION SCHEDULES

.1 Submit schedules of the following for review.

.1 Pipe Identification.

.2 Valve Tag List.

.3 Ceiling Access Identification Colours

.2 Schedules will be required in each major mechanical room. Laminate in clear plastic. Punch a hole in top corner and hang.

.3 Include one copy of schedules in each operating and maintenance manual.

END OF SECTION

1.1 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 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.

1.3 QUALIFICATIONS OF TAB PERSONNEL

.1 Employ Flotech Mechanical Systems Specialists, KD Engineering Co. or Western Mechanical Services as the TAB and Building Commissioning Agent.

.2 Submit names of personnel to perform TAB to the Departmental Representative within 90 days after award of the Contract.

.3 Provide documentation confirming qualifications, successful experience.

1.4 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

1.5 EXCEPTIONS

.1 TAB of systems and equipment regulated by Codes, Standards to satisfaction of Authority Having Jurisdiction.

1.6 TESTING AND BALANCING

.1 Employ the Balancing Agency to test and balance the following systems:

- .1 Fire/smoke damper(s).
- .2 Exhaust air system(s).
- .3 Heat pump system(s).
- .4 Heat recovery system(s).
- .5 Supply air system(s).
- .6 Domestic hot, cold and recirculation water systems.

1.7 FIRE/SMOKE DAMPERS

.1 Test all combination smoke/fire dampers. The test shall be made by releasing the fusible link and witnessing closure of the damper. All dampers shall be left in the open position.

.2 A set of prints shall be marked up to show that each damper has been successfully checked for closure, accessibility and installation. The prints shall be certified correct by the Balancing Agency and submitted to the Departmental Representative.

1.8 BALANCING - AIR SYSTEMS

.1 Adjust duct and terminal balance dampers, and adjust or change drive sheaves to balance supply, and exhaust air systems to provide the design air quantities (within +10%/-5%) at each outlet and inlet and to maintain the design relationship between the supply, and exhaust air system quantities.

.2 Adjust air terminals to optimize the air distribution pattern while minimizing drafts and noise.

.3 Permanently mark the final balance position on all balance dampers.

.4 Submit a report to the Departmental Representative indicating final fan speed, motor operating amperages, system static pressure, filter static pressure, design air quantities and final air quantities obtained.

1.9 BALANCING - LIQUID SYSTEMS

.1 Adjust balance valves and balance fittings to obtain design water flow on the domestic hot water recirculation system.

.2 Permanently mark the final balance position on balance valves and balance fittings.

.3 Submit a report to the Departmental Representative indicating design water flows and final water flows obtained.

1.10 COMMISSIONING

.1 Be responsible for the performance and commissioning of all equipment supplied under the plumbing and HVAC Sections of Mechanical Division. Commissioning is the process of advancing the installation from the stage of static completion to full working order in accordance with the Contract Documents and design intent. It is the activation of the completed installation.

.2 The commissioning shall be executed in accordance with the intent of the following standards:

.1 PWGSC Commissioning Manual CP.1, 4th Edition.

.2 CSA Z320-11 Building Commissioning.

.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 Submit a schedule for the commissioning phase of the work. This schedule shall show:

.1 Equipment start-up schedule.

.2 Submission dates for the various documents required prior to substantial completion.

.3 Timing of the various phases of the commissioning, testing, balancing and demonstration process.

.5 Commissioning is concluded when air and water systems have been balanced and the installation is in full working order and acceptable for use. The work will include the following:

.1 Balancing of the air systems as specified in this Section.

.2 Balancing of the liquid systems as specified in this Section.

.3 Set up air diffusers, registers and grilles for optimum distribution/comfort.

.4 Set up of fans.

.5 Plug all air pressure and flow measuring holes.

.6 Adjust vibration isolators and earthquake restraints for optimum performance.

.7 Verification and certification of the sealing of all HVAC penetrations through fire separations (rated & non-rated) and sound separations.

.8 Verification of water tightness of all roof and exterior wall penetrations.

.9 Verification that all coil drain pans operate.

.10 Set up all automatic control dampers and automatic temperature control devices.

.11 Testing and debugging of EMCS (Energy Monitoring and Control System).

.12 Set up and test all alarm and protective devices.

.13 Power failure test with emergency generator start-up.

1.11 DEMONSTRATION

.1 At the conclusion of commissioning, verify and demonstrate the operation of the systems to the Departmental Representative and then to the Owner's Operating Staff. For demonstration and instruction to Operating staff requirements, refer to this section of the specification and also to Division 25 (Controls Systems).

.2 The verification process shall include the demonstration of the following:

.1 The ease of access that has been provided throughout for servicing coils, motors, drives, fire/smoke dampers, control dampers and damper operators.

.2 Location of and opening and closing of all access panels.

.3 Operation of all automatic control dampers and automatic temperature control devices.

.4 Operation of all alarm and protective devices.

.5 Operation of all fire/smoke dampers.

.6 Operation of all equipment and systems under each mode of operating, and failure, including:

.1 BAS (Building Automation System) control features.

.2 Automatic controls.

.3 Heat pump systems.

.4 Heat recovery systems.

.5 Pumps.

.6 Heaters.

.7 Fans.

.8 Tanks - domestic hot water, and expansion.

.3 Provide instruction during regular work hours prior to acceptance and turnover 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.

.7 At the completion of the commissioning, testing, balancing and demonstration submit the following to the Departmental Representative:

.1 A letter certifying that all work specified under this Contract is complete, clean and operational in accordance with the specification and drawings.

.2 Completed copies of all commissioning check lists plus copies of start-up reports from specialty contractors and vendors.

.3 Record Drawings.

.4 A list of all alarm and protective devices tested, with the final operating settings.

.8 Contractor shall allow for one return to site for post-commissioning review during peak heating season.

Part 2 Products

.1 NOT APPLICABLE

Part 3 Execution

.1 NOT APPLICABLE

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials, requirements and installation for thermal insulation for ductwork and accessories in a commercial type application.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings for insulation and accessories.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

1.4 DEFINITIONS

.1 "CONCEALED" describes insulated mechanical services above suspended ceilings, in trenches, chases, furred spaces and shafts.

.2 "EXPOSED" - will mean not concealed.

1.5 QUALITY ASSURANCE

.1 Installer: Journeyman insulation applicators, skilled in this trade, shall perform the work.

.2 The latest edition of the "BC Insulation Contractors Association (BCICA) Quality Standards Manual", shall apply except where exceeded in this specification.

1.6 ASBESTOS

.1 All material/products provided shall be free of asbestos.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with Building Code, NFPA 90A and CAN/ULC-S102.

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 External Insulation - Flexible:

.1 Maximum thermal conductivity per 25 mm [1"]: 0.040 W/m-°C at 24°C [0.27 Btu-in/(hr-ft2-°F) at 75°F].

2.3 JACKETS

.1 Thermocanvas:

.1 Cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: Compatible with insulation.

.3 Lagging Fabric Seal / Finish Coating.

2.4 SCOPE OF INSULATION

.1 Scope 1: External Insulation - Flexible.

		Thickness	
		mm	[ins]
.1	All supply ducts.	40	[1.5]
.2	Outdoor air ductwork.	50	[2]

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENTS

.1 Apply external insulation to ductwork after successful pressure tests have been made.

.2 Apply insulation and accessories so that the finished product is smooth and neat and with longitudinal seams concealed from view.

.3 Apply insulation, accessories and finishes in accordance with the manufacturer’s recommendations.

.4 Insulation and vapour barrier shall be continuous through all non-rated separations.

.5 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Do not externally insulate any ductwork that is specified to be internally insulated (unless noted otherwise).

.2 Application of External Insulation - Flexible

.1 Adhere insulation with insulation adhesive applied in 150 mm [6”] wide strips on 300 mm [12”] centres.

.2 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.

3.3 DUCTWORK INSULATION FINISHES

.1 "Concealed" insulation will require no further finish.

.2 "Exposed" insulation inside the building shall be finished as follows:

.1 Apply thermocanvas jacket with fabric adhesive.

.2 Finish fabric with one (1) coat of fabric coating.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials, requirements and installation for thermal insulation for piping and accessories.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings for insulation and accessories.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

1.4 DEFINITIONS

.1 "CONCEALED" describes insulated mechanical services above suspended ceilings, in trenches, chases, furred spaces and shafts.

.2 "EXPOSED" - will mean not concealed.

1.5 QUALITY ASSURANCE

.1 Installer: Journeyman insulation applicators, skilled in this trade, shall perform the work.

.2 The latest edition of the "BC Insulation Contractors Association (BCICA) Quality Standards Manual", shall apply except where exceeded in this specification.

1.6 ASBESTOS

.1 All material/products provided shall be free of asbestos.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with Building Code, NFPA 90A and CAN/ULC-S102.

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C [75°F] mean temperature when tested in accordance with ASTM C335.

.3 Mineral Fibre - Low and Medium Temperature:

.1 Maximum thermal conductivity per 25 mm [1"]: 0.033 W/m-°C at 24°C [0.23 Btu-in/(hr-ft2-°F) at 75°F].

.4 Refrigerant Piping:

.1 Flexible Foamed Elastomeric Insulation:

.1 Maximum thermal conductivity per 25 mm [1"]: 0.039 W/m-°C at 24°C [0.27 Btu-in/(hr-ft2-°F) at 75°F].

.2 Flexible Closed Cell Insulation:

.1 Maximum thermal conductivity per 25 mm [1"]: 0.036 W/m-°C at 24°C [0.25 Btu-in/(hr-ft2-°F) at 75°F].

2.3 REINFORCING MEMBRANE

.1 Glass reinforcing membrane as commercially available.

2.4 INSULATION SECUREMENT

.1 16 ga galvanized, stainless steel or copper wire as commercially available.

.2 Tape shall be self-adhesive, aluminum, reinforced, 50 mm [2”] wide minimum.

2.5 CEMENT

.1 Thermal insulating and finishing cement.

.1 Hydraulic setting or Air drying on mineral wool, to ASTM C449/C449M.

2.6 VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 COATINGS

.1 Vapour barrier coating on reinforcing membrane or on insulating cement:

.2 Flexible elastomeric and flexible closed cell insulation finish coating:

2.8 JACKETS

.1 All Service Jacket:

.1 Securement: Staples (flare type), compatible jacket finishing tape, contact adhesives recommended by the jacket manufacturer.

.2 Polyvinyl Chloride (PVC):

.1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.

.2 Minimum service temperatures: -20°C.

.3 Maximum service temperature: 65°C.

.4 Moisture vapour transmission: 0.02 perm.

.5 Thickness: 0.38 mm [0.015"].

.6 Fastenings: Use solvent weld adhesive compatible with insulation to seal laps and joints, tacks and staples, plastic pop rivets., pressure sensitive vinyl tape of matching colour.

.3 Thermocanvas:

.1 Cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Fastenings: Staples (flare type), compatible jacket finishing tape, contact adhesives recommended by the jacket manufacturer.

.3 Lagging adhesive: compatible with insulation.

.4 Aluminum:

.1 To ASTM B209.

.2 Thickness: 22 ga.

.3 Finish: Smooth.

.4 Joining: longitudinal and circumferential slip joints with 50 mm [2”] laps.

.5 Fittings: die-shaped fitting covers with factory-attached protective liner.

.6 Securement: Sheet metal screws, pop rivets, bands.

2.9 PIPING INSULATION SCHEDULES

.1 Thickness of insulation as listed in following table (to ASHRAE 90.1).

Service	Temperature	Pipe Size in mm [inch]			
		Up to 20 [3/4]	25 to 30 [1 to 1-1/4]	40 to 75 [1-1/2 to 3]	100 to 150 [4 to 6]
Coil Cond. Drain	10°C	12	12	12	25
Domestic Cold Water	5°C	12	12	25	25
Domestic Hot Water Supply and Recirculation	41-60°C	25	25	40	40
Refrigerant Suction and Hot Gas	Above 4°C	25	25	25	25

2.10 SCOPE OF INSULATION

.1 Warm and Hot Piping Systems:

.1 Insulate the following systems, unless otherwise noted:

.1 Domestic hot water and hot water recirculation piping.

.2 Traps on accessible lavatories.

.3 Hot gas piping.

.2 Insulate the following valves and fittings if the pipe is insulated:

.1 Elbows, tees, reducers.

.2 Valve bodies on valves and check valves, 65 mm [2-1/2"].and larger.

.3 Flanges.

.4 Strainers (terminate insulation to allow basket removal.)

.3 Do not insulate the following fittings, even if pipe is insulated:

.1 Valves, smaller than 65 mm [2-1/2"].

.2 Valve bonnets.

.3 Unions.

.4 Flexible connections.

.5 Expansion joints.

.6 Check valve covers.

.2 Cool and Cold Piping Systems:

.1 Insulate and vapour seal the following systems, unless otherwise noted:

.1 Refrigerant suction and hot gas piping.

.2 Domestic cold water system including:

.1 Meter body

.2 PRV’s, backflow preventers.

.3 Interior piping to a hose bibb or for irrigation.

.3 Sprinkler system from domestic water connection point to 5 m [16 ft.] downstream or to the inlet of a backflow preventer.

.2 Insulate and vapour seal the following, if the pipe is insulated:

.1 Elbows, tees, reducers.

.2 Valves, (bodies and bonnets) except check valve covers.

.3 Strainers (with removable insulation plug for basket removal).

.4 Flanges

.5 Unions

.3 Do not insulate the following, unless otherwise noted:

.1 Fire protection piping.

.2 Soil stacks, vents.

.3 Flexible connections or expansion joints.

.4 Flexible fixture connections.

.3 Pipe penetrations through walls and floors:

.1 All material for the stuffing, sealing and caulking of the pipe penetration shall be supplied and installed under this section.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces clean, dry and free from foreign material.

3.2 INSTALLATION

.1 Apply materials in accordance with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet and this specification.

.2 Install in accordance with TIAC National Standards.

.3 Apply insulation and accessories so that the product is smooth and neat and with the longitudinal seams concealed from view. Apply insulation, accessories and finishes in accordance with manufacturer's recommendations.

.4 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm [3”].

.5 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.6 Install hangers, supports outside vapour retarder jacket.

.7 Supports and hangers: Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

.8 Maintain vapour barrier without interruption at sleeves, fittings and supports.

.9 Insulation and vapour barrier shall be continuous through all non-rated separations

3.3 INSULATION TERMINAL POINTS

.1 Where exposed, terminate insulation 75 mm [3"] back from all uninsulated fittings for working clearance and bevel insulation at 45° and finish with a hard coat insulating cement to match the adjacent insulation.

.2 Where concealed, terminate insulation 75 mm [3”] back from all uninsulated fittings, with heavy coat of insulation coating to secure glass fibres.

3.4 APPLICATION TO WARM AND HOT PIPING (ABOVE 27°C [80°F])

.1 Piping:

.1 Install medium temperature pipe insulation with integral jacket on pipe and hold in place with spreading staples at 75 mm [3"] centres

.2 Install strip of tape over each butt joint. Overlap minimum 25 mm [1”] 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, or with tightly wrapped flexible insulation to full thickness with PVC fitting cover.

.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. Drains, and caps shall be left uncovered.

3.5 APPLICATION TO COOL AND COLD PIPING SYSTEMS - (BELOW 11°C [52°F])

.1 Piping:

.1 Install low/medium temperature pipe insulation with integral vapour barrier jacket on pipe and secure and seal flaps with vapour barrier adhesive and spreading staples at 75 mm [3"] centres.

.2 Install strip of vapour barrier jacket over each butt joint. Overlap minimum 25 mm [1”] and secure with vapour barrier adhesive and spreading staples.

.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, then apply reinforcing membrane embedded in barrier coating or with tightly wrapped flexible insulation to full thickness with PVC fitting covers. Apply vapour barrier adhesive and tape on all joints and overlaps.

.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 or insulate with preformed insulation fittings 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, Flanges and Victaulic Fittings:

.1 Insulate with oversized pipe insulation or mitred blocks to the thickness of the adjacent pipe insulation, then apply reinforcing membrane embedded in barrier coating.

3.6 PIPE INSULATION FINISHES

.1 "Concealed" insulation will require no further finish.

.2 "Exposed" insulation inside the building shall be finished as follows:

.1 Apply thermocanvas jacket with fabric adhesive or PVC jacket.

.2 Over insulating fittings apply hard coat cement and finish with thermocanvas or apply PVC fitting covers. Over all other insulated components apply thermocanvas jacket with fabric adhesive.

.3 Finish fabric with one (1) coat of fabric coating.

3.7 REFRIGERATION SUCTION AND HOT GAS PIPING

.1 Install flexible foamed elastomeric or flexible closed cell preformed piping insulation.

.2 Secure longitudinal and butt joints with adhesive.

.3 Insulate all fittings and components.

.4 To obtain the specified thickness, apply in layers with staggered joints.

.5 Finish with flexible elastomeric or flexible closed cell insulation coating.

.6 "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 or PVC weather protecting jacket. The longitudinal seam shall be located to shed water. Secure the jacket using necessary fastenings on approximately 150 mm [6"] centres.

.3 Over insulated fittings, valve bodies, valve bonnets, strainers and flanges apply metal or PVC jacket or preformed metal or PVC fittings to provide a complete jacket system. Secure with necessary fastenings.

.4 Locate seams on underside and seal all outdoor jacketing watertight.

3.8 INSULATION PACKING OF PIPE SLEEVES

.1 Tightly pack the space between all pipe sleeves and pipe or between pipe sleeve and pipe insulation with mineral wool insulation to full depth of sleeve to prevent transmission of sound and/or passage of smoke.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials, requirements and installation of low-pressure metallic ductwork, joints and accessories where working static pressure does not exceed 500 Pa [2" w.g.].

1.2 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.

1.3 SUBMITTALS

.1 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

Part 2 Products

2.1 GALVANIZED STEEL

.1 Galvanized steel shall be lock forming quality with galvanizing coat both sides to ASTM A653/A653M, G90 zinc coating.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA.

.1 Nomasco Ductmate System or Exanno Nexus System or Lockformer TDC, TDF system may be used for rectangular duct joints.

.2 At least two opposite faces of all rectangular ducts must be joined together using a type of joint, which cannot pull apart.

2.2 DUCTS - GALVANIZED STEEL

.1 All ductwork shall be constructed and sealed to withstand without damage or permanent deformation at least 150% of the working static pressure.

.2 Construct rectangular ducts in accordance with SMACNA Duct Standards.

.3 Construct round ducts in accordance with SMACNA Duct Standards but excluding beaded crimp joints and snaplock seams.

.4 500 Pa [2" w.g.] working static pressure on:

.1 All supply ductwork.

.2 All exhaust ductwork.

.3 All outdoor air ductwork.

2.3 FITTINGS

.1 Construct rectangular duct fittings in accordance with SMACNA Duct Standards.

.2 Construct round duct fittings in accordance with SMACNA Duct Standards.

.3 Sheet metal gauge of fittings and elbows shall be not less than the thickness of that specified for longitudinal seam straight duct of the equivalent size.

.4 Square throated - radius heel elbows shall not to be used.

.5 Adjustable elbows are not permitted.

.6 Radiused elbows.

.1 Rectangular: Centreline radius of a rectangular duct elbow at least equal to 1.5 times the duct width, measured in the direction of the radius. If it is not possible to install a full radius elbow, use a square elbow with multi-blade turning vanes.

.2 Round: Centerline radius of 1.0 times duct diameter.

.7 Mitred elbows, rectangular: Construct with single wall turning vanes.

.8 Branches:

.1 Rectangular main and branch: 45 degrees entry on branch.

.2 Round main and branch: enter main duct at 45 degrees with conical connection.

.3 Provide volume control damper in branch duct near connection to main duct.

.9 Transitions: In accordance with SMACNA Duct Standards:

.1 Maximum taper of diverging transitions shall be 20°.

.2 Maximum taper of converging transitions shall be 30°.

.3 Maximum divergence upstream of equipment shall be 30°.

.4 Maximum convergence downstream of equipment shall be 45°.

.5 Maximum divergence of evase from centrifugal fan scroll outlet shall be 7°.

.10 Offsets: Full radiused elbows.

2.4 DUCTWORK - STAINLESS STEEL - ROUND

.1 Provide stainless steel exhaust ductwork from the dryers up to the discharge through the exterior walls.

.2 Material: 18 ga. 304 or 316L stainless steel, with No. 2B finish where concealed and No. 4 finish where exposed to the room.

.3 Provide stainless steel escutcheon trim bands around all duct wall or ceiling penetrations.

.4 Elbows: Round duct elbows shall be made of matching stainless steel or stamped elbows of the same material. Centreline radius shall be 1.5 times duct diameter.

.5 Fastening: No screws shall be used to fasten together sections of dryer duct.

.6 Support ductwork with stainless steel U-strap hangers. No. 2B finish where concealed and No. 4 finish where exposed.

2.5 FLEXIBLE DUCTWORK

.1 Flexible ductwork shall not be used on this project.

2.6 HANGERS AND SUPPORTS

.1 Support ductwork to SMACNA using:

.1 Galvanized steel straps.

.2 Cadmium plated threaded rods.

.3 Flat bar or angle hangers.

.2 Attachments to the structure shall be compatible with the structure and selected for the load of the ductwork.

2.7 WIRE MESH SCREENS

.1 Provide wire mesh screens in all air intake openings where noted on the drawings.

.2 Screens shall be constructed from 16 ga aluminum wire.

.3 Screen mesh shall be 12 mm [1/2"] grid.

.4 Mount screens in 20 ga folded aluminum frames.

2.8 SEALANT

.1 SMACNA Seal Classification B for ductwork 500 Pa [2” w.g.] and under working static pressure.

.2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.

.3 Oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of -30°C to 93°C.

Part 3 Execution

3.1 GENERAL

.1 The project drawings are diagrammatic. Effort has been made to indicate offsets and transitions, but not all are necessarily shown. Changes may be required to ductwork to avoid interference with structure and other services. Determine all required adjustments prior to fabrication and provided the adjustments without additional cost to the Contract.

.2 Working static pressure means the maximum pressure that could be created by the equipment when operating at the speed required to achieve the specified performance, by the closure (including closure due to failure) of any specified devices in the ductwork.

.3 Where a duct is to be internally insulated, size the duct so as to provide the free area duct dimensions shown on the drawings.

.4 Flash and counterflash ducts through exterior walls. Pack sleeves with fibreglass insulation and provide sheet metal to hold it in place.

.5 Arrange openings for ductwork through floors and walls to accommodate insulation, packing, sleeves, and fire/smoke dampers as appropriate.

.6 During construction, protect ductwork openings from the entry of dirt, dust and debris with suitable covers.

.7 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.8 Where ductwork is required to pass through open web steel joists, coordinate with the joist fabricator before fabricating ductwork.

3.2 DUCTWORK INSTALLATION

.1 Square throated - radius heel elbows shall not to be used.

.2 Where a duct contains a fire/smoke damper, construct the duct so that the free area of the duct is maintained through the fire/smoke damper unless otherwise indicated.

.3 Install duct necks before grilles, registers and diffusers and cushion heads after diffuser take-offs.

.4 Cross-break or bead all metal ductwork panels unless otherwise noted.

.5 Arrange ductwork so that equipment can be easily serviced and removed.

.6 Ductwork passing through non-rated fire separations, sound insulated walls and through walls and floors which are not fire separations 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 (ULC approved fire stop sealant is not a requirement). Where ducts are externally insulated provide a 24 ga thick galvanized steel band tightly fitted around the insulation and then caulk from band to wall or floor.

.7 Install breakaway joints in ductwork on sides of fire separation.

.8 To avoid a conflict with structure or other services a duct may be reduced up to 10% in cross-sectional area for up to 2 meters [6’-8”] in length. Also, to assist installation any duct may be changed in dimension by up to 50 mm [2”] with a corresponding change in the other dimension to maintain the cross-sectional area. Notify the Departmental Representative of the change. Any other changes in duct dimensions must first be reviewed and accepted by the Departmental Representative.

3.3 SEALING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

.2 Where accessible, apply sealer to inside of joints on ductwork under positive pressure.

.3 Apply sealer to outside of joints on ductwork under negative pressure.

.4 Duct tape is not a permitted sealing method.

3.4 DUCTWORK CLEANING

.1 It is the intent that the ductwork system shall be clean. No dirt, debris or dust shall be evident in a visual examination.

.2 Protect ductwork from fabrication to the completion of the project to keep it clean. Any dust, dirt or debris in the systems shall be removed.

.3 If in the opinion of the Departmental Representative the systems are not clean, provide cleaning as required including, if necessary, retaining a Cleaning Agency to do the work.

.4 Cleaning shall be to the satisfaction of the Departmental Representative.

.5 Submit a letter signed by a principal of the ductwork installing company certifying that all ductwork systems are clean.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials, requirements and installation for duct accessories including flexible connections, access doors and vanes.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings for:

.1 Flexible connections.

.2 Duct access doors.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

Part 2 Products

2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: 24 ga galvanized sheet metal frame with fabric clenched by means of double locked seams.

.2 Material: Fire resistant, self extinguishing, neoprene coated glass fabric, suitable for use from -40°C to +90°C [-40°F to 194°F], density of 1.3 kg/m2 [0.26 lb.ft2].

2.3 ACCESS DOORS IN DUCTS

.1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 24 ga complete with sheet metal angle frame.

.2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 24 ga complete with sheet metal angle frame and 25 mm [1"] thick rigid glass fibre insulation.

.3 Gaskets: neoprene or foam rubber.

.4 Hardware:

.1 Up to 300 x 300 mm [12” x 12”]: 2 sash locks.
.2 Up to 300 x 450 mm [12” x 18”]: 4 sash locks.

2.4 TURNING VANES

.1 Factory or shop fabricated galvanized steel, 22 ga minimum.

.2 Vanes shall be spaced at 40 mm [1-1/2"] centres and shall turn through 90 degrees, with a radius of 50 mm [2"].

.3 Vanes shall not include a straight trailing edge.

.4 Refer to the SMACNA Duct Standards.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 FLEXIBLE CONNECTIONS

.1 Install where indicated.

.2 Length of connection: 100 mm [4”].

.3 Minimum distance between metal parts when system in operation: 75 mm [3"].

.4 Install in accordance with recommendations of SMACNA.

.5 Install in following locations:

.1 Inlets and outlets to supply fans.
.2 Inlets and outlets of exhaust fans.

.6 When fan is running:

.1 Ducting on each side of flexible connection to be in alignment.
.2 Ensure slack material in flexible connection.
.3 Ensure flexible connection does not restrict airflow to suction side of fan.

3.3 DUCT ACCESS INSTALLATION

.1 Size to suit required access.

.2 Location:

.1 At fire/smoke dampers.
.2 At control dampers.
.3 At devices requiring maintenance.

.4 At locations required by Code.

.5 Elsewhere as indicated.

3.4 TURNING VANES

.1 Install in accordance with recommendations of SMACNA and as indicated.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials, requirements and installation for balancing dampers for mechanical forced air ventilation and air conditioning systems.

1.2 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.

1.3 SUBMITTALS

.1 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

Part 2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 SINGLE BLADE DAMPERS

.1 Fabricate from same material as duct but one sheet metal thickness heavier 16 ga, with V-groove stiffened.

.2 Size and configuration to recommendations of SMACNA, except maximum height 300 mm [12”] on rectangular ducts.

.3 Locking quadrant with shaft extension to accommodate insulation thickness.

.4 Inside and outside end bearings. Nylon on dampers up to 300 mm [12”] high, oilite bronze on dampers over 300 mm [12"] high or diameter.

.5 Channel frame of same material as adjacent duct, complete with angle stop.

2.3 MULTI-BLADED DAMPERS

.1 Factory manufactured of material same as duct, 16 ga.

.2 Opposed blade configuration. Metal thickness and construction to recommendations of SMACNA.

.3 Maximum blade height: 200 mm [8”].

.4 Bearings: bronze oilite bushings.

.5 Linkage: shaft extension with locking quadrant.

.6 Channel frame of same material as adjacent duct, complete with angle stop.

2.4 CONCEALED REGULATORS (CR):

.1 For all drywall ceilings, which do not have access panels, provide concealed balancing damper regulators embedded in the finished ceiling.

.2 Concealed damper regulator to be connected to balancing damper by means of 10 mm [3/8"] square rod and to be installed flush with ceiling.

.3 Cover plate to be held in place with 2 screws and to be easily removed for damper adjustment.

.4 Provide all necessary hardware including right angle drives and connecting rods.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install where indicated and where required by the Balancing Agent for balancing.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer’s instructions.

.3 Runouts to grilles and diffusers: Install as far as possible from registers and diffusers.

.4 All dampers shall be vibration free and have no free play when set.

.5 The lever of quadrant operators shall be parallel with the blades.

.6 Provide sheet metal bridge for operators on round ducts over 300 mm [12”] diameter and to raise operator above insulation on insulated ducts.

.7 Ensure damper operators are observable and accessible.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials, requirements and installation for fire/smoke dampers.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings for fire/smoke dampers.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

Part 2 Products

2.1 GENERAL

.1 ULC listed and labelled or Warnock Hersey tested.

.2 Fire damper assembles to be fire tested in accordance with CAN4-S112.

.3 Meet requirements of:

.1 Building Code.
.2 Fire Commissioner of Canada (FCC).
.3 ANSI/NFPA 90A.
.4 Authorities Having Jurisdiction.

2.2 COMBINATION FIRE/SMOKE DAMPERS

.1 Combination fire and smoke dampers actuator: Electrical control system actuated from smoke sensor or smoke detection system and from fusible link.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems, ANSI/NFPA 90A and in accordance with conditions of ULC listing.

.2 Coordinate with Fire Alarm system supplier.

.3 Maintain integrity of fire separation.

.4 After completion and prior to concealment obtain approvals of complete installation from Authority Having Jurisdiction.

.5 Install access door adjacent to each damper, located to test and reset the damper. See Section 23 33 00 - Air Duct Accessories. Install access door adjacent to each damper.

.6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.

.7 Install break-away joints of approved design on each side of fire separation.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials, requirements and installation for acoustic duct lining.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings for acoustic duct lining.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with Building Code, NFPA 90A and CAN/ULC-S102.

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 DUCT LINER - FLEXIBLE

.1 Minimum Noise Reduction Criteria (NRC): 0.70 at 25 mm [1"] thickness based on Type A mounting to ASTM C423.

.2 Maximum thermal conductivity per 25 mm [1"]: 0.040 W/m-°C at 24°C [0.28 Btu-in/(hr-ft2-°F) at [75]°F].

2.3 ACCESSORIES

.1 Insulation Adhesive: Water-based fire retardant type.

.2 Reinforcing Membrane: Glass fibre-reinforcing membrane.

2.4 SCOPE OF INSULATION

.1 Scope 1: Internal Duct Liner - Flexible.

		Thickness	
		mm	[ins]
.1	All ductwork where indicated by single hatching.	25	[1]
.2	All ductwork where noted on the drawings.	refer to drawings	

Part 3 Execution

3.1 GENERAL

.1 Where a duct is to be internally insulated, size the duct so as to provide the free area duct dimensions shown on the drawings.

3.2 APPLICATION OF INTERNAL DUCT LINER - FLEXIBLE

.1 Adhere insulation with insulation adhesive applied to the entire metal surface, with the coating side of insulation exposed to the air stream.

.2 Seal all transverse joints, raw edges, and other points of penetration of the coating with reinforcing membrane and insulation coating/sealer.

.3 Seal all longitudinal joints with insulation coating sealer.

.4 No raw edges of internal insulation material shall be exposed to the moving air stream.

.5 Duct size shown is dimension inside the insulation. Metal duct sizes shall be increased to allow for the internal acoustic insulation thickness.

3.3 INSULATION TERMINATION

.1 Terminate insulation short of all control, fire/smoke dampers so as not to interfere with their operation.

.2 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with sealer.

.3 Replace damaged areas of liner at discretion of the Departmental Representative.

.4 Protect leading and trailing edges of duct sections with sheet metal nosing having 15 mm overlap and fastened to duct.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials, requirements and installation for fans, motors, accessories and hardware for commercial use.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings for all fans.

.2 Indicate, at minimum, the following:

.1 Sound rating data.

.2 Fan curves showing operating point plotted on curves.

.3 Motor efficiencies.

.4 Motors, sheaves, bearings, shaft details.

.5 Sound rating data at point of operation.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

1.4 PERFORMANCE REQUIREMENTS

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

.2 Capacity: flow rate, total static pressure, BHP, W, efficiency, RPM, power, model, size, sound power data and as indicated on schedule.

.3 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99. Dynamically balance fans to 1.5 mm/s [0.06 in/s] vibration amplitude, maximum measured on bearing housings. Provide fan shafts with critical speed at least 1.5 times operational speed.

.4 Submit fan sound power levels with shop drawings, measured to AMCA 300 and calculated to AMCA 301, or other data acceptable to the Departmental Representative. Provide test data if requested. Fans exceeding design levels may be rejected.

.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210 and ASHRAE 51. Units shall bear AMCA certified rating seal.

1.5 MAINTENANCE

.1 Obtain signed receipt from the Departmental Representative when spare parts are handed over.

.2 Provide the following spare parts:

.1 Matched sets of belts for each fan.

Part 2 Products

2.1 FANS GENERAL

.1 Refer to drawings for motor position, rotation and discharge arrangements.

.2 Motors:

.1 Premium efficiency motors unless otherwise specified.
.2 Sizes as scheduled.

.3 Accessories and Hardware:

.1 Matched sets of V-belt drives.
.2 Belt guards.
.3 Coupling guards.
.4 Fan inlet and/or outlet safety screens.

.4 Factory primed before assembly in colour standard to manufacturer.

2.2 CABINET FANS

.1 Steel cabinet arranged for ducted inlet and outlet connections with duct collars (where shown) or ceiling exhaust opening complete with aluminum exhaust grille (where scheduled).

.2 Acoustically insulated cabinet.

.3 Centrifugal fan on rubber isolators.

.4 Access panel.

.5 Integral motor thermal overload protection.

.6 Motor disconnect plug and integral receptacle.

.7 Accessories:

.1 Solid state speed control.
.2 Motorized control damper.

2.3 RANGE HOODS

.1 760 mm [30"] wide.

.2 Aluminum washable filter.

.3 Lights and light switch.

.4 Solid state fan speed control.

.5 Suitable for horizontal or vertical ducting.

.6 Built-in backdraft damper and duct collar for use with 254 mm x 83 mm [10" x 3-1/4"] ducting.

.7 Baked enamel finish to Architect's colour choice.

.8 Accessories: Aluminum, flush wall cap with grille.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 FAN INSTALLATION

.1 Install fans as indicated, complete with vibration isolators and seismic restraints as specified in Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment, flexible connections.

.2 Install fans with flexible connections on inlet ductwork and on discharge ductwork in accordance with Section 23 33 00 - Air Duct Accessories. Ensure metal bands of connectors are parallel with minimum 25 mm [1"] flex between ductwork and fan during running.

.3 Install connectors on the suction side of axial fans in such a manner so that the connectors cannot be sucked into the air stream. Provide flange extensions as necessary.

.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.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials, requirements and installation for supply and exhaust grilles and registers and diffusers.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

- .1 Submit shop drawings for diffusers, registers and grilles.
- .2 Indicate, at minimum, following:
  - .1 Throw and terminal velocity.
  - .2 Noise criteria.
  - .3 Pressure drop.
  - .4 Neck velocity.

.2 Closeout Submittals:

- .1 Provide maintenance data for incorporation into Operational and Maintenance manual.

1.4 PERFORMANCE REQUIREMENTS

.1 Catalogued or published ratings shall be those obtained from tests carried out by the manufacturer or those ordered by him from an independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Grilles, registers and diffusers of same generic type shall be the product of one manufacturer.

2.2 GENERAL

.1 Acceptable Products for grilles, registers and diffusers shall meet capacity, pressure drop, terminal velocity, throw, noise level and neck velocity of the Standard of Acceptance.

.2 Frames:

- .1 Full perimeter gaskets.
- .2 Plaster frames where set into plaster or gypsum board.
- .3 Concealed fasteners.

.3 Concealed manual volume control damper operators where scheduled.

.4 Coordinate with ceiling type and grid size.

.5 Means of attachment for two seismic restraint wires unless screwed to sheet metal duct.

.6 Refer to Air Terminal schedules for terminal details and to drawings for sizes, air quantities 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 datasheet.

3.2 AIR TERMINAL INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Install with oval head, cadmium plated screws in countersunk holes where fastenings are visible.

.3 Paint ductwork matte black behind terminals where internal surfaces are visible.

.4 Install ductwork as high as practical using offsets if necessary to obtain a duct neck length of minimum two diameters.

.5 Confer with the Departmental Representative in advance of ductwork construction where there are conflicts with light locations or where locations on mechanical drawings differ from the Architectural reflected ceiling plans.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials, requirements and installation for louvres.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings for louvres, intakes and vents.

.2 Indicate, at minimum, the following:

.1 Pressure drop.

.2 Face area.

.3 Free area.

.2 Test Reports:

.1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

.3 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

1.4 PERFORMANCE REQUIREMENTS

.1 Catalogued or published ratings shall be those obtained from tests carried out by the manufacturer or those ordered by him from an independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Louvres of same generic type shall be the product of one manufacturer.

2.2 FIXED LOUVRES - ALUMINUM

.1 Material: extruded aluminium alloy (6063-T5).

.2 Blades: 100 mm [4"] deep at 45° and 90 mm [3-1/2"] centres. Upturned rain stop at trailing edge, drip channel at leading edge.

.3 Frame, head, sill and jamb: 100 mm [4"] deep one piece extruded aluminium, minimum 12 ga. Channel type frame, no flange. Jamb drainage channel.

.4 Mullions: at 1.5 m [5 ft] maximum centres, continuous blade.

.5 Fastenings: stainless steel (Society of Automotive Engineers) SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminium and head of bolt, or between nut, SS washer and aluminium body.

.6 Screen: 12 mm [1/2"] mesh, 16 ga wire aluminium birdscreen on inside face of louvres in formed 20 ga aluminium U-frame, removable.

.7 Finish:

.1 Factory applied enamel, colour to Architect's approval.

.2 Clear anodized finished.

.3 Prime coated.

.4 Mill finish.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 LOUVRE INSTALLATION

.1 Install in accordance with manufacture's and SMACNA's recommendations.

.2 Reinforce and brace air vents, intakes and goosenecks to withstand local wind loads.

.3 Provide all necessary flashing and counter flashing.

.4 Anchor securely into opening from inside. Seal with caulking all around to ensure weather tightness.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials, requirements and installation for energy recovery equipment, accessories and hardware for commercial use.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Indicate, at minimum, the following:

.1 HRV details.

.2 Fan curves showing operating point plotted on curves.

.3 Motor efficiencies.

.4 Motors, sheaves, bearings, shaft details.

.5 Sound rating data at point of operation.

.6 Fan curves showing point of operation.

.7 Vibration isolation.

.8 Bearings.

.9 Filters.

.10 Electrical schematics.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

1.4 CERTIFICATION OF RATINGS

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

1.5 MAINTENANCE

.1 Obtain signed receipt from the Departmental Representative when spare parts are handed over.

.2 Provide the following spare parts:

.1 Matched sets of belts for each fan.

1.6 QUALITY ASSURANCE

.1 Unit shall be constructed in accordance with industrial design practices.

.2 All units shall be factory tested before shipment.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Units shall be stored and handled per manufacturer's recommendations.

Part 2 Products

2.1 HEAT RECOVERY VENTILATOR (HRV-1)

.1 Capacity: as scheduled.

.2 Unit shall consist of dual fans each airstream, heat recovery core, positively draining pan (no standing water), automatic defrost function, in an acoustically insulated cabinet.

.3 Quality Assurance:

.1 The energy recovery cores used in these products shall be third party Certified by AHRI under its Standard 1060 for Energy Recovery Ventilators. AHRI published certifications shall confirm manufacture's published performance for airflow, static pressure, temperature and total effectiveness, purge air (OACF) and exhaust air leakage (EATR). Products that are not currently AHRI Certified will not be accepted.

.2 The HRV core shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of ten years from the date of purchase. The balance-of-unit shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of two years from the date of purchase.

.4 Core:

.1 The energy recovery core shall be:

.1 Material: Polymer with desiccant wheel technology.

.2 Type: Channel matrix wheel with removable segments.

.2 The HRV shall be capable of transferring both sensible and latent energy between airstreams. Latent energy transfer shall be accomplished by direct water vapour transfer from one air stream to the other, without exposing transfer media in succeeding cycles directly to the exhaust air and then to the fresh air.

.3 The HRV core shall perform without condensing or frosting under normal operating conditions (defined as outside temperatures above -23°C [-10°F] and inside relative humidity below 40%). Occasional more extreme conditions shall not affect the usual function, performance or durability of the core. No condensate drains will be allowed.

.4 Unit shall have the capacity to operate continuously without the need for bypass, recirculation, pre-heaters or defrost cycles under normal operating conditions.

.5 Airflow through the HRV core shall be laminar over the products entire operating airflow range, avoiding deposition of particulates on the interior of the energy exchange material.

.5 Construction:

.1 The unit case shall be constructed of G90 galvanized, 20-gauge steel, with lapped corners and zinc plated screw fasteners. The unit roof shall be one piece or have watertight standing seam joints and shall overlap wall panels and doors in order to positively shed water.

.2 Access doors shall provide easy access to blowers, HRV cores, and filters. Doors shall have an airtight compression seal using closed cell foam gaskets rated for outdoor exposure.

.3 Provide double wall construction with 24-gauge galvanized steel liner. Case walls and doors shall be insulated with 25 mm [1”], 4 pound density, foil/scrim faced, high-density fibreglass board insulation, providing a cleanable surface and eliminating the possibility of exposing the fresh air to glass fibres.

.4 The HRV cores shall be protected by a MERV 8 rated, 50 mm [2”] nominal, pleated, disposable filter in both airstreams. Provide one set of spare filters.

.5 Unit shall have single-point power connection and a single-point 24 VAC contactor control connection.

.6 Blower motors shall be EPACT compliant for energy efficiency and be thermally protected or supplied with external starters.

.7 Blowers shall be quiet running, forward curve type and be either direct drive or belt drive. Belt drive motors shall be provided with adjustable pulleys and motor mounts allowing for proper belt tensioning.

.8 Blowers shall be statically and dynamically balanced. Heavy duty shaft and pre-lubricated self-aligning bearings, rubber mounted, rubber isolated motor.

.9 Vibration Isolation: Unit shall be spring isolated and seismically restrained with flexible connection between fan and cabinet.

.6 Accessories:

.1 Provide factory installed fused disconnects.

.2 Provide factory installed transformer/relay package to supply a 24VAC power source.

.3 Provide factory installed filter monitors for each airstream.

.4 DDC system shall be able to control the operation of each fan separately.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

.2 Manufacturers field service representative shall approve installation and is present to supervise start up and to instruct operators.

3.2 INSTALLATION

.1 Ensure adequate clearances for servicing and maintenance.

.2 Provide flexible duct connections at unit duct flanges.

.3 Provide and install sheaves and belts required for final air balance.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials, requirements and installation for variable capacity, heat pump/heat recovery air conditioning system.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

- .1 Submit shop drawings for air conditioning units.
- .2 Indicate, at minimum, the following:
  - .1 Mounting methods.
  - .2 Capacity ratings.
  - .3 Physical size.
  - .4 Finish.
  - .5 Controls.
  - .6 Interconnection wiring schematics.

.2 Closeout Submittals:

- .1 Provide maintenance data for incorporation into Operational and Maintenance manual.

1.4 QUALITY ASSURANCE

.1 The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label.

.2 ULC listed.

.3 System supplier shall provide the installing contractor installation training prior to installing the system.

Part 2 Products

2.1 GENERAL

.1 The heat recovery system shall consist of:

- .1 Outdoor unit (CU).
- .2 Mode Control Unit (MCU).
- .3 Indoor heat pump units (HP).
- .4 Refrigerant piping and fittings.
- .5 Controls.

.2 The heat recovery system shall provide simultaneous heating and cooling without the use of reheat.

.3 The heat recovery system shall have the ability to change operation mode (MAIN heating / MAIN cooling) without turning off the compressors allowing for constant heating and cooling operation.

2.2 OUTDOOR UNIT (CU)

.1 The outdoor unit shall be completely factory assembled, internally piped and wired.

.2 Each unit shall be run tested at the factory.

.3 Outdoor unit shall have:

.1 Have a sound rating no higher than 62/83(Pressure/Power) dB(A).

.2 Have a night quiet setting to reduce nighttime sound levels.

.3 Have an accumulator with crank case heater and controls.

.4 Have a high pressure safety switch, fuse, over-current protection and crank case heater.

.5 Be capable of operating in cooling mode from -5°C to 48.9°C [23°F to 120°F].

.6 Be capable of operating in heating mode from 23.9°C to -25°C [75°F to -13°F] ambient temperatures without additional low ambient controls, additional modules, or low ambient accessories.

.7 Have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.

.8 Provide continuous heating during oil return and the defrost cycle through the use of rotational defrost.

.4 Unit Cabinet:

.1 The chassis shall be fabricated of galvanized steel, bonderized and finished with a powder coated baked enamel.

.5 Fan:

.1 The outdoor condenser fan shall be furnished with direct drive motors.

.2 All fan motors shall have inherent motor protection, and permanently lubricated bearings.

.3 All fan motors shall be mounted for quiet operation.

.4 All fans shall be provided with a raised guard to prevent contact with moving parts. The fans shall have vertical discharge airflow.

.6 Refrigerant:

.1 R410A refrigerant. Manufacturer shall only provide the refrigerant as required for unit charge.

.2 Contractor shall be required to provide additional refrigerant as required.

.7 Coil:

.1 The outdoor condenser coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.

.2 The condenser coil shall have Blue Fin anti-corrosion protection.

.3 The coil shall be protected with an integral metal guard.

.4 The coil fins shall be coated with hydrophilic paints. Coil shall be capable of withstanding a minimum 1000 hour salt spray test.

.8 Compressors:

.1 The outdoor units shall be equipped with inverter driven, vapor injection scroll compressor(s).

.2 The compressor shall:

.1 Utilize inverter driven technology to modulate capacity.

.2 Be capable of 1/60th second advanced micro-control.

.3 Utilize vapor injection technology which shall increase the mass flow rate of refrigerant, resulting in improved performance for low temperature conditions.

.4 Be equipped with an internal thermal overload protection.

.5 Be mounted to avoid the transmission of vibrations.

.9 Controls:

.1 The Outdoor unit shall be equipped with multiple circuit boards that interface to the VRF Control System and shall perform all functions necessary for operation.

.10 Electrical:

.1 208 volt, 3 phase, 60 Hz.

.11 Capacity:

.1 Refer to drawings schedules.

2.3 MODE CONTROL UNIT (MCU)

.1 The Outdoor Unit shall be capable of connecting to multiple Mode Change Units (MCUs).

.2 The MCU shall be completely factory assembled, piped and wired.

.3 Each unit shall be run tested at the factory.

.4 Casing:

.1 The MCU casing shall be fabricated of galvanized steel.

.2 Removable top access plate to ensure ease of maintenance.

.5 Refrigerant System:

.1 R410A refrigerant.

.2 There shall be a liquid/gas separator and multiple refrigeration control valves in each unit.

.3 The unit shall house two tube-in-tube heat exchangers (sub cooling) to ensure heating and cooling capacity at the indoor unit.

.4 The MCU shall be furnished with multiple, two position refrigerant valves and linear electronic expansion valves and temperature sensors which shall be used to control the variable refrigerant flow to maintain design refrigerant temperatures.

.5 All pipe connections shall be braze type.

.6 Integral Drain Pan:

.1 Unit shall not require condensate piping from the internal drain pan.

.2 Units that require a condensate drain shall not be acceptable.

.7 Electrical:

.1 208 volt, 1 phase, 60 Hz.

.8 Control:

.1 The MCU shall interface to the VRF Control System and shall perform all functions necessary for operation.

2.4 INDOOR, HEAT PUMP UNITS (HP)

.1 General

.1 The indoor units shall be factory assembled, wired and run tested with piping, control circuit board, condensate pump, and fan motor.

.2 Cabinet and Ceiling Panel:

.1 The cabinet shall have a 100 mm [4”] knockout for providing ducted, pretreated, and filtered outdoor air to the unit.

.2 The ceiling panel shall have LED indicator lights and an infrared receiver.

.3 Fan:

.1 Turbo fan with a direct driven motor.

.2 Statically and dynamically balanced to run on the motor with permanently lubricated bearings.

.3 Three (3) fan speeds: Low, Medium, High.

.4 Filter:

.1 The return air shall be filtered by means of a long-life washable permanent, electro-static filter included in the ceiling panel.

.5 Coil:

.1 The indoor coil shall be of nonferrous construction with slit fins on copper tubing.

.2 The tubing shall have inner grooves for high efficiency heat exchange.

.3 All tube joints shall be brazed with phos-copper or silver alloy.

.4 The coils shall be pressure tested at the factory.

.5 A condensate pan with drain pump shall be provided under the coil.

.6 The coil fins are coated with hydrophilic paints.

.6 Condensate Drainage:

.1 The indoor unit shall include an internal condensate pump with check-valve as standard with a maximum vertical lift of 725 mm [29”].

.2 The indoor unit shall have an integral condensate float switch to disable the unit in the event of condensate overflow.

.2 Electrical:

.1 208 volt, 1 phase, 60 Hz.

.3 Controls:

.1 The indoor units shall interface to the VRF Control System and shall perform all functions necessary for operation.

.4 Indoor Unit Types:

.1 Circular Ceiling Cassette

.1 Fully recessed into the ceiling complete with a circular ceiling grille with 360° even air distribution.

.2 The ceiling panel shall be, white, circular in shape with a circular air outlet opening.

.2 4-Way Ceiling Cassette with Grille

.1 Recessed into the ceiling complete with a square ceiling grille with 4-way even air distribution.

.2 2-stage operation - Cooling the space with the louver opens (fixed or swing) until the room temperature nears set temperature. Once room temperature is near set temperature, the operation unit will close the louver and using the face of the ceiling panel to gently cool the space with 'still' air through the perforated grille.

.3 Unit shall include a humidity sensor to prevent condensation formation in stage 2 operation in high humidity conditions.

.3 1-Way, Ceiling Cassette with Grille

.1 Recessed into the ceiling complete with a rectangular ceiling grille with 1-way air distribution.

.2 2-stage operation - Cooling the space with the louver opens (fixed or swing) until the room temperature nears set temperature. Once room temperature is near set temperature, the operation unit will close the louver and using the face of the ceiling panel to gently cool the space with 'still' air through the perforated grille.

.3 Unit shall include a humidity sensor to prevent condensation formation in stage 2 operation in high humidity conditions.

.4 Ducted Fan Coil Unit - Concealed

.1 High-performance, high static pressure capable, concealed ducted fan coil that mounts above the ceiling with a fixed horizontal discharge supply and return.

.2 The unit shall be complete with a discharge air temperature sensor. The temperature sensor shall allow configuration to control unit operation based on target cooling and heating discharge air temperatures. The temperature sensor reading shall be visible on the VRF Control system.

.3 The indoor unit shall allow service access from four sides (top, bottom, left, right).

.5 Wall Mounted

.1 Wall mounted, exposed unit with gloss white finish.

2.5 ACCESSORIES

.1 Y-Joint Kits:

.1 Required component for systems with multiple evaporators or MCU's on the same system.

.2 Y-joints shall be provided for liquid, suction, and hot gas fittings as required.

.3 Kits shall be installed as per manufacturer guidelines.

2.6 REFRIGERANT TUBING AND FITTINGS

.1 Tubing:

.1 Provide processed tubing for refrigeration installation, deoxidized, dehydrated and sealed.

.2 Hard copper tube, type L, to ASTM B88M.

.3 Annealed copper tube to ASTM B280, with minimum wall thickness as per CSA B52.

.2 Fittings

.1 Service: design pressure 300 psig and temperature 250°F.

.2 Brazed: wrought copper to ANSI B16.22 or cast bronze to MIL-F-1183E.

.3 Flanged: bronze or brass, Class 150 and Class 300 to ANSI B16.24.

.4 Flare: Bronze or brass, for refrigeration, to ANSI B16.26.

.5 Long radius type for elbows and return bends.

.3 Joints

.1 Brazing materials shall be SIL-FOS-15 phosphor-copper-silver alloy for copper piping jointed by copper fittings and silver solder for brass fittings.

.4 Insulation

.1 All refrigerant lines from the outdoor unit to the MCU, from MCUs to Indoor Units shall be insulated with a minimum insulation thickness as recommended by the Manufacturer.

2.7 VRF CONTROL SYSTEM

.1 The VRF Control system shall be capable of supporting remote controllers, system controllers, centralized controllers, an integrated web based interface, graphical user workstation, and system integration to Building Management Systems (EMCS) via BACnet.

.2 The VRF Control shall support operation monitoring, scheduling, error monitor, power distribution, online maintenance support, and integration with the EMCS.

.3 Multi-Function Controller:

.1 The wall mounted, wired controller shall control the indoor units. Provided for each Indoor Unit.

.2 The controller shall have the following minimum features:

.1 Indoor Unit operation ON/OFF.

.2 Indoor Unit operation mode, set temperature, air flow direction, fan speed, individual louver control (with supported indoor units), discharge air temperature (with supported indoor units).

.3 Quiet and sleep modes.

.4 Error display.

.5 Filter replacement alarm display and reset.

.6 Energy saving operation:

.1 Upper/lower temperature setting.

.2 Automatic operation stop function.

.3 Energy saving operation mode.

.4 Weekly operating schedule.

.7 Options to set:

.1 Desired operation mode, setting temperature, power mode (ON/OFF), and fan speed to operate based on weekly or daily schedules.

.4 Building Management Systems (EMCS) Interface

.1 Interface to provide control and monitoring of the VRF Control system through web browser via BACnet to provide individual or group control of the indoor units.

.2 The interface shall have basic operation controls including:

.1 Individual or batch control of the indoor units.

.2 Indoor Unit operation ON/OFF.
.3 Indoor Unit operation mode.
.4 Set temperature.
.5 Air flow direction.
.6 Fan speed.
.7 Error email notification.
.8 Temperature limitations.
.9 Operation mode limitation.
.10 Online maintenance.

.3 The Interface shall support:
.1 System configuration.
.2 1-day/daily/weekly scheduling.
.3 Monitoring of operation status.
.4 Online maintenance tool.
.5 Operation superseding of the remote controllers.
.6 Editable user defined control logic.
.7 Malfunction monitoring.

.4 The Interface shall allow configuration of occupied/unoccupied room settings for each indoor unit.

.5 SD memory card slot for data storage and software updating.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install units and all VRF system components as indicated and to manufacturers' recommendations.

.2 Provide and install all necessary refrigerant and condensate piping and interconnecting wiring between the Outdoor Unit, MCU, Indoor Units, controllers and controls.

.3 Maintain proper clearance around equipment to permit performance of service maintenance.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials, requirements and installation for electric forced air heaters.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

- .1 Submit shop drawings for forced flow heaters.
- .2 Indicate, at minimum, the following:
  - .1 Motor element.
  - .2 Mounting methods.
  - .3 kW rating, voltage, phase.
  - .4 Cabinet material thicknesses.
  - .5 Physical size.
  - .6 Finish.
  - .7 Controls.

.2 Closeout Submittals:

- .1 Provide maintenance data for incorporation into Operational and Maintenance manual.

Part 2 Products

2.1 FORCE FLOW UNITS - ELECTRIC

.1 CSA approved.

.2 Construction

- .1 Commercial grade.
- .2 Steel cabinet with baked enamel finish.
- .3 Inlet and outlet bar grilles on front face.
- .4 Semi-recessed mounting.

.3 Finish:

- .1 Epoxy/polyester powder paint.
- .2 Colour to Architect’s choice.

.4 Heating element: Stainless steel sheathed heating elements, with corrosion protected steel fins.

.5 Capacity: As scheduled.

.6 Controls:

.1 Two speed direct drive fan assembly and switch.
.2 Factory installed switching relays.
.3 Fan delay switch.
.4 On-off switch.
.5 Over-temperature protection.
.6 Relays and controllers suitable for control through the building DDC system.

2.2 INSTALLATION

.1 Install in accordance with the manufacturer's installation drawings, recommendations and requirements.

.2 Verify electrical service work with characteristics stamped on unit.

.3 Touch up scratches in factory paint finishes on units.

.4 Make power and control connections.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials, requirements and installation for commercial electric convectors.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings for heaters and accessories.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

Part 2 Products

2.1 BASEBOARD HEATERS - ELECTRIC

.1 CSA approved.

.2 Construction

.1 Commercial grade.

.2 Heavy duty aluminum front cover.

.3 20-gauge satin coat steel cabinet.

.3 Finish:

.1 Epoxy/polyester powder paint.

.2 Colour to Architect’s choice.

.4 Heating element:

.1 Stainless steel tubular heating element with aluminum fins.

.2 Floating heating element on high-temperature nylon bushings reducing expansion noises.

.5 Watt density: Watt density: 900 W/m [275 W/ft].

.6 Capacity: As scheduled.

.7 Control:

.1 Electronic relay and controllers suitable for control through the building DDC system.

.2 Linear high-limit temperature control with automatic reset.

Part 3 Execution

3.1 HEATING UNITS INSTALLATION

.1 Install in accordance with the manufacturer's installation drawings, recommendations and requirements.

.2 Verify electrical service work with characteristics stamped on unit.

.3 Touch up scratches in factory paint finishes on units.

.4 Make power and control connections.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials, requirements and installation for electric unit heaters.

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

- .1 Submit shop drawings for unit heaters.
- .2 Indicate, at minimum, the following:
  - .1 Performance criteria.
  - .2 Mounting methods.
  - .3 Physical size.
  - .4 kW rating, voltage, phase.
  - .5 Cabinet material thicknesses.
  - .6 Colour and finish.

.2 Closeout Submittals:

- .1 Provide maintenance data for incorporation into Operational and Maintenance manual.

Part 2 Products

2.1 UNIT HEATERS - ELECTRIC

.1 CSA approved.

.2 Construction

- .1 Horizontal, ceiling mounting with factory supplied brackets.
- .2 18 and 20-gauge steel.
- .3 Adjustable louvres to direct air flow.

.3 Finish:

- .1 Epoxy/polyester powder paint.
- .2 Colour to Architect’s choice.

.4 Fan

- .1 Direct drive propeller type.
- .2 Totally enclosed factory-lubricated ball bearing motor.
- .3 Thermally-protected motor.

.4 Fan delay purges heater of residual heat.

.5 Heating element: Tubular heating elements; stainless steel.

.6 Capacity: As scheduled.

.7 Controls:

.1 High-limit temperature control with automatic reset.

.2 Relays and controllers suitable for control through the building DDC system.

Part 3 Execution

3.1 HEATING UNITS INSTALLATION

.1 Install in accordance with the manufacturer's installation drawings, recommendations and requirements.

.2 Verify electrical service work with characteristics stamped on unit.

.3 Set unit heater discharge pattern required to suit application.

.4 Touch up scratches in factory paint finishes on units.

.5 Make power and control connections.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes methods and procedures for start-up, verification and commissioning, for building Energy Monitoring and Control System (EMCS) and includes:

- .1 Start-up testing and verification of systems.
- .2 Check out demonstration or proper operation of components.
- .3 On-site operational tests.

1.2 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.

1.3 SUBMITTALS

.1 Final Report: Submit report to Departmental Representative.

- .1 Include measurements, final settings and certified test results.
- .2 Bear signature of commissioning technician and supervisor.
- .3 Report format to be approved by Departmental Representative before commissioning is started.
- .4 Revise "AS-BUILT" documentation, commissioning reports to reflect changes, adjustments and modifications to EMCS as set during commissioning and submit to Departmental Representative.
- .5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

.2 Closeout Submittals:

- .1 Provide documentation, Operational and Maintenance Manuals, and training of O&M personnel for review of Departmental Representative before interim acceptance.

1.4 COMPLETION OF COMMISSIONING

.1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by Departmental Representative.

1.5 ISSUANCE OF FINAL CERTIFICATE OF COMPLETION

.1 Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

Part 2 Products

.1 NOT USED

Part 3 Execution

3.1 SYSTEM COMMISSIONING AND CALIBRATION

.1 Program each standalone EMCS panel immediately following installation.

.2 Set up and calibrate all control loops and sensors during the initial start-up of the systems and check, recalibrate and readjust as necessary during the Departmental Representative's demonstration and instruction period.

.3 Upon completion of the installation, perform all necessary testing and debugging operations satisfactorily.

.4 Perform all modifications and alterations as required to correct any deficiencies noted during these tests.

.5 Check sensor calibration and control system operation during the first heating season and prior to the first cooling season.

3.2 SUBSTANTIAL PERFORMANCE TEST PROCEDURES

.1 Overview: The successful completion of SEVEN [7] day acceptance test as described herein is a prerequisite to Substantial Performance. Before the SEVEN [7] day acceptance test may begin the EMCS must be completely operational including the following:

.1 Every point shall be checked end to end to ensure accuracy and integrity of systems. Each point of the EMCS Points List shall be signed off by a representative of the Controls Contractor.

.2 Start up control strategies shall be written in Operator Control Language.

.3 Time schedules shall be built and in control of time-controlled equipment.

.4 Graphical displays shall be complete and operational.

.5 Each sensor shall be placed on a trend.

.6 Runtime totalizers shall be set.

.7 Load/save of panel programs must be demonstrated.

.8 All features of system shall be exercised.

.9 Operator shall be briefed on operation of system.

.10 A trend on one panel shall be set up for a point from every other panel. These points shall also be trended in their own panels for the same intervals. Comparison of the two groups of trends will indicate if any communication problems are occurring during SEVEN [7] day test.

.11 All alarms shall be operational.

.12 Calibration of all sensors.

.13 Review with the Contractor all tests to be performed during the Seven Day test. Add any tests the Departmental Representative sees necessary in order to demonstrate proper operation of the Mechanical and Controls system.

.2 During SEVEN [7] Day Test

.1 Fire alarm shall be tested to ensure correct action of all fire sequences.

.2 Power failure for building shall be simulated, system recovery monitored.

.3 Controls strategy sequences shall be initiated which will exercise as many features of the system as possible given the temperature conditions at the time of

the test. Some sequences may require artificially loading the building in order to simulate conditions for the control sequences to respond properly.

.4 Demonstration of network operation will be required.

.5 Demonstration of hardware low limits and damper interlocks will be required.

.6 Spot checks of points end-to-end integrity will be carried out. If several problems are identified, a complete reconfirmation of system integrity will be required by Contractor.

.7 Temporarily supply an alarm printer which shall be left on for complete SEVEN [7] day test. All printouts shall be kept for review at completion of test.

.8 Results of all tests shall be documented, including written description of conditions during the test, any artificial conditions created in order to perform the test, and a one page trend chart showing the operation of relevant parts of the system during each test.

.3 Documentation: The following documentation must be in place before completion of SEVEN [7] day test and the granting of Substantial Performance:

.1 Panel layout sheets complete with point name, point address and wire identification number. One copy attached to each respective panel door.

.2 All points tagged with point name, point address and panel number.

.3 System generated Point Check-Out data sheets calibration information.

.4 As-Built control drawings.

.5 As-Built ladder wiring diagrams showing all hardware interlocks and panel input or output number.

.6 Operating and Maintenance Manual for all sensors, transducers, valves, operators, solid state relays, EMCS panels and controllers.

.7 On-line graphics with reduced floor plans showing sensors, terminals, and panel locations as well as mandatory graphic requirements.

3.3 ADJUSTING

.1 Final adjusting: upon completion of commissioning as reviewed by Departmental Representative, set and lock devices in final position and permanently mark settings.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes requirements and procedures for training program, instructors and training materials for the building Energy Monitoring and Control System (EMCS).

1.2 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.

1.3 SUBMITTALS

.1 Submit training proposal complete with hour-by-hour schedule including brief overview of content of each segment to Departmental Representative 30 days prior to anticipated date of beginning of training.

.1 List name of trainer and type of visual and audio aids to be used.

.2 Show co-ordinated interface with other EMCS mechanical and electrical training programs.

1.4 INSTRUCTIONS AND DEMONSTRATION TO OWNER

.1 The Controls Programming Contractor shall provide instruction and demonstrate to designated personnel the adjustment, operation and maintenance, including pertinent safety requirements, of the EMCS equipment and system provided to the satisfaction of the Departmental Representative.

.2 Training to be project-specific.

1.5 TIME FOR INSTRUCTION

.1 Provide a minimum of one day [7-1/2 hours] instruction.

1.6 TRAINING MATERIALS

.1 Provide equipment, visual and audio aids and materials for classroom training.

.2 Supply manual for each trainee, describing in detail data included in each training program.

.3 Review contents of manual in detail to explain aspects of operation and maintenance.

1.7 ADDITIONAL TRAINING

.1 List courses offered by name, duration and approximate cost per person per week. Note courses recommended for training supervisory personnel.

Part 2 Products

.1 NOT USED.

Part 3 Execution

.1 NOT USED.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes general requirements for building Energy Monitoring and Control System (EMCS).

1.2 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.

1.3 SUBMITTALS

.1 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

1.4 GENERAL

.1 The control system shall be fully electric / electronic, modular, flexible and fully commissioned Energy Monitoring and Control System (EMCS).

.2 Provide the controls system complete with all necessary control components and connections to achieve the specified functions and to permit the HVAC systems to perform properly in the manner described and as hereinafter specified.

.3 Provide all necessary wiring and components within the building to connect the EMCS, via Internet, to allow remote monitoring of the building EMCS.

.4 Provide all necessary wiring and components within the building to connect the building EMCS to the CCG Base Communications trunk.

.5 Set up and adjust the control system (including adjustment of actuator linkage) to achieve optimum operation of the HVAC system. This includes sequencing, timing and readjustment, as required. Modifications to the sequence of operation will not be considered as extra to the Contract. These modifications shall continue through the construction period, commissioning period and warranty period as required to achieve optimum operation of the mechanical system.

.6 Division 25 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. Both Controls Contractor and Programming Contractor are 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 control system shall be installed and programmed by the Controls Contractor using competent personnel directly and regularly employed by that company.

1.5 EXISTING BASE CONTROLS

.1 All new controls shall be consistent with the installation; format and standards of the CCG Base existing EMCS and all work shall meet or exceed existing controls standards. This shall include graphics, hardware, programming, nomenclature, etc.

Part 2 Products

2.1 EQUIPMENT

.1 The control system shall be Bacnet Testing Laboratories (BTL) certified. The Building Controller, Advanced Application Controllers and Application Specific Controllers shall all be BTL certified. All hardware shall be BACnet; gateways or interpreter devices are not acceptable.

.2 All sensors and control system components shall be compatible. All control panels and components (except dampers and sensors) shall be located in the Mechanical Room

.3 The Controllers' outputs shall be equipped with HOA switches.

2.2 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 Mechanical Division:

.1 Automatic control dampers.

.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.

Part 3 Execution

3.1 MANUFACTURER'S RECOMMENDATIONS

.1 Installation: to manufacturer's recommendations.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes methods and procedures for shop drawings and submittals for building Energy Monitoring and Control System (EMCS).

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

- .1 Hard copy to be completely indexed and coordinated package to assure compliance with contract requirements and arranged in same sequence as specification and cross-referenced to specification section and paragraph number.
- .2 Submit shop drawings for the complete EMCS in accordance with General Conditions and Section 23 0500 - Common Work Results for Mechanical.
- .3 Provide shop drawings of all equipment on the drawings and specifications to the Departmental Representative for review.
- .4 Shop drawings shall include:
  - .1 Written description indicating Sequence of Operation.
  - .2 System graphics and a description of the methodology used to keep graphics files updated and consistent with one another.
  - .3 Manufacturer's descriptive technical literature for all equipment and devices.
  - .4 An overall system interconnecting schematics showing all remote panels (Field Panels, and LAN devices), and power/surge protection locations.
  - .5 Distributed panel locations (building plan as appropriate to identify physical locations).
  - .6 Wiring diagrams.
  - .7 One-line diagram from sensor and control points to Field Interface device and/or standalone EMCS panel including all components and cables.
  - .8 Terminal cabinets, including termination listing.
  - .9 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.
  - .10 Detailed block diagrams of transmission trunk routing and configuration.
  - .11 Damper schedules indicating size, configuration, capacity and locations.

1.4 SHOP DRAWING REVIEW

.1 Review or non-review of shop drawings does not alter the requirements of the equipment and materials provided to conform to the Specification.

.2 When submitting the controls shop drawings arrange a time to review these in detail in the Departmental Representative's office.

Part 2 Products

.1 NOT USED

Part 3 Execution

.1 NOT USED

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes requirements and procedures for final control diagrams and Operation and Maintenance (O&M) Manual for building Energy Monitoring and Control System (EMCS).

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings for all control devices.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

Part 2 Products

2.1 OPERATING AND MAINTENANCE MANUALS

.1 Refer to Section 23 0500 - Common Work Results for Mechanical.

.2 The maintenance manual data is intended to cover the operation and maintenance of all control systems and equipment installed.

.3 Forward 4 copies of the Controls and Instrumentation section of the operating and maintenance manuals to the Balancing Agency to ensure the binding and format of material are compatible. Ensure sufficient time has been given to the Balancing Agency for the compiling of the complete operating and maintenance manuals by the commissioning deadline. One complete manual shall be furnished prior to the time that system or equipment tests are performed.

.4 The manuals shall include the name, address and telephone number of the Control Contractor 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.

.5 Also provide the controls Operation and Maintenance manual information in electronic form burned onto a CD.

2.2 RECORD DRAWINGS

.1 Refer to Section 23 0500 - Common Work Results for Mechanical.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes requirements and procedures for identification of devices, sensors, wiring, conduit and equipment, for building Energy Monitoring and Control System (EMCS) work and nameplates materials, colours and lettering sizes.

1.2 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.

1.3 SUBMITTALS

.1 Submit to Departmental Representative for approval samples of nameplates, identification tags and list of proposed wording.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

Part 2 Products

2.1 GENERAL

.1 All manual switches, unless they come with standard nameplates, shall be labelled with engraved lamicoid plastic nameplates to clearly indicate the service. Wording on nameplates shall be subject to approval by the Departmental Representative.

2.2 NAMEPLATES FOR PANELS

.1 Label and identify all panels and points with a numbering system consistent with the Owner’s EMCS network numbering system.

.2 Identify all EMCS panels and associated devices with symbols relating directly to the control diagram. Provide plastic labels for each input and output point with the following information:

.1 Point descriptor.

.2 Point type and channel number.

.3 Corresponding EMCS panel number.

.3 Mount an input/output layout sheet within each EMCS panel. This sheet shall include the name of the points connected to each controller.

2.3 NAMEPLATES FOR FIELD DEVICES

.1 Identify all controls with symbols relating directly to the control diagram.

.2 Data to include: point name and point address.

.3 Use plasticized tags, engraved brass, aluminum, metalphoto or lamicoid labels and secure them to, or adjacent to, the control devices with key chains.

.4 Provide lamicoid label by each freeze stat. “LOW TEMP CUT-OUT. MANUAL RESET”.

2.4 NAMEPLATES FOR ROOM SENSORS

.1 Identify by stick-on labels using point identifier.

.2 Location: as directed by Departmental Representative.

.3 Letter size: to suit, clearly legible.

2.5 WIRING

.1 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.

.2 Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.

.3 Power wiring: identify circuit breaker panel/circuit breaker number inside each EMCS panel.

.4 Use colour coded conductors, white for neutral.

2.6 CONDUIT

.1 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.

.2 Identification bands to be sprayed on and not less than 100 mm [4"] wide.

.3 Bands to be pink in colour unless in conflict with Electrical Division colours.

.4 Identify all junction box covers with control company label. Paint junction box covers blue.

Part 3 Execution

3.1 NAMEPLATES AND LABELS

.1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials, requirements and installation for field installation of the Energy Monitoring and Control System (EMCS).

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings for all control devices and equipment.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

1.4 SYSTEM DESCRIPTION

.1 Electrical:

.1 Provided by the Control Contractor (Mechanical Division):

.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.

.2 Refer to the electrical equipment schedule, the electrical drawings and the electrical specification, which describes the limits of the extent to the work in Electrical Division serving mechanical systems.

.3 Materials, equipment, connections and power not provided by Electrical Division but required for the Control System shall be provided under this Division.

.4 All control circuit transformers (120/1/60 or 24/1/60 and as designated).

.5 All control wiring and metallic conduit for mechanical system controls.

.6 Supply, installation and connection of all electric control items including: relays, outside sensors, sub-master control circuits, safety devices, electric thermostats, wiring to terminal strips, proportional controllers, controllers, etc.

.7 All wiring and conduit from power distribution system to any control devices needing power (including EMCS components).

.8 Hard wiring between field control devices and EMCS field panels.

.9 Be responsible for coordinating with Electrical Division.

.10 Electrical work installed under Mechanical Division shall be to the standards specified under Electrical Division.

.2 Provided by the Electrical Division:

.1 All power wiring and conduit from power distribution system up to and including connection to all motors and starters.

.2 All disconnect switches required (unless specified in schedules as being integral with equipment).

.3 All motor protection switches, stop-start switches, magnetic starters, contactors and hand-off-automatic selector switches except those supplied as part of packaged equipment.

.4 Terminal strips within the motor control centers (MCC) for control connections.

.5 Fire alarm signals.

.3 Note: All magnetic starters for equipment shall have the following features supplied under Electrical Division:

.1 Hand-off-automatic selector or on-off selector, or start-stop buttons in cover with hand-automatic bridge if applicable.

.2 Pilot light.

.3 120 volt coils.

.4 120 volt control transformer.

.5 Four auxiliary dry contacts for interlocks; two normally open and two normally closed.

.4 The Controls Contractor is responsible for reading Electrical Division plans and specifications to determine scope of responsibility and standards.

Part 2 Products

2.1 WIRING AND CONDUIT

.1 Carrier System:

.1 All wiring for 24 volts or less in mechanical service spaces, in stud walls or where exposed to view shall be run in EMT conduit except the final 900 mm [3 feet] of wiring to all operators and to all sensors subject to vibration which shall be run in flexible metallic conduit.

.2 Provide conduit for all wiring between the fire alarm panel and the EMCS panels.

.3 All wiring for over 24 volts shall be run in EMT conduit.

.4 Provide steel fittings with nylon throats for all conduit connections.

.2 Wire:

.1 Line voltage power or switched power wiring - #12 gauge copper wire minimum.

.2 Line voltage control wiring - #14 gauge copper wire, length not to exceed 50 meters; #12 gauge copper wire, lengths exceeding 50 meters.

.3 Low voltage - minimum #20 gauge wire as directed by applicable electrical codes and requirements.

.3 Cable:

.1 Data transmission cable shall be minimum Category 5 cable.

Part 3 Execution

3.1 INSTALLATION

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

3.2 ELECTRICAL COMPONENTS, WIRING AND CONDUIT

.1 Run carrier system and wire not in conduit parallel to building lines.

.2 Support carrier system to Electrical Division standards independent of piping, ductwork and equipment.

.3 Support wire not in a carrier system every one meter independent of piping, ductwork and equipment.

.4 Control wiring shall not be placed in the electrical cable tray.

.5 All wiring shall be concealed in finished spaces.

.6 Seal all penetrations through fire separations as per Code requirements.

.7 Adhere to all applicable electrical Codes and Regulations.

.8 Obtain electrical permit.

.9 For non CSA equipment, submit to Inspection Authorities and obtain approval prior to installation of equipment on site.

3.3 IDENTIFICATION

.1 Refer to Section 25 05 54- EMCS: Identification.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes requirements and procedures for warranty and activities during warranty period and service contracts, for building Energy Monitoring and Control System (EMCS).

1.2 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.

1.3 SUBMITTALS

.1 Submit detailed preventative maintenance schedule for system components to Departmental Representative.

.2 Submit detailed inspection reports to Departmental Representative.

.3 Submit dated, maintenance task lists to Departmental Representative and include the following sensor and output point detail, as proof of system verification:

- .1 Point name and location.
- .2 Device type and range.
- .3 Measured value.
- .4 System displayed value.
- .5 Calibration detail
- .6 Indication if adjustment required,
- .7 Other action taken or recommended.

.4 Submit network analysis report showing results with detailed recommendations to correct problems found.

.5 Records and logs:

- .1 Maintain records and logs of each maintenance task on site.
- .2 Organize cumulative records for each major component and for entire EMCS chronologically.
- .3 Submit records to Departmental Representative, after inspection indicating that planned and systematic maintenance have been accomplished.

.6 Revise and submit to Departmental Representative in accordance with Section 01 78 00 - Closeout Submittals "RECORD DRAWINGS" documentation and commissioning reports to reflect changes, adjustments and modifications to EMCS made during warranty period.

.7 Closeout Submittals:

- .1 Provide maintenance data for incorporation into Operational and Maintenance manual.

1.4 WARRANTY

.1 Refer to General Conditions.

.2 The system including all hardware and software components shall be warranted for a period of one year following the date of final acceptance. Any manufacturing defects arising during this warranty period shall be corrected without cost to the Departmental Representative.

.3 All applicable software as detailed in this specification shall be updated free of charge during the warranty period. This will ensure that all system software will be the most up-to-date software available. All future update to the software/hardware shall be made available to the Departmental Representative.

.4 Provide written assurance that a local service centre will be maintained with a complete stock of replacement parts, and is capable of servicing any and all troubles in the system.

.5 Use of installed equipment during construction shall not shorten or alter the warranty period as specified in the General Conditions.

.6 The warranty shall cover all costs for parts, labour, associated travel, any software sequence modifications, and expenses throughout the warranty period.

.7 Take note of and provide any extended warranties specified.

1.5 MAINTENANCE SERVICE DURING WARRANTY PERIOD

.1 The Controls Contractor shall provide all services, materials and equipment necessary for the maintenance of the entire Control System, for a period of one year concurrent with the warranty period. Any necessary material required for the maintenance work shall be provided by the Controls Contractor.

.2 The Controls Contractor shall provide one inspection per quarter or as required by the manufacturer and all service for the required maintenance.

.3 Systems Modification: recommendations for system modification shall be provided in writing to the Departmental Representative. No system modification, including operating parameters and control settings, shall be made without prior approval and necessary maintenance on printers.

.4 Provide services, materials, and equipment to maintain EMCS for specified warranty period. Provide detailed preventative maintenance schedule for system components as described in Submittal article.

.5 Emergency Service Calls:

.1 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.

.2 Repairs of a non-emergency nature shall be promptly repaired on the next normal business day.

.3 Initiate service calls when EMCS is not functioning correctly.

.4 Qualified control personnel to be available during warranty period to provide service to "CRITICAL" components whenever required at no extra cost.

.5 Furnish Departmental Representative with telephone number where service personnel may be reached at any time.

.6 Perform Work continuously until EMCS restored to reliable operating condition.

.6 Operation: Foregoing and other servicing to provide proper sequencing of equipment and satisfactory operation of EMCS based on original design conditions and as recommended by manufacturer.

.7 Work requests: record each service call request, when received separately on approved form and include:

.1 Serial number identifying component involved.

.2 Location, date and time call received.

.3 Nature of trouble.

.4 Names of personnel assigned.

.5 Instructions of work to be done.

.6 Amount and nature of materials used.

.7 Time and date work started.

.8 Time and date of completion.

.8 Provide system modifications in writing. No system modification, including operating parameters and control settings, to be made without prior written approval of Departmental Representative.

Part 2 Products

.1 NOT USED.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform as minimum (3) three minor inspections and one major inspection (more often if required by manufacturer) per year.

.2 Provide detailed written report to Departmental Representative as described in submittal article.

.3 Perform inspections during regular working hours, 0800 to 1630 h, Monday through Friday, excluding statutory holidays.

.4 Following inspections are minimum requirements and should not be interpreted to mean satisfactory performance:

.1 Perform calibrations using test equipment having traceable, certifiable accuracy at minimum 50% greater than accuracy of system displaying or logging value.

.2 Check each field input/output device.

.3 Provide dated, maintenance task lists, as described in Submittal article, as proof of execution of complete system verification.

.5 Minor inspections to include, but not limited to:

.1 Perform visual, operational checks to BC's, peripheral equipment, interface equipment and other panels.

.2 Check equipment cooling fans as required.

.3 Visually check for mechanical faults, air leaks [and proper pressure settings on pneumatic components].

.4 Review system performance with Operations Supervisor to discuss suggested or required changes.

.6 Major inspections to include, but not limited to:

.1 Work under Minor inspection.

.2 Clean OWS(s) peripheral equipment, BC(s), interface and other panels, micro-processor interior and exterior surfaces.

.3 Check signal, voltage and system isolation of BC(s), peripherals, interface and other panels.

.4 Verify calibration/accuracy of each input and output device and recalibrate or replace as required.

.5 Provide mechanical adjustments, and necessary maintenance on printers.

.6 Run system software diagnostics as required.

.7 Install software and firmware enhancements to ensure components are operating at most current revision for maximum capability and reliability.

.8 Perform network analysis and provide report as described in Submittal article.

.7 Rectify deficiencies revealed by maintenance inspections and environmental checks.

.8 Continue system debugging and optimization.

.9 Testing/verification of occupancy and seasonal-sensitive systems to take place during four (4) consecutive seasons, after facility has been accepted, taken over and fully occupied.

.10 Test weather-sensitive systems twice: first at near winter design conditions and secondly under near summer design conditions.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes hardware and software requirements for the graphics and programs for the Building Energy Monitoring and Control System (EMCS).

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings for all control devices.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

1.4 FAMILIARIZATION WITH THE OWNER'S STANDARDS

.1 The Controls Contractor shall be responsible to become familiar with the installation, programming and graphics of the CCG Base existing standards.

Part 2 Products

2.1 PROGRAM REQUIREMENTS

.1 All control software, graphics generation software, energy management software and maintenance software shall be provided. Provide a total of two (2) licenses for each of these software packages and install on a remote computers.

.2 All software shall be provided for the Owner to make any changes to the system without Control Contractor support (i.e. if the Owner needs to change a graphic, provide the graphic software that generated the original).

.3 Provide all hardware and software necessary to allow remote communications via modem and Internet to off-site locations. The offsite locations shall be able to communicate with the remote site system even if the remote PC is turned off or not functioning. If a gateway or key is required for any remote communication function what so ever, the Control Contractor shall provide to the Owner, at no cost, for as many remote sites present and future as the Owner desires.

.4 The Controls Contractor shall set and adjust the control system to achieve optimum operation of the 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 shall continue through the construction

period, commissioning period and warranty period as required to achieve optimum operation of all systems controls.

2.2 POINT NAMES

.1 All point names, real and virtual, shall be consistent with the naming system used in the Owner's other buildings.

.2 The Controls Contractor shall coordinate the proposed naming system with the Departmental Representative and submit the list for review.

2.3 GRAPHICAL USER INTERFACE

.1 Graphical User Interface for this project shall be consistent with the graphics used in the Owner's other buildings.

.2 Operator workstation interface software shall optimize operator understanding through the use of English language prompting, English language point identification and industry standard PC application software.

.3 The software shall provide, as a minimum, the following functionality:

.1 Real-time graphical viewing and control of environment.
.2 Scheduling and override of building operations.
.3 Collection and analysis of historical data and dynamic data (trend plot).
.4 Definition and construction of dynamic colour graphic displays.
.5 Editing, programming, storage and downloading of global controller databases.
.6 Alarm reporting, routing, messaging, and acknowledgment.

.4 Provide a graphics, which shall minimize the use of keyboard through the use of a mouse and "point and click" approach to menu selection.

.5 Provide functionality such that any of the following may be performed simultaneously on-line, and in any combination, via user-sized windows:

.1 Dynamic colour graphics and graphic control.
.2 Alarm management, routing to designated locations, and customized messages.
.3 Week at a Glance Time-of-Day scheduling.
.4 Trend data definition and presentation.
.5 Graphic definition and construction.
.6 Program and point database editing on-line.

.6 Provide a security system that prevents unauthorized use unless the operator is logged on. Access shall be limited to the operator's terminal functions unless the user is logged on.

.7 Each operator Terminal shall provide security for 50 users (minimum). Each user shall have an individual password. Each user shall be individually assigned which control functions and menu items the user has access to. All passwords, user names and access assignments shall be adjustable on-line, at the operator's terminal. Each user shall also have a set security level that defines access to displays and also defines what individual points the user can control.

.8 Operator Activity Tracking - An audit trail report to track system changes, accounting for operator initiated actions, changes made by a particular person or changes made to a specific piece of equipment designated time frame, shall be printable and archived for future use. The operator activity tracking shall be in a tamper-proof buffer file.

.9 Reports shall be generated on demand or via pre-defined schedule and directed to CRT displays, printers or disk. As a minimum, the system shall allow the user to easily obtain the following types of reports:

.1 A general listing of all or selected points in the network.

.2 List of all points currently in alarm.

.3 List of all points currently in override status.

.4 List of all points currently locked out (manual report).

.5 List of user accounts and access levels.

.6 Excel reports.

.7 System diagnostic reports including, list of EMCS panels on line and communicating, status of all EMCS terminal unit device points.

.8 List of programs.

.10 Scheduling and Override:

.1 Provide a graphical spreadsheet-type format for simplification of time-of-day scheduling and overrides of building operations. Schedules reside in both the PC workstation and EMCS Global Controller to ensure time equipment scheduling when PC is off-line, PC is not required to execute time scheduling. Provide override access through menu selection or function key. Provide the following spreadsheet graphic types as a minimum:

.1 Display of Weekly schedules shall show all information in easy to read 7-day (week) format for each schedule. This includes all on/off times for each day along with all optimum start information.

.2 Holiday schedules shall show all dates that are to be holidays. Holidays shall be shown on the terminal in a graphical calendar format showing all scheduled days for a given month. User shall be able to easily scroll through the months for each year. Each day assigned as a holiday shall display as "All Off" or show "Scheduled" for that day.

.3 Event schedules shall be shown in the same graphical calendar format and manner as Holiday schedules.

.2 Operator shall be able to change all information for a given Weekly, Holiday or Event schedule if logged on with the appropriate security access.

.11 Collection and Analysis of Historical Data:

.1 Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point may be trended automatically at time-based intervals or change of value, both of which shall be user-definable. Trend data may be stored on hard disk for future diagnostics and reporting. Additionally, trend data may be archived to network drives or removable disk media for future retrieval.

.2 Trend data reports shall be provided to allow the user to view all trended point data. Reports may be customized to include individual point or predefined groups of at least six points. Provide additional functionality to allow predefined groups

of up to 250 trended points to be easily transferred on-line to Microsoft Excel. EMCS Contractor shall provide custom designed spreadsheet reports for use by the Owner to track energy usage and cost, equipment run-times, equipment efficiency, and/or building environmental conditions. EMCS Contractor shall provide set up of custom reports including creation of data format templates for monthly or weekly reports.

.3 Provide additional functionality that allows the user to view real-time trend data on trend graph displays. A minimum of six points may be graphed together. The dynamic graphs shall continuously update point values. At any time the user may redefine sampling times or range scales for any point. In addition, the user may pause the graph and take “snapshots” of screens to be stored on the workstation disk for future recall and analysis. Exact point values may be viewed and the graphs may be printed.

.4 System software shall be capable of graphing the trend log point data. Software shall be capable of creating x-y graphs that display up to 6 points at the same time in different colours. Graphs shall show point value relative to time.

.5 Operator shall be able to change trend log set up information as well. This includes information to be trend logged as well as interval at which information is to be logged. All points in the system may be logged. All operations shall be password protected. Set up and viewing may be accessed directly from any and all graphics point is displayed on.

.12 Application Software:

.1 The application software is the auxiliary software, which shall be included in this system.

.2 Energy Management software:

.1 Daily use.

.2 Monthly use.

.3 Daily Hi and Low.

.4 Monthly Hi and Low.

.5 Demand Limiting and Load Shedding Program.

.3 Maintenance Software:

.1 Schedule Maintenance.

.2 Run time accumulation for any specified equipment.

.13 Alarm Indication:

.1 System Terminal shall provide audible, visual and printed means of alarm indication. The Alarm Dialog box shall always become the Top Dialog box regardless of the application(s) being run at the time.

.2 Provide log of alarm messages. Alarm log shall be archived to the hard disk of the system terminal. Each entry shall include point descriptor and address, time and date of alarm occurrence, point value at time of alarm, time and date of point return to normal condition, time and date of alarm acknowledge.

.3 Alarm messages shall be in plain English (or specified language) and shall be user definable on site or via remote communication. System shall provide a minimum of 20 user definable messages for each zone controlled.

.4 Alarm shall be sent to the Operator Work Station.

.5 Print out all alarms on the Operator Work Station printer.

.14 Controller Status: Provide means for operator to view communication status of all controllers connected to the system. Display shall include controller and status. Status will show if controller is communicating or not.

.15 Configuration/Set up: Provide means for operator to display and change system configuration. This shall include but not be limited to system time, day of the week, date of day light savings set forward/setback, printer type and port addresses, modem port and speed, etc. Items shall be modified utilizing easy to understand terminology using simple mouse/cursor key movements.

.16 Dynamic Colour Graphic Displays

.1 Create Site Layout Colour graphic including icons which link to building equipment, building floor plan displays with room temperatures and other building sensors values dynamically displayed. Icons on the floor plans will allow links to the building Mechanical equipment. Provide System graphics for each piece of mechanical equipment and hot water systems as applicable, with dispersed dynamic data as indicated in the Points List. Points required by the sequence of operations shall also be displayed even if they are not defined by the Points List to optimize system performance analysis and speed alarm recognition.

.2 All points on the EMCS Points List and all related virtual points shall be included in the graphic screens.

.3 Provide as a minimum the following graphics.

.1 Main menu graphic.

.2 Building Floor plans which indicate:

.1 All spaces served by the systems.

.2 Room temperature sensors.

.3 Control dampers.

.4 Air conditioning and associate condensing units.

.3 Individual AHU graphics including dampers, air temperatures, etc. (including any related exhaust fans).

.4 Heat Recovery System.

.5 Domestic water system including:

.1 Pressures.

.2 Hot water recirculation pump.

.6 EF shall be shown on the floor plans, clicking on the device will display all data associated with the device.

.7 All graphics will provide in addition to the system points the following. They are:

.1 Outside air temperatures

.2 Fire Alarm.

2.4 GRAPHICS AND POINTS ACCEPTANCE PROCEDURES

.1 A copy of each graphical screen page shall be signed off and dated by the Controls Contractor and the Departmental Representative. Any changes shall be noted. This signed set shall be left on site as the “RECORD DRAWINGS”.

.2 A summary print out generated by the supplied system of each group of point types for each panel shall be printed after commissioning and calibration. Each sheet shall be signed by the Controls Contractor's commissioning person, and the Departmental Representative. The print out will be stored in a binder by the Departmental Representative for reference by all.

.3 If any changes are noted during spot checks they shall be manually written on the original print out with the date and signature of person noting changes.

2.5 BUILDING AUTOMATION SYSTEM POWER FAILURE AND SYSTEM RESTART

.1 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.

.2 Restart the system automatically and in an orderly fashion once power is restored.

.3 Restart equipment based on priority to minimize in-rush currents as large loads are reintroduced.

.4 Restart only those systems or loads that are normally scheduled to operate at the time of the restart.

.5 Alarm any equipment that fails to restart when requested.

.6 Provide manual reset lockout capability.

2.6 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 EMCS if any equipment is not in the intended operating condition or if any analog input is not within the intended operating range continuously for at least one minute.

Part 3 Execution

3.1 INSTALLATION REQUIREMENTS

.1 Provide necessary power as required from 120 V emergency power panels for all equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials, requirements and installation for control devices integral to the Building Energy Monitoring and Control System (EMCS).

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings for all control devices.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

Part 2 Products

2.1 GENERAL

.1 Provide all remote sensing points and instrumentation as required for the complete operational capability of the Control System. All sensors shall have the accuracies as stated hereinafter.

.2 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.3 All instruments of a particular category shall be of the same type and manufacture.

.4 All external trim material shall be completely corrosion resistant with all internal parts assembled in watertight, shockproof, vibration proof, heat resistant assembly.

.5 Use standard conduit box termination with screwdriver connector block unless otherwise specifically stated.

.6 Components shall be suitable for operating conditions from 0°C [32°F] to 60°C [140°F] with 10-90% RH (non-condensing) unless otherwise specifically stated.

.7 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.

.8 Outdoor installations: Use weatherproof construction in NEMA 4 enclosures.

.9 Devices installed in user occupied space not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

2.2 CURRENT TRANSDUCERS

.1 Design: Best Coil D78009; Nelsen-Kulisan.

.2 Range: 0-120 amps.

.3 Accuracy: +/-1%.

.4 Interface care:

.1 +/-1% accuracy.

.2 Integral zero and span adjustment.

.3 1-5 VDC or 4-20 mA output for full range input.

.5 Acceptable Products: Greystone CS-350

2.3 PANELS

.1 Controllers, Relays, [Current to Pneumatic Transducers,] Solenoid Air Valves, to be installed in NEMA I enclosures.

.2 Panels to be either free standing or wall mounted enamelled steel cabinets with hinged and key locked front door.

.3 Panels shall be modular with multiple panels being used if required for capacity in any particular location. They shall handle all requirements with space to accommodate an additional 20% without adding further cabinets.

.4 All panels shall be lockable with same key.

.5 All wiring [and tubing] within panels to be located in trays or individually clipped to back of panel, and clearly identified.

.6 [Each panel for transducers shall have a single, quality, minimum 85 mm [3-3/8”] diameter pressure gauge with flexible tubing and needle mounted permanently in the panel. Each transducer shall have a downstream pressure access point. The flexible tubing on the gauge shall be sufficient length to access all pressure access points.]

2.4 RELAYS

.1 Provide double voltage 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.

2.5 SURGE SUPPRESSOR/FILTER

.1 Design: Tripp Lite Isobar Gold Seal.

.2 UL 1449 and UL 1283 listed.

.3 Noise suppression minimum:

.1 20 dB at 50 kHz.
.2 40 dB at 150 kHz.
.3 80 dB at 1 MHz.
.4 30 dB at 6 to 1000 MHz.

.4 High voltage spike suppression between hot to neutral, hot to ground. Handles up to 13,000 amp spikes. 210 Watt-second capacity, 300 volt let-through, less than 5 nanoseconds response.

.5 Provide surge suppressor/filter for each EMCS Panel.

2.6 TEMPERATURE SENSORS

.1 Temperature sensors shall be thermistor or resistance type.

.2 The following shall apply to thermistor or resistance temperature sensors as applicable.

.1 RTDs shall be 1,000 ohm at 0°C (+/- .2 ohm) nickel or platinum element with strain minimizing construction and 3 integral anchored leadwires, coefficient of resistivity of 0.000385 ohms/ohm/°C.
.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, +/- 0.5°C.
.2 0°C to 50°C, +/- 0.25°C.
.3 0°C to 25°C, +/- 0.1°C.
.4 0°C to 100°C, +/- 1°C.
.6 Temperature sensors on the four water connections to the heat exchanger shall have a temperature range of 50°C to 150°C and an accuracy of +/-1°C.

.3 Temperature sensors shall be of the following types:

.1 Room type - LCD display to show space temperature and temperature set point complete with momentary override switch, set point adjustment, and LCD display to show space temperature and temperature set point. Element length of 10-50 mm with ceramic tube or equivalent mode of mechanical protection.
.2 General purpose duct type - suitable for insertion into air ducts at any angle, insertion length shall be suitable for application. Copper sheathed construction.
.3 Outside air type - complete with non-corroding shield designed to minimize solar and wind effects, threaded fitting for mating to 12 mm [1/2”] conduit, probe length of 100 to 150 mm [4” to 6”], weatherproof construction in NEMA 4 enclosure.

Part 3 Execution

3.1 GENERAL

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.3 Testing: All field devices shall be properly calibrated and tested for performance and accuracy. A report detailing test performed and results to be submitted to the Departmental Representative for approval. The Departmental Representative will verify results at random. Provide all testing equipment necessary. Provide manpower necessary to assist Departmental Representative's verification.

.4 Fire stopping: provide space for fire stopping in accordance with Section 07 84 00 – Fire stopping. Maintain fire rating integrity.

.5 Identification: Identify field devices in accordance with Section 25 05 54 - EMCS: Identification.

3.2 PANELS

.1 Arrange for conduit entry from top, bottom or either side.

.2 Wiring within panels: locate in trays or individually clipped to back of panel.

.3 Identify wiring and conduit clearly.

3.3 TEMPERATURE SENSORS

.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:

.1 Weatherproof construction in NEMA 4 enclosures.

.2 These installations shall be protected from solar radiation and wind effects by stainless steel shields.

.4 Install space instruments at a height of 1.5 m above the finished floor, unless otherwise indicated.

.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 Duct installations:

.1 Shall be located to sense the correct temperature of the air only.

.2 Shall not be located in dead air spaces.

.3 The location shall be within the vibration and velocity limits of the sensor.

.4 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.

.5 Elements shall be thermally isolated from brackets and supports to respond to air temperature only.

.6 Sensor element to be supported separately and not connected to coils or filter racks.

3.4 TESTING AND COMMISSIONING

.1 Calibrate and test field devices for accuracy and performance.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes materials, requirements and installation for control dampers and actuators integral to the Building Energy Monitoring and Control System (EMCS).

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings for control dampers and actuators.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operational and Maintenance manual.

Part 2 Products

2.1 CONTROL DAMPERS

.1 Opposed type blade for all modulating dampers unless otherwise indicated.

.2 Parallel type blade for all two position dampers unless otherwise indicated.

.3 Extruded aluminum or formed galvanized steel blades, frames, gussets and blade stops.

.4 Shafts - galvanized steel with keyways for securing blades to shafts.

.5 Hardware - keyed to prevent blade slippage and to provide smooth blade movement.

.6 Bearings - oil impregnated sintered bronze. Provide additional thrust bearings for vertical blades. Confirm in advance with Departmental Representative any vertical blade dampers.

.7 Assemblies - rigid and adequately braced with corner gussets.

.8 Maximum frame dimensions - 1220 mm [48"] wide and 1220 mm [48"] high, unless otherwise indicated. Multiple sections to have stiffening mullions.

.9 Bearings and seals - suitable for exposure to a minimum of -30°C [-22°F] and a maximum of 100°C [212°F].

.10 Maximum blade width - 200 mm [8"].

.11 Low leakage type with blade and frame seals.

.12 Maximum leakage in closed position shall be 50 L/s per square metre [10 CFM per square ft.] of face area at 1000 Pa [4" w.g.] pressure differential. For smoke control purposes dampers to be labelled to ULC Standard S112.1 (UL-555S) level 1 leakage.

.13 Galvanized coating on all sheared edges of galvanized steel frames and blades exposed to outside atmosphere.

.14 Indicated size is outside frame dimension. Confirm with installer before fabrication.

.15 Blades to be horizontal in vertical mounted dampers. Refer to drawings for orientation of dampers.

.16 Provide an additional drive shaft bearing if the drive shaft is longer than 75 mm [3"].

.17 Dampers shall be adequate for the maximum system pressure. Refer to the appropriate section of the specification.

2.2 DAMPER ACTUATORS

.1 Damper actuators for all control dampers shall be supplied by this trade.

.2 Spring return for "fail-safe" in Normally Open or Normally Closed position where required.

.3 Size actuators to control dampers against maximum pressure or dynamic closing pressure whichever is greater.

.4 Size damper actuators so that they will provide smooth and full travel of the dampers while stroking in both directions.

.5 Electric/Electronic Damper Actuators:

.1 Actuators for control dampers shall be provided by the Controls Contractor.

.2 Provide 120 or 24 volt damper actuators.

.3 Actuators shall be direct coupled enabling it to be mounted directly to the damper shaft without the need for connecting linkage.

.4 The actuators shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.

.5 Proportional actuators shall accept a 2 to 10 VAC or 4 to 20 mA signal and provide a 2 to 10 VDC position feedback signal.

Part 3 Execution

3.1 CONTROL DAMPER INSTALLATION

.1 Hand over to and instruct the installer on damper installation.

.2 Check that dampers are installed square and true and that blades close tightly against seals and stops.

.3 Ensure that damper end-linkages are easily accessible (coordinate with installer).

.4 Do not install dampers within the thickness of any wall unless otherwise indicated (coordinate with installer).

.5 Where individual dampers are installed, provide a separate damper actuator for each damper.

.6 Where multi-section dampers are installed, provide a separate damper actuator for each section or pair of sections.

.7 Locate damper actuators so that they are easily accessible for testing and servicing.

.8 Where damper actuator operates outdoor or exhaust air dampers, pretension the damper drive linkage to ensure tight closure.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes at minimum detailed narrative description of Sequence of Operation for the Building Energy Monitoring and Control System (EMCS).

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit with the shop drawings a written description indicating Sequence of Operation.

Part 2 Products

.1 NOT USED

Part 3 Execution

3.1 OCCUPANCY SCHEDULE

.1 Provide a schedule to define OCCUPIED and UNOCCUPIED periods for each system and set up the specified related controls.

3.2 MISCELLANEOUS SYSTEMS

.1 Outdoor Air

.1 Provide an outdoor air temperature sensor and monitor it.

.2 Emergency Generator

.1 Run wiring in waterproof conduit from EMCS panel underground to the emergency generator.

.2 Monitor all generator alarms including but not limited to generator failure, low fuel, etc.

.3 Trap Seal Priming

.1 Provide 12 mm [1/2”] solenoid valve(s) on the cold water system.

.2 This valve shall be piped to the traps of the floor drains.

.3 Open the solenoid valve on a regular schedule to provide trap priming to the two drains.

.4 Electric Power Meter

.1 Coordinate and provide all required software and hardware to monitor the electric meter on the EMCS system.

.2 Electric meters and transmitters provided by Electrical Division. Meter communications include Ethernet over copper media and/or BACnet using Ethernet and/or RS485 for integration to BMS system. (NOTE coordinate communications integration with EMCS system with the Electrical contractor to ensure cross compatibility between system for protocol, media and licensing).

.3 Monitor the following electric meters.

.1 Main Service.

.5 Lighting Control

.1 Refer to Electrical specifications.

.2 Provide all interface, points and controls to monitor and controls the lighting system through the building EMCS system.

.3 Coordinate final lighting sequences with the Owner.

3.3 FIRE PROTECTION SYSTEMS

.1 Run wiring in EMT conduit from EMCS panel to alarm panel.

.2 Monitor the fire alarm panel for:

.1 Alarm signal.

.2 Trouble signal

3.4 DOMESTIC COLD WATER SYSTEM CONTROLS

.1 Monitor the following:

.1 Pressure on the cold water entering the building. Provide pressure sensor.

.2 Pressure on the cold water after the meter. Provide pressure sensor.

.3 Pressure on the cold water after the booster pumps. Provide pressure sensor.

.2 Domestic Water Meter

.1 Monitor the domestic water meter.

3.5 DOMESTIC HOT WATER SYSTEM CONTROLS

.1 The system consists of:

.1 Electric Domestic hot water tank, T-DHW.

.2 Domestic hot water circulation pump, P-DHWR.

.2 The internal controls of T-DHW shall control the operation of the system.

.3 Provide control to start and stop recirculation pump P-DHWR on an OCCUPIED/UNOCCUPIED schedule. Monitor the pump’s current.

3.6 VARIABLE REFRIGERANT FLOW (VRF) HEAT PUMP SYSTEM

.1 The VRF Controls System shall control the operation of the VRF systems including the Outdoor Unit, Indoor Units, controllers and sensors.

.2 Provide and install all necessary control and interconnecting wiring between the Outdoor Unit, MCU, Indoor Units, controllers, controls and the EMCS.

.3 Coordinate with Section 23 82 21.15 Variable Refrigerant Flow (VRF) Heat Pump System.

.4 Provide a complete EMCS graphics of the VRF Control System.

.5 Through the VRF Controls System interface monitor, control, provide occupancy schedules and temperature alarms for the following Indoor Units:

.1 HP-101, circular ceiling cassette.
.2 HP-106, circular ceiling cassette.
.3 HP-107, 4-way ceiling cassette.
.4 HP-112, fan coil - concealed.
.5 HP-126b, wall mounted.
.6 HP-201, circular ceiling cassette.
.7 HP-202, circular ceiling cassette.
.8 HP-207, 1-way ceiling cassette.
.9 HP-208, 1-way ceiling cassette.
.10 HP-209, 1-way ceiling cassette.
.11 HP-210, 4-way ceiling cassette.
.12 HP-211, 1-way ceiling cassette.
.13 HP-212, 1-way ceiling cassette.

.6 The following shall be monitored and controlled for each Indoor Unit:

.1 ON/OFF - monitor and control.
.2 Operation mode - monitor and control.
.3 Temperature set point - monitor and control.
.1 For HP-112 monitor and control the VRF supply air temperature for unit control and provide a room temperature sensor to reset the VRF supply air sensor to maintain room temperature set point.
.4 Fan speed - monitor and control.
.5 Error email notification - monitor.
.6 Temperature limitations - monitor and control.
.7 Operation mode limitation - monitor and control.

3.7 HEAT RECOVERY SYSTEM AND WASHROOM EXHAUST (HRV-1)

.1 The system consists of:

.1 Heat Recovery Ventilator (HRV-1):
.1 Exhaust fan (EF-HRV1).
.2 Supply fan (SF-HRV1).
.2 Room Temperature Sensors.

.2 Monitor the following:

.1 Supply air temperature from the HRV (T-HRV1-SA).
.2 Exhaust air temperature (T-HRV1-EA).
.3 Current from HRV exhaust fan.
.4 Current from HRV supply fan.

.3 OCCUPIED

.1 SF-HRV1 and EF-HRV1 shall run continuously.

.2 Operate the heat recovery wheel to maintain the supply air temperature set point. Initially set to 20°C [68°F]. Work with the Users to determine the lowest satisfactory temperature set point.

.4 UNOCCUPIED

.1 SF-HRV1 and EF-HRV1 shall be OFF.

.2 Set back each temperature set point by 4°C [8°F].

3.8 WASHROOM TRANSFER FAN (TF-115)

.1 The system consists of:

.1 Transfer fan (TF-115)

.2 Monitor the following:

.1 Current from the transfer fan.

.3 OCCUPIED

.1 EF-115 shall be ON.

.4 UNOCCUPIED

.1 EF-115 shall be OFF.

3.9 ELECTRIC FORCED FLOW HEATERS (FF-102, FF-124)

.1 Provide a room temperature sensor for each forced flow heater and monitor the room temperature. Coordinate the exact location of the sensors on site with the Departmental Representative.

.2 Provide a relay in the forced flow heater.

.3 Cycle the unit heater (FF-xxx) to maintain room temperature set point.

.4 When UNOCCUPIED set back each set point temperature by 4°C [8°F].

3.10 WORK SHOP ROOM TEMPERATURE CONTROL (ROOM 126)

.1 The system consists of:

.1 Unit heaters (UH-126-1, UH-126-2).

.2 Room temperature sensor.

.3 Door switch.

.2 Provide a room temperature sensor for Room 126 and monitor the room temperature. Coordinate the exact location of the sensors on site with the Departmental Representative.

.3 Monitor the operation (OPEN/CLOSED) of the bay door.

.4 Provide a relay in the unit heaters.

.5 Cycle the unit heaters (UH-126-1 and UH-126-2) to maintain room temperature set point.

.6 When the bay door is OPEN for more than 10 minutes (adjustable) then disable the unit heaters.

3.11 WORKSHOP EXHAUST FAN (ROOM 126)

.1 The system consists of:

.1 Intake louvre and control damper (CD-EF126-OA).

.2 Exhaust fan (EF-126) and control damper (CD-EF126).

.3 Wall mounted ON/OFF switch.

.2 Provide the control dampers.

.3 Electrical Division shall provide a manual wall mounted switch to control the operation of the exhaust fan. Monitor the operation of the exhaust fan.

.4 Hardwire the control dampers CD- EF126-OA and CD-EF126 to OPEN when EF-126 starts and CLOSE when the fan is not running.

3.12 ELECTRICAL ROOM TEMPERATURE CONTROL (RM 126a)

.1 The system consists of:

.1 Intake louvre and control damper (CD-EF126a-OA).

.2 Exhaust fan (EF-126a) and control damper (CD-EF126a).

.2 Provide a temperature sensor and monitor the temperature in the Electrical Room.

.3 Provide the control dampers.

.4 If the temperature sensor calls for cooling then cycle EF-126a to maintain set point.

.5 Hardwire the control dampers CD- EF126a-OA and CD-EF126a to OPEN when EF-126a starts and CLOSE when the fan is not running.

.6 Monitor the motor current for EF-126a.

3.13 FITNESS RM EXHAUST FAN (EF-205)

.1 The system consists of:

.1 Exhaust fan (EF-205).

.2 Wall mounted timer switch.

.2 Electrical Division shall provide a manual wall mounted timer switch to control the operation of the exhaust fan.

3.14 ELECTRIC BASEBOARD HEATERS (BB-xxx)

.1 Provide a room temperature sensor for each baseboard heater and monitor the room temperature. Coordinate the exact location of the sensors on site with the Departmental Representative.

.2 Provide a relay in each baseboard heater.

.3 Cycle the baseboard (BB-xxx) to maintain room temperature set point.

.4 When UNOCCUPIED set back each set point temperature by 4°C [8°F].

3.15 ALARMS

.1 Provide software high and low alarms for each space temperature sensor. Initially set at 10°C [18°F] above set point and 5°C [9°F] below set point.

.2 Provide software high and low alarms for each current sensor.

.3 Provide software low alarm for each of the domestic water pressures. Initially set at 280 Pa [40 psig] for 5 minutes continuous.

.4 Provide other software alarms as indicated in this section and the points list.

3.16 EQUIPMENT FAIL POSITIONS

.1 All outdoor air control dampers shall fail closed.

.2 The Electrical room control dampers shall fail open.

.3 The fail position is the position on a loss of power or control signal.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes at minimum input/output points list for the Building Energy Monitoring and Control System (EMCS).

1.2 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.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit with the shop drawings the complete Input/Output points list.

.2 Submit shop drawings for all control devices.

1.4 POINTS LIST

NOTE: This Points List does not necessarily include all required points. Any additional points required to achieve the Sequence of Operation in Section 25 90 01 shall be provided.

UNIT NO. OR LOCATION	TYPE OF POINT	Input DI	Input AI	Output DO	Output AO	NOTES
MISCELLANEOUS SYSTEMS						
T-OA	Temp Sensor - Outdoor Air		X			
GEN	Emergency Generator Alarm	X				
TP-xxx	Solenoid Valve - Trap Seal Priming			###		Number of valves as required
E-MAIN	Electric Power Meter		X			
LIGHTS	Lighting Control	Refer to Electrical specifications				
FIRE PROTECTION SYSTEMS						
FIRE ALARM	Monitor Fire Alarm Panel	X				
FIRE-TROUBLE	Monitor Fire Panel - Trouble	X				
DOMESTIC WATER SYSTEM						
DCWP-1	Pressure Sensor - Water Entering Building		X			
DCWP-2	Pressure Sensor - after the Backflow Preventer		X			
DCWP-3	Pressure Sensor - after the Water Meter		X			
DCW METER	Water Meter		X			
DOMESTIC WATER SYSTEM						
P-DHWR	Pump ON/OFF - DHW Recirc			X		
P-DHWR	Current Sensor		X			

□

NOTE: This Points List does not necessarily include all required points. Any additional points required to achieve the Sequence of Operation in Section 25 90 01 shall be provided.

UNIT NO. OR LOCATION	TYPE OF POINT	Input DI	Input AI	Output DO	Output AO	NOTES
HEAT RECOVERY SYSTEM AND WASHROOM EXHAUST (HRV-1)						
HRV1-SF	Fan ON/OFF			X		
HRV1-SF	Current		X			
HRV1-EF	Fan ON/OFF			X		
HRV1-EF	Current		X			
T-HRV-SA	Supply Air Temp Sensor		X			
T-HRV-EA	Exhaust Air Temp Sensor		X			
HRV1-W	Heat Recovery Wheel ON/OFF			X		
WASHROOM TRANSFER FAN (TF-115)						
TF-115	Fan ON/OFF			X		
TF-115	Current		X			
ELECTRIC FORCED FLOW HEATERS						
T-102	Rm Temp Sensor		X			
FF-102	Heater ON/OFF			X		
T-124	Rm Temp Sensor		X			
FF-124	Heater ON/OFF			X		
WORK SHOP ROOM TEMPERATURE CONTROL (ROOM 126)						
T-126	Rm Temp Sensor		X			
DOOR-126	Door OPEN/CLOSED	X				
UH-126-1	Heater ON/OFF			X		
UH-126-2	Heater ON/OFF			X		
WORKSHOP EXHAUST FAN (ROOM 126)						
EF-126 CD-EF126	Monitor Fan ON/OFF, Control Damper OPEN/CLOSE	X				Damper wired to fan
CD-EF126-OA	Control Damper OPEN/CLOSE			X		
ELECTRICAL ROOM TEMPERATURE CONTROL (RM 126a)						
T-126a	Rm Temp Sensor		X			
EF-126a CD-EF126a	Fan ON/OFF, Control Damper OPEN/CLOSE			X		Damper wired to fan
EF-126a	Current Sensor		X			
CD-EF126a-OA	Control Damper OPEN/CLOSE			X		
ELECTRIC BASEBOARD HEATERS (BB-xxx)						
T-114	Rm Temp Sensor		X			
BB-114	Heater ON/OFF			X		
T-116-1	Rm Temp Sensor		X			
BB-116-1	Heater ON/OFF			X		
T-116-2	Rm Temp Sensor		X			
BB-116-2	Heater ON/OFF			X		
T-120	Rm Temp Sensor		X			
BB-120	Heater ON/OFF			X		

□

NOTE: This Points List does not necessarily include all required points. Any additional points required to achieve the Sequence of Operation in Section 25 90 01 shall be provided.

UNIT NO. OR LOCATION	TYPE OF POINT	Input DI	Input AI	Output DO	Output AO	NOTES
T-123	Rm Temp Sensor		X			
BB-123	Heater ON/OFF			X		

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 This Section describes the Common Work Results applicable to electrical disciplines.

1.2 GENERAL

.1 The general conditions and general requirements together with all amendments and supplements contained in the General Specifications shall form an integral part of the electrical specification and will be made part of this contract.

.2 Reference to “Electrical Divisions” shall mean all Divisions 26, 27, 28, 23 and 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 Confirm with the architectural plans and specifications the extent and nature of the work and how it will affect the electrical work. Include in the tender sum for any complications or additional work described therein.

.5 Review mechanical plans and specifications for the extent of electrical work required to make mechanical systems complete and include this work in the tender sum.

.6 Review structural plans for limitations of penetrations or inclusions of electrical equipment. In the tender sum, allow for avoiding critical areas with electrical equipment.

.7 Review existing site conditions for limitations of penetrations or inclusions of electrical equipment. In the tender sum, allow for avoiding critical areas with electrical equipment.

.8 Comply with the requirements of the General Contract, and coordinate the installation with all other trades on site.

.9 Confirm on-site the exact location of equipment, outlets, and fixtures and the location of outlets for equipment supplied by other trades.

1.3 WORK INCLUDED

.1 This work shall include the supply and installation of all the necessary materials and apparatus for complete operating systems as indicated on the plans or mentioned in this specification, with the exception of materials or apparatus specifically mentioned to be omitted or to be supplied by owner.

.2 Items obviously necessary or reasonably implied to complete the work, shall be included as if shown on drawings and noted in the specifications.

.3 All materials, tools, appliances, scaffolding, apparatus and labour necessary for the execution, erection and completion of the systems described herein shall be furnished. This includes providing lighting and power for own work.

.4 This contract shall include, but is not confined to, the following scope of work:

.1 Incoming services
.2 All electrically related civil works, trenching, backfilling, resurfacing
.3 Underground ducts including concrete encasement and pullboxes.
.4 Main power service
.5 Power distribution equipment
.6 Power connections and outlets
.7 Automatic Transfer Switch
.8 Surface wireways
.9 Emergency generator system
.10 Mechanical equipment connections
.11 Lighting system
.12 Lighting controls
.13 Exit signs
.14 Emergency lighting
.15 Solar PV System

.5 Complete all electrical connections to equipment and accessories pertaining to this contract and leave all in operating condition to the electrical Consultant's satisfaction.

1.4 WORK EXCLUDED

.1 The contract scope of work shall not include the following:

.1 Low voltage mechanical systems control wiring where indicated in electrical and mechanical specifications to be done by controls contractor shall be excluded from the electrical contractor work as noted.

1.5 DRAWINGS AND SPECIFICATIONS

.1 The drawings and specifications compliment each other and what is called for by one is binding as if called for by both. If there is any doubt as to meaning or true intent due to a discrepancy between the electrical drawings and specifications, and all other contract documents, obtain written ruling from Consultant prior to tender closing. **Failing this, the most expensive alternative is to be allowed for.**

.2 The plans show the approximate location of outlets and apparatus but the right is reserved to make such changes in location as may be necessary to meet the emergencies of construction in any way. No extra will be allowed for such changes to any piece of electrical equipment unless the distance exceeds 3 metres, or if the relocation is required after initial installation is complete.

.3 It is imperative that the contractor visit the site and completely familiarize himself as to the work to be undertaken.

1.6 CODES AND STANDARDS

.1 All electrical work shall be carried out in accordance with the latest edition of the CEC C22.1 (Canadian Electrical Code) as amended and adopted by the Province of British

Columbia and to the satisfaction of the Electrical Inspection Authority having jurisdiction, except where specified or specifically stated otherwise.

.2 Do underground systems in accordance with CSA C22.3 No.1 latest edition, except where specified or specifically stated otherwise.

.3 All work shall be carried out in accordance with the National Building Code current edition (including all local amendments) to the satisfaction of local building inspector authority having jurisdiction.

.4 Any electrical material and/or equipment supplied by any contractor or sub-contractor for installation on this project must bear evidence of CSA approval or special CSA certification acceptable to the Authorities having Jurisdiction.

1.7 CARE, OPERATION AND START-UP

.1 Instruct Operating Personnel in the operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.8 VOLTAGE RATINGS

.1 Operating voltages: to CAN3-C235 latest 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.

1.9 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay all associated fees.

.3 Fees will cover all routine inspections by the District Electrical Inspector. Any fees for follow-up inspections found to be necessary by the District Electrical Inspectors as a result of incorrect work shall be borne by this contractor without any cost to the owner.

.4 Notify SAR Representative of changes required by Electrical Inspection Department prior to making changes.

.5 Furnish Certificates of Acceptance from Electrical Inspection Department Authorities having Jurisdiction on completion of work to SAR Representative.

.6 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work. Obtain electrical permit and pay associated fees.

.7 Consultant will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost to the Contractor.

.8 Furnish to SAR Representative on completion of work Certificates of Acceptance from Electrical Inspection Department.

1.10 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with the Construction Waste Management Plan as established by the Construction Manager.

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

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

.4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Consultant.

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

1.11 SINGLE LINE ELECTRICAL DIAGRAMS

.1 Provide single line electrical diagrams under plexiglass as follows:

.1 Electrical distribution system: locate in main electrical room.

.2 Drawings: 600mm x 600mm minimum size.

1.12 LOCATION OF OUTLETS

.1 Locate outlets in accordance with these specifications and as indicated on the Architectural and Electrical drawings.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000mm, and information is given before installation.

.4 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

1.13 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise on the Architectural and Electrical drawings.

.1 Local switches: 1400 mm.

.2 Wall receptacles:

.1 General: 300 mm (Second Level)

.2 : 900 mm (First Level)

.3 Above top of continuous baseboard heater: 200 mm.

.4 Above top of counters or counter splash backs: 175 mm.

.5 In mechanical rooms: 1400 mm.

.3 Panelboards: as required by Code or as indicated.

.4 Telephone and data outlets: 300 mm.

.5 Fire alarm stations: 1200 mm.

.6 Fire alarm bells: 2100 mm (or if in conflict with ceiling, 300mm below ceiling).

1.14 LOAD BALANCE

.1 Measure phase current to panelboards with normal loads (lighting and mechanical) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State voltage, time and date at which each load was measured.

1.15 EXTRA WORK

.1 Any extra work ordered to be done shall be governed by this specification unless specific instructions or clauses are contained in the Change Order. In such cases, these instructions or clauses shall supersede those of the specification for this particular application only.

1.16 FIELD QUALITY CONTROL

.1 All electrical work to be carried out by qualified, licensed electricians or supervised apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform

specific tasks. The activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.

.2 The work of this division to be carried out by a contractor who holds a valid Master Electrical Contractor License as issued by the Province that the work is being conducted.

.3 Conduct and pay for following tests:

.1 Power generation and distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and lighting control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: fire alarm system, communications.

.4 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.5 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350V with a 500V instrument.

.2 Check resistance to ground before energizing.

.6 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.7 Submit test results for Consultant's review.

1.17 CO-ORDINATION OF TRADES

.1 Consult with Construction Manager and all subtrades involved to confirm the location of the various outlets and equipment, and cooperate fully to ensure that no conflict arises during the installation.

.2 Special care shall be taken that equipment, outlets, junction boxes or pullboxes will not be obstructed by other structure, equipment, pipes or ducts installed under this general contract by other trades.

.3 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.

.4 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.

.5 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 the Consultant and all affected parties.

.6 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.

1.18 PROTECTION OF EQUIPMENT

.1 This contractor shall provide and ensure maximum protection of electrical equipment on the site. Electrical equipment, including existing electrical equipment, shall be kept clean and dry at all times and caution shall be taken to ensure no mechanical damage is done to the equipment. Equipment shall not be delivered to the site until it can be stored safely or placed in final position and the space is clean.

1.19 DAMAGES

.1 If the finish of electrical equipment is damaged either when received or during installation, have such equipment completely refinished and restored to its original condition at no cost to the owner.

.2 Irreparably damaged equipment shall be replaced at no cost to the owner.

1.20 SHOP DRAWINGS

.1 Submit electronic shop drawings, product data and samples in accordance with the contract specifications.

.2 Shop drawings to have been reviewed and stamped by contractor prior to submittal.

.3 Shop drawings and product data shall indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

.4 Where applicable, include wiring, single line and schematic diagrams.

.5 Include wiring drawings or diagrams showing interconnection with work of other sections.

.6 Prior to manufacture of any item made specifically for this job, submit detailed drawings of the item through the Construction Manager.

.7 Shop drawings must be received by the Consultant at a date early enough to permit reasonable study prior to approval and manufacture, or to permit alterations where necessary. Late submissions of shop drawings will be sufficient reason for a stoppage of construction pending approval, or removal and replacement of any unsatisfactory item at the contractor's expense.

.8 Shop drawings/product data 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 schedule data.

.5 Advertising literature will be rejected.

.6 The project and equipment designations shall be identified on each document.

.7 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 Control explanation and internal wiring diagrams for packaged equipment.

.4 A written description of control sequences relating to the schematic diagrams.

1.21 CUTTING AND PATCHING

.1 This contractor is responsible for all cutting or blocking out required to install electrical equipment.

.2 If this contractor makes excessive cuts or does not coordinate work so that finished work requires cutting or patching, then this contractor shall pay for all patching to original condition.

.3 Any dispute resulting from this shall be referred to the general contractor for decision.

1.22 PROTECTION OF EXPOSED LIVE EQUIPMENT

.1 Protect exposed live equipment during construction for personnel safety.

.2 Shield and mark live parts "LIVE 120 VOLTS", or with appropriate voltage.

.3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

1.23 INSPECTIONS AND TESTS

.1 Notify the SAR Representative and authorities having jurisdiction at least five (5) working days in advance when the installations will be ready for inspection or testing.

.2 Test reports, signed by all attending authorities, shall be submitted to the SAR Representative through the General Contractor after successful completion of an inspection or test.

.3 Conduct all tests in a thorough and complete manner to the satisfaction of the SAR Representative and pay for any fees incurred to complete tests.

.4 Furnish the Consultant with a copy of Certificate of Inspection from Authorities having Jurisdiction indicating that all work has been satisfactorily completed and issued prior to final connection.

1.24 CLEAN UP

.1 Vacuum clean all new raceways and any electrical equipment. Ensure that no debris or spare parts are left in any electrical equipment.

.2 Any scrap material shall be removed from the site and disposed of by the Contractor.

.3 At time of final cleaning, clean lighting reflectors, lenses and other lighting surfaces that have been exposed to construction dust and dirt.

1.25 SURPLUS MATERIALS

.1 All material removed from existing site and not being reused in this contract shall be the property of the owner and delivered as directed by the owner’s representative. Material as it becomes surplus shall be reviewed by the SAR Representative and that part considered of value to the owner shall be classed as surplus material, all other becomes scrap material, and shall be disposed of by the contractor.

1.26 SPARE PARTS

.1 This contract calls for spare parts or material. These are to be provided new in unopened cartons to the owner at the time of substantial completion of the contract.

.2 Obtain a signed receipt from the owner's representative for all these parts or materials and include a copy in the front of the maintenance manual. Without this receipt these items will be treated as a deficiency and the cost withheld at twice the estimated value by the SAR Representative.

1.27 AS BUILT DRAWINGS

.1 Obtain two (2) sets of white prints for the sole purpose of recording changes in installation as they occur. One (1) set is to be used in the field for day-to-day recording, and one (1) set for submittal after completion.

.2 These plans shall be kept up-to-date as changes occur and shall be available to be inspected by the SAR Representative.

.3 Arrange and pay for the incorporation of any "as-built" changes to digital PDF plans and AutoCAD plans on disks. These changes shall be of similar quality of presentation as the original plans. NOTE: All plans whether requiring as-built changes or not, shall be included in this disk.

.4 Should the contractor require the Electrical Consultant to prepare the as-built CAD disk, the cost would be $275 per plan, unless excessive changes have been required. Costs associated with such excessive changes should be included with the change orders.

.5 These amended drawings shall be given to the SAR Representative at time of final inspections.

.6 "As-built" drawings shall include the location and circuit numbers of junction boxes in ceiling spaces, and all conduit placed in or under poured concrete. Note normal depth of conduits below top of concrete slab.

.7 See architectural documents for quantity of paper copes and disc.

1.28 OPERATING AND MAINTENANCE MANUALS

.1 Submit operating and maintenance manuals and disc for equipment as requested by the general section of the contract. Include descriptive and technical data, all shop drawings, operating procedures, routine and preventative maintenance, wiring diagrams, spare parts lists, warranties, service companies, suppliers for replacement parts, test results, fire alarm certificate of verification, generator test result, electrical inspection authority certificate and contract guarantee.

.2 Submit documentation in **green colored** heavy duty three ring binders, with lettering on spine identifying: "OPERATING AND MAINTENANCE MANUAL", project title and system names.

.3 Submit one copy for approval by SAR Representative prior to assembly of final sets.

1.29 DEMONSTRATION OF SYSTEMS

.1 Instruct operating personnel in the operation, care and maintenance of equipment.

.2 Arrange and pay for services of manufacturer's factory service Consultant to supervise start-up of installation, check, adjust, balance and calibrate components of generator system.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.30 WARRANTY

.1 Within a period of one year from the date of final acceptance of work, replace or repair at own expense any defect in workmanship or material. Reused material shall be operating satisfactorily at the time of final acceptance but subsequent failures are not the responsibility of this contractor.

.2 Warranties for equipment having more than one year guarantee shall be made out to owner, and copies shall be provided in the maintenance manuals.

.3 Maintenance from manufacturer and contractor of all equipment shall be included for first year, including all lamps except incandescent.

1.31 PAINTING

.1 Arrange and pay for the painting of the devices noted in these specifications, in particular:

.1 exposed conduits and conduit fittings.

.2 Painting shall be to match colour and finish of adjacent walls, with at least two coats of sprayed enamel paint to the satisfaction of the Architect.

1.32 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Provide a coordination/protective study and short circuit study of all equipment specified herein and submit for review.

.2 Include the following:

.1 120/208V panelboards, transfer switch, emergency generator and connecting feeder cables.

.2 Generator overcurrent device, generator short circuit curves

.3 Any additional data necessary for successful completion of the coordination and short circuit study.

1.33 ARC FLASH HAZARD ASSESSMENT

.1 The Electrical Contractor is to include in tender sum a cash to retain the services of an Electrical Engineer to perform an arc flash hazard assessment of electrical power distribution equipment installed under this contract in accordance with NFPA-70E requirements and IEEE-1584 Guidelines.

.2 Arc flash hazard assessment is to take place at time of completion of power distribution equipment installation and is to include power system wide short circuit and protective device coordination study of the electrical equipment installed to determine arc flash hazard threshold incident energy level boundaries and PPE requirements at each distribution panel installed.

.3 Printed warning labels to be provided for installation by the Electrical Contractor at each panel indicating the following:

.1 Flash hazard boundary (inches)

.2 Cal/cm^2 Flash hazard at 18 inches

.3 PPE level and required protective equipment

.4 Shock hazard in KV when cover is removed

.5 Available fault current level in KA

.4 Include copy of arc flash assessment in with maintenance manuals.

Part 2 Products

2.1 MANUFACTURERS AND CSA LABELS

.1 Visible and legible, after equipment is installed.

2.2 MATERIALS AND EQUIPMENT

.1 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.

.2 Factory assemble control panels and component assemblies.

2.3 WARNING SIGNS

.1 As specified and to meet the requirements of the BC Electrical Inspection Authority and the Consultant.

.2 Decal signs, minimum size 175mm x 250mm.

2.4 FINISHES

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

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

2.5 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.2 Nameplates:

.1 Lamicoid 3mm thick plastic engraving sheet, mechanically attached with self tapping screws.

.2 Nameplate colors shall be as follows:

.1 Normal power: Black face with white letters;

.2 Life safety emergency power: Red face with white letters;

.3 Standby power: Blue face with white letters.

.3 Nameplate sizes shall be as follows

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

.3 Labels:

.1 Embossed plastic labels with 6mm high letters unless specified otherwise.

.4 Wording on nameplates and labels to be approved by SAR Representative prior to manufacture.

.5 Allow for average of twenty-five (25) letters per nameplate and label.

.6 Identification to be English

.7 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.8 Identify equipment with Size 3 labels engraved "ASSET INVENTORY No. [___]". Number as and if directed by Consultant.

.9 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.10 Terminal cabinets and pull boxes: indicate system and voltage.

.11 Transformers: indicate capacity, primary and secondary voltages.

2.6 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1 [latest edition].

.4 Use colour coded wires in communication cables, matched throughout system.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies materials and installation for seismic restraint systems for electrical installations.

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 Engineer shall be able to provide a proof of professional insurance and the related practice credentials, upon request. The Seismic Engineer shall be familiar with SMACNA, ECABC & NFPA guidelines as well as the BC Building Code requirements.

.3 The Contractor's Seismic Engineer shall submit original signed BC Building Code "Letters of Assurance" "Model Schedules S-B and S-C" to the Prime Consultant or Electrical Consultant.

.4 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 Engineer, 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 Engineer 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 Engineer 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 Engineer.

.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 Engineer.

Part 2 Execution

2.1 GENERAL

.1 All seismic restraints systems shall conform to local authority having jurisdiction and all applicable code requirements.

2.2 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 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.

.3 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.

.4 Provide transverse bracing at 12.2 m [40 ft] intervals maximum unless otherwise noted. Provide bracing at all 90^{o} bend assemblies, and pull box locations.

.5 Provide longitudinal bracing at 24.4 m [80 ft] intervals maximum unless otherwise noted.

.6 Do not brace conduit runs against each other. Use separate support and restraint system.

.7 Support all conduits in accordance with the capability of the pipe to resist seismic load requirements indicated.

.8 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.

.9 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.

.10 Provide large enough conduit sleeves through walls or floors to allow for anticipated differential movements with firestopping where required.

.11 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 Engineer and submit shop drawings to consultants for their reference.

2.3 FLOOR MOUNTED EQUIPMENT

.1 Bolt all equipment, e.g. generators, etc. to the structure. Design anchors and bolts for seismic force applied horizontally through the center of gravity to a seismic force of 0.5g. For equipment which may be subject to resonances, use a nominal 1.0 g seismic force.

.2 Provide flexible conduit connections between floor mounted equipment to be restrained and its adjacent associated electrical equipment.

2.4 LED FIXTURES

.1 LED fixtures in suspended ceilings shall be hung independently of the ceiling system. Fixtures shall be secured to concrete or structural deck above by at least two seismic cables which are connected to the fixture at diagonal points.

.2 Surface and recessed style fixtures shall be hung independently of the ceiling system. Fixtures shall be secured to concrete or structural deck above by seismic cables.

.3 Fixtures which are hung independently of ceiling systems shall have minimum of one seismic cable in addition to the chain or cable used to support the fixture. Seismic restraint cables shall be secured into the concrete or structural deck above.

.4 Cables shall be corrosion resistant and approved for the application.

.5 Fixtures which are rod hung shall have seismic ball alignment fittings at the ceiling and fixture.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies the materials and installation for wire and box connectors, rated to 1000V.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

- .1 CAN/CSA-C22.2No.18 latest edition, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
- .2 CSA C22.2No.65 latest edition, Wire Connectors.

.2 National Electrical Manufacturers Association (NEMA)

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper alloy sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2No.65, with current carrying parts of copper alloy sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

- .1 Connector body and stud clamp for stranded copper conductors.
- .2 Clamp for stranded copper conductors.
- .3 Stud clamp bolts.
- .4 Bolts for copper conductors.
- .5 Sized for conductors as indicated.

Part 3 Execution

3.1 NOT USED

.1 Not Used

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies coppe5rated 0-1000 Volts and the most common electrical insulation and covering materials.

.2 This section does not include fire rated building wire to ULC S139 and CSA C83, marine, hazardous, mining, instrumentation, communication and fire alarm wiring.

1.2 REFERENCES

.1 CSA C22.2 No .0.3 latest edition, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No. 131 latest edition, Type TECK 90 Cable.

1.3 GENERAL REQUIREMENTS

.1 Typically use insulated 98% conductivity copper conductor wiring enclosed in conduit for the general wiring systems unless otherwise indicated.

.2 Teck cable may only be used where specifically indicated on the drawings or in the specifications. Where permitted, Teck wiring up to 750 system volts to be PVC jacketed armoured cable, multi-copper conductor type Teck90 1000 volt having a PVC jacket with FT-4 flame spread rating.

.3 Flexible AC90 armoured cabling (BX) shall "**NOT**" be used for the general wiring system other than final drops to recessed light fixtures.

.4 Provide all control wiring except HVAC controls as specified in Mechanical Divisions.

.5 Refer to Equipment Schedule(s) for detailed responsibilities.

.6 Non-metallic sheathed wiring is not to be used on this project.

.7 All wiring to be in conduit unless situation requires otherwise. Review with consultant.

Part 2 Products

2.1 WIRE AND CABLE 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 [latest edition].

.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 AC90 (BX) cable may only be utilized for drops from ceiling mounted outlet boxes. Use anti-short connectors.

2.2 TECK CABLE (IF ALLOWED)

.1 Cable: to CAN/CSA-C22.2 No. 131 latest edition.

.2 Conductors:

- .1 Grounding conductor: copper.
- .2 Circuit conductors: copper, size as indicated.

.3 Insulation:

- .1 Type: ethylene propylene rubber.
- .2 Chemically cross-linked thermosetting polyethylene rated type RW90, 600V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking galvanized steel or aluminum.

.6 Fastenings:

- .1 One 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 or more cables at 1000 mm centers.
- .3 Threaded rods: 6 mm dia. to support suspended channels.

.7 Connectors:

- .1 Watertight approved for TECK cable.

2.3 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from galvanized steel or aluminum strip.

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Fittings.

.2 In underground ducts in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Fittings.

.3 All wires are to be pulled in together in a common raceway, using liberal amounts of Compound 77 lubricant.

.4 All power circuits connected to isolated ground type receptacles are to have individual separate neutral c/w insulated bonding conductor.

.5 No combining of circuits onto common neutral will be permitted. Use 2 pole or 3 pole breakers for combined circuits, no connector clips will be allowed.

.6 Ensure that all single phase loadings are reasonably closely balanced over the main feeders.

.7 All dimmer circuits are to have individual neutral conductors for each circuit.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies U shape support channels either surface mounted. Suspended or set in poured concrete walls or ceilings.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41mm, 2.5mm thick, surface mounted, suspended, or set in poured concrete walls and ceilings.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to surfaces with lead anchors or nylon shields as required.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to suspended ceilings with toggle bolts.

.4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.5 Fasten exposed conduit or cables to building construction or support system using straps.

- .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.

.6 Suspended support systems.

- .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.7 For surface mounting of two or more conduits use channels at 1.5m on centre spacing.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Consultant.

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies materials and installation for splitters, junction boxes, pull boxes and cabinets.

1.2 PRODUCT DATA

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

.2 Product Data: submit manufacturer's product data sheets indicating dimensions, materials, and finishes, including classifications and certifications.

.3 Shop Drawings: submit shop drawings for custom manufactured items showing materials, finish, dimensions, accessories, layout, and installation details.

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 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 minimum extension all around, for flush-mounted pull and junction boxes.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor.

.3 Install terminal blocks as required.

.4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Install size 2 identification labels indicating system name, voltage and phase, as appropriate to clearly indicate the enclosure use.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies rigid and flexible wiring fasteners, fittings and installation.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES - GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped. Do not use sectional boxes.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi-gang device boxes for flush installation, minimum size 76 x 51 x 38 mm or as indicated.

.2 Larger 102 mm square x 54mm deep outlet boxes to be used for single gang when more than one conduit enters one side, for telecommunication outlets (for slack storage), or for flush mounting devices in finished plaster and/or tile walls. Provide raised device covers as required.

.3 For larger boxes (those requiring more wiring space, MUTOAs, etc.) use pre-ganged 102 mm high x 51 mm deep solid type as required. Allow extra gang for telecommunication outlets.

.4 For larger boxes for special receptacles (multi-phase, high ampacity) use 102 mm square or 119 mm square boxes 54 mm deep with appropriate cover(s).

.5 Boxes for surface mounted switches, receptacles, or telecommunications outlets to be 102 mm square, or 102 mm high utility, boxes, with rounded corners and raised surface covers. Minimum 38 mm (54 for telecom.) deep

.6 Lighting fixture outlets: 102 mm square outlet boxes or octagonal outlet boxes.

.7 Provide extension and plaster rings as required.

2.3 SURFACE CONDUIT BOXES

.1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.

2.4 FITTINGS – GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of foreign materials.

.3 Conduit outlet bodies for conduit up to 35 mm. Use pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Typical outlet box mounting heights are indicated in Section 26 05 00 or refer to wiring device and communication specification sections and to architectural layouts for particular mounting heights of outlet boxes where indicated.

.2 Support boxes independently of connecting conduits.

.3 Fill open boxes with paper, sponges, 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 of opening.

.5 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are 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 No sectional or handy boxes to be installed.

.8 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.

.9 Outlets installed back to back in party stud walls to be off-set by one stud space.

.10 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.

.11 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.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies rigid and flexible conduits, fasteners, fittings and installation.

1.2 REFERENCES

.1 Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware: to CSA C22.2 No. 18.

.2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83.

.4 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.5 PVC (DB2) conduit: to CSA #C22.1 211-1.

.6 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3.

1.3 BASIC WIRING METHODS

.1 Underground or in concrete exterior to building:

.1 All wiring shall be in Schedule 40 RPVC conduit.

.2 Partition walls and ceilings:

.1 All wiring to be run in EMT conduit for:

.1 Branch circuits.

.2 Low voltage systems.

.3 Distribution feeders and sub-feeders.

.4 Surface wiring in electrical and mechanical rooms.

.3 Motors, transformers and all vibrating equipment:

.1 Short (600mm to 1200mm) PVC jacketed flexible conduit with liquid tight connectors shall be used. Allow sufficient slack to avoid strain on connectors at extreme extension of equipment movement.

.4 Surface raceways - interior:

.1 All surface raceways shall be EMT, except if located without protection in areas susceptible to damage, which shall be rigid steel conduit.

.5 Surface raceways - exterior:

.1 All surface raceways shall be UV compensated Schedule 40 RPVC conduit, protected from damage and excessive heating to the Consultant's satisfaction.

1.4 LOCATION

.1 Electrical drawings are diagrammatic and do not show all conduits, wire, cable, etc. Electrical contractor to provide conduit, wire cable, etc., for a complete operating job to meet in all respects the intent of the drawings and specifications.

.2 Outlet positions shown on architectural drawings (plans and elevations) to take precedence over locations and mounting heights indicated on electrical plans or in specifications.

.3 Locate electrical devices on walls with regard given for convenience of operation and conservation of wall space. Switches, receptacles, fire alarm pull stations, etc. generally to be vertically lined up where items are in the same general location. Adjacent common devices to be installed in common outlet box.

.4 Review the exact location criteria of each electrical outlet and device with the Architect and Consultant prior to rough-in. Relocate any item installed without architectural confirmation as required by the architect or Consultant at no cost to the owner as long as the relocation is within 3m of the location originally shown on the electrical drawings.

.5 Do not install outlets back-to-back in party walls; allow a minimum of one stud space horizontal clearance between boxes. Install behind all outlets in party walls a Lowry Acoustic backing pad.

.6 Locate light switches on latch side of doors. Locate disconnect devices in mechanical rooms on latch side of door.

.7 All outlets located on exterior walls to be complete with moulded plastic vapour barriers to maintain integrity of wall vapour barrier system.

.8 All raceways and wiring shall be installed concealed in building fabric, except for mechanical and electrical rooms where they shall be installed on the surface.

.9 All outlet boxes, junction boxes, and cabinets to hold electrical devices shall be mounted so the equipment can be flush mounted unless indicated otherwise.

.10 All junction boxes and other raceway access devices shall be mounted to avoid being visible from public areas. Obtain approval from Architect or Consultant for any and all junction boxes that, due to the building design, cannot be concealed.

.11 All junction boxes mounted, out of necessity, on surface of solid walls shall be painted to match adjacent surface, with junction boxes painted to match designated systems.

Part 2 Products

2.1 RIGID PVC RACEWAY SYSTEM

.1 Rigid PVC fittings shall be of the same manufacturer as the conduit.

.2 PVC boxes and covers shall be Sceptre “F” Series or equivalent complete with all components and adaptors.

.3 PVC junction boxes exceeding the size of "F" Series shall be Sceptre: "JB" Series boxes and be complete with junction box adaptors.

.4 All fittings with removable covers shall be complete with VC gaskets and brass securing screws and inserts. All metal components shall be brass or stainless steel.

2.2 PVC DUCT RACEWAY

.1 PVC duct fittings shall be of the same manufacturer as duct.

.2 PVC duct shall be colour coded white for communications, grey for power.

2.3 EMT RACEWAY

.1 Electrical Metallic Tubing (EMT) shall be galvanized steel of sufficient quality and thickness to allow smooth field formed bends.

.2 EMT couplings, connectors and fittings shall be steel. Cast type units shall not be used on this installation.

2.4 PVC JACKETTED FLEXIBLE CONDUIT

.1 PVC jacketed flexible conduit (liquid tight) shall be interlocking spiral aluminum conduit with continuous extruded PVC jacket.

.2 Conduit fittings shall be steel liquid tight type that fit over PVC jacket and seal uniformly all round.

2.5 OUTLET BOXES AND JUNCTION BOXES

.1 Except as noted for rigid PVC raceways, all outlet boxes and junction boxes shall be one piece formed or welded.

.2 Outlet boxes to be galvanized steel.

.3 Junction boxes to be galvanized steel or aluminum.

2.6 ACCESS HATCHES

.1 Provide and install access hatches in drywall ceilings to access junction boxes. Coordinate with other trades and check locations with architect before installing.

.2 Access hatches shall have the following specifications:

.1 Door: aluminum frame with gypsum board inlay.
.2 Frame: Recessed aluminum
.3 Finish: to receive the same finish and paint as the surrounding surface.
.4 Hinge: concealed, non-corroding.
.5 Latch: flush screwdriver cam latch.

.3 Access hatches to be of a size to suit but not less than 305mm square.

2.7 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1500mm oc.

.4 Threaded rods, 6 mm dia., to support suspended channels.

2.8 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT in all exterior applications. Set-screws are not acceptable.

.4 are not acceptable.

2.9 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.10 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 INSTALLATION

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

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

.3 Use rigid galvanized steel threaded conduit except [where specified otherwise].

.4 Use epoxy coated conduit underground corrosive areas.

.5 Use electrical metallic tubing (EMT) except in cast concrete and above 2.4 m not subject to mechanical injury.

.6 Use rigid PVC conduit underground, in corrosive areas, and surface mounted in wet areas not subject to damage.

.7 Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without a prewired outlet box, connection to surface or recessed fluorescent fixtures and work in movable metal partitions.

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

.9 Use explosion proof flexible connection for connection to explosion proof motors.

.10 Install conduit sealing fittings in hazardous areas. Fill with compound.

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

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

.13 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.14 Install fish cord in empty conduits.

.15 Run 2-25 mm spare conduits up to ceiling space and 2-25 mm spare conduits down to ceiling space from each flush panel. Terminate these conduits in junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in [flush concrete] [surface] type box.

.16 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.17 Dry conduits out before installing wire.

.18 Conduits shall be installed mechanically continuous from outlet to outlet and without pockets. All the necessary standard bushings, elbows and bends shall be provided. All conduit bends shall have a radius of not less than six (6) times the internal diameter of the conduit and in no case shall the equivalent of more than four quarter bends from outlet to outlet be made. For all conduit sizes to be used for low voltage raceway, the conduits shall have a minimum bending radius of 230mm.

.19 Conduit bends shall be made with no more than 10% flattening of the conduit. Bends shall be smooth throughout deformations.

.20 On surface wall runs, all conduit shall be installed in true vertical or horizontal direction and on ceilings in true 90 degree angles or parallel to the walls. Crossings of conduits shall also be made at 90 degree angles. Parallel running conduit shall be kept on equal spacing on the entire length of run including bends.

.21 All conduits shall be fastened to structure with steel straps (no cast type straps allowed).

.22 Where more than three conduits are run parallel in ceiling cavity, they shall be installed on cantruss type channel, complete with all manufacturer’s fittings to secure channel to structure and to conduit.

.23 Raceways extending out concrete slabs shall be securely protected using rebar stubs or similar material. All duct stubs are to be kept sealed during construction

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended or surface channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.3 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies the installation of direct buried cables and cables in ducts including protection, markers and testing.

1.2 REFERENCES

.1 Canadian Standards Association, (CSA International)

.2 Insulated Cable Engineers Association, Inc. (ICEA)

Part 2 Products

2.1 MARKERS

.1 Concrete type cable markers: 600 x 600 x 100 mm with words: cable, joint or conduit impressed in top surface, with arrows to indicate change in direction of duct runs.

Part 3 Execution

3.1 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.1 Do not pull spliced cables inside ducts.

.2 Install multiple cables in duct simultaneously.

.3 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.4 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.5 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.6 After installation of cables, seal duct ends with duct sealing compound.

3.2 FIELD QUALITY CONTROL

.1 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.2 Acceptance Tests

.1 Ensure that terminations and accessory equipment are disconnected.

.2 Ground shields, ground wires, metallic armour and conductors not under test.

.3 Leakage Current Testing.

.1 Raise voltage in steps from zero to maximum values as specified by manufacturer for type of cable being tested.

.2 Hold maximum voltage for specified time period by manufacturer.

.3 Record leakage current at each step.

.3 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.

.4 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials, components, cabinets, instruments and installation for metering and switchboard Instruments. Metering in this section is for owners use (non-revenue).

1.2 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI C39.1- latest edition, Requirements, Electrical Analog Indicating Instruments.

.2 Canadian Standards Association, (CSA International)

.1 CAN3-C17- latest edition, Alternating - Current Electricity Metering.

1.3 PRODUCT DATA

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

.2 Indicate meter and/or instrument, outline dimensions, panel drilling dimensions and include cutout template.

Part 2 Products

2.1 METER

.1 Three-phase Polyphase, kilowatt demand indicating recording meter: to CAN3-C17.

.2 Combination energy and demand meter: to CAN3-C17.

.3 Accuracy: 2%.

.4 Ratings: as indicated on the drawings.

.5 Provision for remote sensing.

2.2 METER CABINET

.1 Sheet steel CSA enclosure to be EEMAC-1 unless otherwise indicated with meter backplate, to accommodate meter, test terminal block and associated equipment, factory installed and wired.

2.3 METERING INSTRUMENT TRANSFORMER CABINET

.1 Sheet steel CSA enclosure EEMAC-1 unless otherwise indicated to accommodate potential and current transformers as required.

2.4 TEST TERMINAL BLOCKS

.1 Test terminal blocks: as required.

2.5 INDICATING INSTRUMENTS

.1 Indicating instruments: to ANSI C39.1, 1% accuracy, switchboard mounting:

.1 Ammeter: true RMS, range as indicated.

.2 Voltmeter: true RMS, range as indicated.

.3 Wattmeter: range as indicated.

.4 Varmeter: range as indicated.

.5 Frequency meter: range as indicated.

.6 Power factor meter: range as indicated.

2.6 INSTRUMENT SELECTOR SWITCHES

.1 Voltmeter and Ammeter selector switches: rotary, multi-position, maintained contacts, panel mounting, rated to suit instrument[s], nameplate marked as indicated to coincide with each rotary position. Ammeter selector switches designed to preclude opening of current circuits.

.2 Four position ammeter selector switches identified “off-A-B-C”.

.3 Four position voltmeter selector switches identified “A-B, B-C, C-A, off”.

.4 Seven position voltmeter selector switches identified “A-B, B-C, C-A, off, A-N, B-N, C-N”.

2.7 RECORDING INSTRUMENTS

.1 Recording instruments: 1% accuracy switchboard mounting:

.1 Ammeter: range as indicated.

.2 Voltmeter: range as indicated.

.3 Wattmeter: range as indicated.

.4 Varmeter: range as indicated.

.5 Frequency meter: range as indicated.

.6 Power factor meter: range as indicated.

2.8 SHOP INSTALLATION

.1 Install meters and instrument transformers in separate compartment.

.2 Ensure adequate spacing between current transformers installed on each phase.

.3 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources, electrical supplies.

Part 3 Execution

3.1 METERING INSTALLATION

.1 Install meters and instruments in location free from vibration and shock.

.2 Make connections in accordance with instrument diagrams.

.3 If applicable, ensure power factor corrective equipment connected on load side of meter.

.4 Connect meter and instrument transformer cabinets to ground.

3.2 FIELD QUALITY CONTROL

.1 Conduct tests in accordance with Section 26 05 00 - Common Work Results - Electrical and in accordance with manufacturer's recommendations.

.2 Perform simulated operation tests with metering, instruments disconnected from permanent signal and other electrical sources.

.3 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources and electrical supplies.

.4 Perform tests to obtain correct calibration.

.5 Do not dismantle meters and instruments.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials, components, cabinets, instruments and installation for metering and switchboard Instruments. Metering in this section is for owners use (non-revenue).

1.2 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI C39.1- latest edition, Requirements, Electrical Analog Indicating Instruments.

.2 Canadian Standards Association, (CSA International)

.1 CAN3-C17- latest edition, Alternating - Current Electricity Metering.

1.3 PRODUCT DATA

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

.2 Indicate meter and/or instrument, outline dimensions, panel drilling dimensions and include cutout template.

Part 2 Products

2.1 METER

.1 Three-phase Polyphase, kilowatt demand indicating recording meter: to CAN3-C17.

.2 Combination energy and demand meter: to CAN3-C17.

.3 Accuracy: 2%.

.4 Ratings: as indicated on the drawings.

.5 Provision for remote sensing.

2.2 METER CABINET

.1 Sheet steel CSA enclosure to be EEMAC-1 unless otherwise indicated with meter backplate, to accommodate meter, test terminal block and associated equipment, factory installed and wired.

2.3 METERING INSTRUMENT TRANSFORMER CABINET

.1 Sheet steel CSA enclosure EEMAC-1 unless otherwise indicated to accommodate potential and current transformers as required.

2.4 TEST TERMINAL BLOCKS

.1 Test terminal blocks: as required.

2.5 INDICATING INSTRUMENTS

.1 Indicating instruments: to ANSI C39.1, 1% accuracy, switchboard mounting:

.1 Ammeter: true RMS, range as indicated.

.2 Voltmeter: true RMS, range as indicated.

.3 Wattmeter: range as indicated.

.4 Varmeter: range as indicated.

.5 Frequency meter: range as indicated.

.6 Power factor meter: range as indicated.

2.6 INSTRUMENT SELECTOR SWITCHES

.1 Voltmeter and Ammeter selector switches: rotary, multi-position, maintained contacts, panel mounting, rated to suit instrument[s], nameplate marked as indicated to coincide with each rotary position. Ammeter selector switches designed to preclude opening of current circuits.

.2 Four position ammeter selector switches identified “off-A-B-C”.

.3 Four position voltmeter selector switches identified “A-B, B-C, C-A, off”.

.4 Seven position voltmeter selector switches identified “A-B, B-C, C-A, off, A-N, B-N, C-N”.

2.7 RECORDING INSTRUMENTS

.1 Recording instruments: 1% accuracy switchboard mounting:

.1 Ammeter: range as indicated.

.2 Voltmeter: range as indicated.

.3 Wattmeter: range as indicated.

.4 Varmeter: range as indicated.

.5 Frequency meter: range as indicated.

.6 Power factor meter: range as indicated.

2.8 SHOP INSTALLATION

.1 Install meters and instrument transformers in separate compartment.

.2 Ensure adequate spacing between current transformers installed on each phase.

.3 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources, electrical supplies.

Part 3 Execution

3.1 METERING INSTALLATION

.1 Install meters and instruments in location free from vibration and shock.

.2 Make connections in accordance with instrument diagrams.

.3 If applicable, ensure power factor corrective equipment connected on load side of meter.

.4 Connect meter and instrument transformer cabinets to ground.

3.2 FIELD QUALITY CONTROL

.1 Conduct tests in accordance with Section 26 05 00 - Common Work Results - Electrical and in accordance with manufacturer's recommendations.

.2 Perform simulated operation tests with metering, instruments disconnected from permanent signal and other electrical sources.

.3 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources and electrical supplies.

.4 Perform tests to obtain correct calibration.

.5 Do not dismantle meters and instruments.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This Section specifies standard and custom panelboards and their installation.

1.2 SCOPE OF WORK

.1 Provide and install panelboards as indicated on the drawings, single line diagram, panel schedules and these specifications.

.2 Types of panelboards in this section include the following:

.1 CDP type Power distribution panelboards.

.2 Lighting and power panelboards

1.3 PRODUCT INFORMATION

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.2 Shop drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

.3 Shop drawings to include matching tub and trim details for factory installed low voltage relay cabinets where specified.

1.4 PLANT ASSEMBLY

.1 Install circuit breakers in panelboards before shipment from plant.

.2 In addition to CSA requirements, manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.3 All panelboards to be of a common manufacturer.

1.5 FINISH

.1 Apply finishes in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Panel finish in electrical and equipment rooms and closets to be standard ASA Grey baked enamel. Confirm with Consultant prior to shop finishing panels.

Part 2 Products

2.1 PANELBOARDS, DOORS AND TRIMS

.1 Panelboards: to CSA C22.2 No. 29 and product of one manufacturer.

.2 Bus and breakers unless otherwise indicated on the drawings and in the specifications, shall be rated for:

.1 Minimum 10 kA at 208Y/120V.

.2 Minimum 22 kA at 600A

.3 Copper bus with full size neutral.

.4 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number.

.5 Mains capacity, number of circuits and number and size of branch circuit breakers as indicated.

.6 Provide all necessary connectors and mounting hardware in every space to facilitate installation of future breakers. Provide blank fillers for all spaces.

.7 Concealed hinges and concealed trim mounting screws, hinged locking door with flush catch.

.8 Panelboards to have flush doors. (Gasketted where required for damp locations).

.9 Provide two keys for each panelboard and key similar voltage and system panelboards alike.

.10 Panel tubs to be typically 600mm wide.

.11 Provide door within door trims where indicated to facilitate ease of service maintenance Each tub trim cover to be hinged and self supporting and to swing out to expose breaker cable terminations and wireways. Hinged trim shall be secured with cover screws on opening side by concealed machine screws. Hinged breaker cover shall be recessed into the hinged overall tub cover. Breaker cover shall have latch type closures. Submit details on shop drawings prior to manufacturing.

2.2 BREAKERS

.1 All breakers to be:

.1 For Panelboards: Bolt on type molded case, non-adjustable and non-interchangeable trip, single, two and three pole, 120/208V and with trip free position separate from "On" or "Off" positions.

.2 Two and three pole breakers to have common simultaneous trip and able to be located in any circuit position within the panelboard.

.3 Main breaker (where required) to be separately mounted at top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.4 Provide circuit breakers with indicated trip ratings as shown in the panelboard schedules or the Single Line Diagram.

.5 Provide spare circuit breakers as indicated on panel schedules or single line diagram as applicable. Provide minimum **10% spare breakers**.

.6 Provide breaker type Ground Fault Interrupter(s) (GFI) as indicated.

.7 Provide Lock-on devices for Exit sign circuits and Emergency Battery Equipment circuits.

2.3 PANELBOARD IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Nameplate for each panelboard size 5 (2 line) engraved as indicated and include panel designation and voltage/phase.

.3 Complete updated circuit directory with typewritten card(s) located in slide-in plastic pocket(s) fixed to the back of the related door. Directory card to indicate the panel designation, mains size, voltage/phase and the location and load controlled of each circuit. Include a “letter sized” paper copy of each directory in the project maintenance manual.

.4 Provide a plasticized typewritten information card fixed to the back of the each panel door. Information card to indicate the panel designation and location, feeder type and size and locations of any controlling contactors and feeder pullboxes. Include a “letter sized” paper copy of each information card in the project maintenance manual.

Part 3 Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb true and square, to adjoining surfaces.

.2 Panelboards located in service rooms, mechanical rooms, and electrical rooms to be mounted on unistrut supports.

.3 Mount panelboards to height given in Section 26 05 00 or as indicated.

.4 Connect loads to circuits as indicated.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section [26 05 00 - Common Work Results - Electrical].

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2No.248.12-[Latest Addition] , Low Voltage Fuses Part 12: Class R (Bi-National Standard with, UL 248-12 (1st Edition).

1.3 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Submit fuse performance data characteristics for each fuse type and size above [___] A. Performance data to include: average melting time-current characteristics.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section [01 74 19 - Construction/Demolition Waste Management and Disposal], and with the Waste Reduction Workplan.

.1 Place materials defined as hazardous or toxic waste in designated containers.

.2 Ensure emptied containers are sealed and stored safely for disposal away from children.

.3 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

1.5 DELIVERY AND STORAGE

.1 Ship fuses in original containers.

.2 Store fuses in original containers in storage cabinet

1.6 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Three spare 300A fuses.

.3 [Six] spare fuses of each type and size installed.

Part 2 Products

2.1 FUSES GENERAL

.1 Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification.

.2 Fuses: product of one manufacturer for entire project.

2.2 FUSE TYPES

.1 Class L fuses (formerly HRC-L).

.1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type L2, fast acting.

.2 Class J fuses (formerly HRCI- J).

.1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type J2, fast acting.

2.3 FUSE STORAGE CABINET

.1 Fuse storage cabinet, manufactured from aluminum, hinged, lockable front access door finished in accordance with Section 26 05 00 - Common Work Results - Electrical.

Part 3 Execution

3.1 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit.

.2 Ensure correct fuses fitted to physically matched mounting devices.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies materials and installation for fused and non-fused disconnect switches.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4-[M89 (R2000)], Enclosed Switches.

.2 CSA C22.2 No.39-[M89 (R2003)], Fuseholder Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 HEALTH AND SAFETY

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

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

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

.4 Separate for reuse and recycling and place in designated containers Steel Metal Plastic waste in accordance with Waste Management Plan.

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

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible, horsepower rated, disconnect switch in CSA Enclosure to CAN/CSA C22.2 No.4 size as indicated.

.2 Provision for padlocking in on-off switch position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated, in accordance with Section 26 28 14 - Fuses - Low Voltage.

.5 Quick-make, quick-break action.

.6 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 The generator system shall consist of a standby generator, circuit breaker, instrumentation, transfer switch, bypass switch contactors, battery charger, voltage regulator. Belly fuel tank, sound attenuating enclosure, muffler.

1.2 REFERENCES

.1 Meet Canadian Standards Association (CSA International).

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-3.6 - 10 Regular Sulphur Diesel Fuel.
- .2 Alternator to ANSI / NEMA MG-1.
- .3 Diesel engine to IOS 3046-1.

1.3 RELATED SECTIONS

.1 Section 26 36 23 - Automatic Transfer Switch.

.2 Section 23 35 16 - Engine Exhaust Pipe.

.3 Division 23 Mechanical.

Part 2 ASSEMBLY

.1 Generating system consists of:

- .1 Turbo supercharge diesel engine
- .2 Alternator
- .3 Alternator control panel
- .4 Battery charger and battery
- .5 Generator ventilation requirements
- .6 Steel mounting base
- .7 Automatic digital voltage regulator
- .8 Electronic Governor
- .9 Panelboards
- .10 Remote kill button
- .11 Block heater
- .12 Battery blanket
- .13 Radiator
- .14 Digital control panel
- .15 36 hour double wall fuel tank
- .16 Sound Attenuated Enclosure
- .17 Muffler
- .18 Breakers

.2 System designed to operate as an unattended emergency standby unit.

2.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00 Common Work Results - Electrical.

.2 Include:

- .1 Engine: make and model, with performance curves.
- .2 Alternator: make and model.
- .3 Automatic voltage regulator: make, model and type.
- .4 Manual bypass switch: make and model.
- .5 Battery: make, type and capacity.
- .6 Battery charger: make, type and model.
- .7 Alternator control panel: make and type of meters and controls.
- .8 Governor type and model
- .9 Cooling air requirements in m^3/s
- .10 British standard or DIN rating of engine
- .11 Flow diagrams for:
  - .1 Diesel fuel
  - .2 Cooling air
- .12 Dimensioned drawing showing complete generating set mounted on steel base, including vibration isolators, exhaust system, drip trays, and total weight.
- .13 Continuous full load output of set at 0.8PF lagging.
- .14 Description of set operation including:
  - .1 Automatic starting and transfer to load and back to normal power, including time in seconds from start of cranking until unit reaches rated voltage and frequency.
  - .2 Manual starting
  - .3 Automatic shut down and alarm on:
    - .1 Overcranking
    - .2 Overspeed
    - .3 High engine temp
    - .4 Low lube oil pressure.
    - .5 Short circuit
    - .6 Alternator overvoltage
    - .7 Lube oil high temperature.
    - .8 Over temperature on alternator
  - .4 Manual remote emergency stop
- .15 Muffler
- .16 Battery and charger

2.3 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for diesel generator for incorporation into manual specified in Section 26 05 00 – Common Work Results - Electrical.

.2 Include in Operation and Maintenance Manual instructions for particular unit supplied and not general description of units manufactured by supplier and:

.1 Operation and maintenance instructions for engine, alternator, control panel, automatic transfer switch, manual bypass switch, battery charger, battery, fuel system, engine room ventilation system, exhaust system and accessories, to permit effective operation, maintenance and repair.

.2 Technical data:

.1 Illustrated parts lists with parts catalogue numbers.

.2 Schematic diagram of electrical controls.

.3 Flow diagrams for:

.1 Fuel system

.2 Lubricating oil

.3 Cooling system

.4 Certified copy of factory test results.

.5 Maintenance and overhaul instructions and schedules.

.6 Precise details for adjustment and setting of time delay relays or sensing controls which require on site adjustment.

2.4 WARRANTY

.1 For Work of this Section, 12 month warranty period prescribed in Section 26 05 00 – Common Work Results – Electrical is extended to 60 **months**.

2.5 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with the manufacturer's recommendations.

.2 Include, at a minimum:

.1 2 Fuel filter replacement elements.

.2 2 Lube oil filter replacement elements.

.3 2 Air cleaner filter elements.

.4 2 Sets of fuses for control panel.

.5 Special tools for unit servicing.

.6 Provide a wall mounted cabinet on the housing interior wall to store item #2.

Part 3 Products

3.1 DIESEL ENGINE

.1 Diesel engine:

.1 Engine: standard product of current manufacture, from company regularly engaged in production of such equipment.

.2 A turbo supercharged engine.

.1 Mechanically driven supercharged not acceptable.

.3 Capacity:

.1 Rated continuous power in kW at rated speed, after adjustment for system losses in auxiliary equipment necessary for engine operation; to be calculated as follows: Rated continuous output = Generator kW divided by Generator efficiency at full load.

.4 Cooling System:

.1 Liquid cooled: heavy duty industrial radiator mounted on generating set base with engine driven pusher type fan to direct air through radiator from engine side remotely with electrically driven fan, with ethylene glycol anti-freeze non-sludging above minus 46 degrees C.

.5 Block Heater:

.1 Thermostatically controlled lube oil or liquid coolant heater connected to line side of automatic transfer switch to allow engine to start in room ambient minus 10 degrees C.

.1 Switch and fuse in heater circuit, mounted in engine-alternator control cubicle and fed from line side of automatic transfer switch.

.6 Governor:

.1 Electronic isochronous governor capable of 0.25% steady-state frequency regulation. (No droop)

.7 Fuel System:

.1 Direct injection

.2 Fuel filter water separator no smaller than 30 micron, energized to run.

.8 Starting System:

.1 Positive shift, gear engaging starter 12 or 24V dc.

.2 Cranking limiter to provide 3 cranking periods of 10s duration, each separated by 5 s rest.

.3 Lead acid, 12 or 24V storage battery with sufficient capacity to crank engine for 1min at 0 degrees C without using more than 25% of ampere hour capacity.

.4 Battery charger: constant voltage, solid state, two stage from trickle charge at standby to boost charge after use. Regulation: plus or minus 1% output for plus or minus 10% input variation. Automatic boost for 6h every 30 days. Equipped with dc voltmeter, dc ammeter and on-off switch. Minimum charger capacity: 7 A.

.9 Vibration isolated engine instrument panel with:

.1 Lube oil pressure gauge

.2 Lube oil temperature gauge

.3 Lube oil level gauge

.4 Coolant temperature gauge

.5 Coolant level gauge

.6 Running time meter: non-tamper type

.10 Guards to protect personnel from hot and moving parts. Locate guards so that normal daily maintenance inspections can be undertaken without their removal.

.11 Drip Tray.

3.2 ALTERNATOR

.1 Rating: 208 V, 3 phase 4 wire, 150 kW, 60Hz, at 0.8PF.

.2 Output at 40 degrees C ambient:

.1 100% full load continuously.

.3 Revolving field, brushless, single bearing.

.4 Amortisseur windings.

.5 Synchronous type.

.6 Dynamically balanced rotor permanently aligned to engine by flexible disc coupling.

.7 Exciter: rotating brushless.

.8 NEMA class H insulation on windings.

.9 Platinum resistance temperature transducers embedded in stator winding and connected to alternator control circuitry.

.10 Voltage regulator: thyristor controlled rectifiers with phase controlled sensing circuit:

.1 Stability: 0.25% maximum voltage variation at any constant load from no load to full load.

.2 Regulation: 1.5% maximum voltage deviation between no-load steady state and full-load steady state.

.3 Transient: 10% maximum voltage dip on one-step application of 0.8PF full load.

.4 Transient: 12% maximum voltage rise on one-step removal of 0.8PF full load.

.5 Transient: 1 s maximum voltage recovery time with application or removal of 0.8PF full load.

.11 Alternator: capable of sustaining 300% rated current for period not less than 10s permitting selective tripping of down line protective devices when short circuit occurs.

.12 Acceptable manufacturers: Stamford, Leroy-Somer, Marathon.

3.3 AUTOMATIC DIGITAL VOLTAGE REGULATOR

.1 Co-ordinate with generator power input.

.2 Under-speed and sensing loss protection.

.3 Permanent magnetic generator excitation.

.4 Positive voltage buildup from residual levels.

.5 Closed loop control of output voltage with load regulation +/- 1.0%.

.6 Excitation directly powered by a PMG for motor starting.

3.4 CONTROL PANEL

.1 Mounting base isolated from diesel generator.

.2 Instruments:

.1 Digital indicating type 2% accuracy, rectangular face, flush panel mounting:

.1 Voltmeter: ac, scale 0 to 750 V.

.2 Ammeter: ac, scale 0 to 1600 A.

.3 Wattmeter scale 0 to 250 kW.

.4 Frequency meter: scale 55 to 65Hz.

.5 kW.h meter.

.2 Voltmeter selector switch, rotary, panel mounting, round notched handle, four position, labelled "Off-Phase A-Phase B-Phase C".

.3 Ammeter selector switch, rotary, maintained contacts, panel mounting, designed to prevent opening of current circuits, round notched handle, four position labelled "OFF- Phase A-Phase B-Phase C".

.4 Instrument Transformers

.1 Potential-dry type for indoor use:
  .1 Ratio: 208 to 120.
  .2 Rating: 208 V, 60Hz, BIL 25 kV.
.2 Current-dry type for indoor use:
  .1 Ratio: 208 to 120.
  .2 Rating: 208 V, 60Hz, BIL 25 kV.
  .3 Positive action automatic short-circuiting device in secondary terminals.

3.5 CONTROLS:

.1 Engine start button.
.2 Selector switch: Off-Auto-Manual - Test full load test no load.
.3 Engine emergency stop button and provision for remote emergency stop button.
  .1 Alternator output breaker:
    .1 Circuit breaker: bolt-on, moulded case, temperature compensated for 40 degrees C ambient, dual thermal-magnetic trip.
  .2 Voltage control rheostat: mounted on inside of control panel.
  .3 Operating lights, panel mounted:
    .1 "Normal power" pilot light.
    .2 "Emergency power" pilot light.
    .3 Green pilot lights for breaker on and red pilot lights for breaker off.
  .4 Solid state indicator lights for alarm with 2 sets manually reset NO/NC contacts wired to terminal block for remote annunciation on:
    .1 Low fuel level
    .2 Low battery voltage
    .3 Ventilation failure
    .4 Low coolant temperature
    .5 Low DC voltage
    .6 High DC voltage
    .7 Ground fault
    .8 Fuel leak
  .5 Solid state controller for automatic shutdown and alarms with 1set manually reset NO/NC contacts wired to terminal block for remote annunciation on:
    .1 Engine overcrank
    .2 Engine overspeed
    .3 Engine high temperature
    .4 Engine low lube oil pressure
    .5 Short circuit
    .6 AC over voltage
    .7 Fail to crank
    .8 Emergency stop

.6 Lamp test button

.7 Provision for remote monitoring

.8 Alarms and conditions for shut down indicated in items .4 and .5 available on digital display panel on the control panel.

.9 Control system include sender failure monitoring logic for speed sensing, oil pressure and engine temperature and be capable of discriminating between failed sender or wiring components and an actual failure conditions.

.10 Control system include an idle mode control which allows the engine to run in the idle mode in the Manual position only. In this mode, the alternator excitation system shall be disabled.

.11 Control system to have data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set as well as the total time of operation at various loads as a percent of the standby rating of the generator set.

.12 Three sets of NO/NC relays to be provided, one for common alarm one for the running condition one for low fuel condition.

.13 Controls include a load shed control, to operate a set of dry contacts when the generator is overload.

3.6 SILENCER:

.1 The exhaust flex-connector and all exposed exhaust components, including muffler, shall be fully insulated by means of a thermofibre blanket-type heat resistant wrapping, 25 mm thick, with SS mesh inner liner and silicone/aluminzed outside cover secured by stainless steel lacing hooks and wire.

3.7 GENSET ENCLOSURE

.1 The sound attenuated genset housing shall be a rigid, free-standing, vandal-resistant cabinet, fabricated to EEMAC 3 standards with sufficient bracing to form a structure capable of withstanding wind, snow and ice loading. The roof shall have a minimum 100 mm overhang and provide rain gutters over all doors and openings. External hinges shall each feature a waterproof cap and lower grease fitting to permit pressure lubrication.

.2 After fabrication the metal surfaces of the enclosure shall be prepared to SSPC-SP6 commercial blast. Immediately following surface preparation, a 3 mil coating of zinc rich epoxy metal primer shall be applied. Primer coating material shall be Amercoat 68HS. After curing, two additional 2 mil coats of aliphatic polyurethane shall be applied, Amercoat 450HS approved, for a total 7 mil film thickness.

.3 Alternatively, galvanized metal surfaces shall be prepared with an etching primer, Metaprime 39103/39104 approved. Following this, two separate 2 mil coats of aliphatic polyurethane shall be applied, Amercoat 450HS coating material approved, for a total 4 mil film thickness.

.4 Exterior surfaces shall be “RT-4805 Green”.

.5 Access to all regularly serviced items within the enclosure shall be provided by at least two hinged doors on each side. Handles shall be padlockable using standard View Royal padlock in the closed position.

.6 The enclosure must be vandal resistant. Externally accessible fasteners shall preferably be blind head (e.g. stove bolts) will be permissible. Air inlet and outlet openings shall be designed such that objects of any size directed at the enclosure from vertically downward to horizontally flat cannot enter and shall be sized such that inlet air velocity is below the level at which water penetration will occur. No other enclosure openings will be allowed.

.7 A minimum 25 mm of compressed fiberglass board insulation with oil impervious membrane shall be mechanically fastened to the interior enclosure walls.

3.8 MANUAL DOUBLE BYPASS SWITCH

.1 See Section 26 36 23 – Automatic Transfer Switch Complete with Double By-Pass.

3.9 STEEL MOUNTING BASE

.1 Complete generating set mounted on structural steel base of sufficient strength and rigidity to protect assembly from stress or strain during transportation, installation and under operating conditions on suitable level surface.

.2 Assembly fitted with vibration isolators and control console resiliently mounted.

.1 Spring type isolators with adjustable side snubbers and adjustable for levelling.

.3 Sound insulation pads for installation between isolators and concrete base.

.4 Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts not acceptable. Fasteners used corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation of service work.

.5 Enclosure constructed of minimum 12 gauge steel for framework and 14 gauge steel for panels. All hardware and hinges stainless steel.

.6 Enclosure shall include the following maintenance provisions:

.1 Flexible coolant and lubricating oil drain lines that extend to the exterior of the enclosure, with internal drain valves.

.2 External radiator fill provision.

3.10 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Control panel:

.1 Nameplates for controls including alternator breakers and program selector switch.

.2 Nameplates for meters, alarms, indicating lights and minor controls.

3.11 FABRICATION

.1 Shop assemble generating unit including:

.1 Base

.2 Engine and radiator

.3 Alternator

.4 Control panel

.5 Battery and charger

.6 Automatic transfer equipment

.7 Sound Attenuated Enclosure

.8 Muffler

3.12 FINISHES

.1 Apply finishes in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Alternator control cubicle: paint inside, exterior to match engine and alternator.

.3 Exhaust and inlet air hoods.

.4 Other ducts and racks grey.

.5 Supply 0.25L of touch-up enamel (appropriate colour).

Part 4 Execution

4.1 SOURCE QUALITY CONTROL

.1 Factory test generator set including engine, alternator, control panels and accessories in presence SAR Representative.

.2 Test procedure:

.1 Prepare blank forms and check sheet with spaces to record data. At top of first sheet record:

.1 Date.

.2 Generator set serial no.

.3 Engine, make, model, serial no.

.4 Alternator, make, model, serial no.

.5 Voltage regulator, make and model.

.6 Rating of generator set, kW, kV.A, V, A, r/min, Hz.

.2 Mark check sheet and record data on forms in duplicate as test proceeds.

.3 SAR Representative's signature on completed forms to indicate concurrence in results of test.

.3 Factory Tests:

.1 Factory test to be a “complete” system test including generator enclosure, transfer switch, fuel tanks, panels, operational dampers, etc.

.2 With 100% rated load, operate set for 24 h, taking readings at 30 min intervals, and record following:

.1 Time of reading

.2 Running time

.3 Ambient temp in °C

.4 Lube oil pressure in kPa

.5 Lube oil temp in °C

.6 Engine coolant temp in °C

.7 Exhaust stack temp in °C

.8 Alternator voltage: phase 1, 2, and 3

.9 Alternator current: phase 1, 2, and 3

.10 Power in kW

.11 Frequency in Hz

.12 Power Factor

.13 Battery charger current in A

.14 Battery voltage

.15 Alternator cooling air outlet temp

.3 After completion of 24 hours run, demonstrate following shut down devices and alarms:

.1 Overcranking

.2 Overspeed

.3 High engine temp
.4 Low lube oil pressure
.5 Short circuit
.6 Alternator overvoltage
.7 Low battery voltage, or no battery charge
.8 Manual remote emergency stop
.9 High alternator temperature

.4 Next install continuous strip chart recorders to record frequency and voltage variations during load switching procedures. Each load change delayed until steady state conditions exist. Switching increments to include:

.1 No load to full load to no load.
.2 No load to 70% load to no load.
.3 No load to 20% load to no load.
.4 20% load to 40% load to no load.
.5 40% load to 60% load to no load.
.6 60% load to 80% load to no load.

.5 Demonstrate low oil pressure and high engine temperature shutdown devices operation without subjecting engine to these excesses.

4.2 SUB BASE TANK:

.1 Provide an in-skid sub-base diesel fuel tank, in size suitable for 36 hours operation of the engine at full load for the generator set. The fuel tank shall be a standard product of the manufacturer of the engine-generator set. The tank shall be ULC listed, made of aluminized steel, with welded construction, and pressure tested to 5 psi.

.2 The tank is to be dual wall.

.3 The fuel tank shall be provided with a low fuel gauge.

.4 Provide diesel fuel for testing and **ensure the tank is full** at completion of project.

Part 5 Execution

5.1 INSTALLATION

.1 Locate generating unit and install as indicated.

.2 Install fuel supply system as indicated.

.3 Complete wiring and interconnections as indicated.

.4 Start generating set, provide load bank and fuel and test to ensure correct performance of components.

.5 Provide power for charger from an emergency power panel.

5.2 FIELD QUALITY CONTROL (SITE TEST)

.1 Notify SAR Representative 10 working days in advance of test date.

.2 Demonstrate:

.1 Unit start, transfer to load, retransfer to normal power, unit shut down, on "Automatic" control.

.2 Unit start and shut down on "Manual" control

.3 Unit start and transfer on "Test" control.

.4 Unit start on "Engine start" control.

.5 Operation of manual bypass switch.

.6 Operation of automatic alarms and shut down devices.

.3 Perform **6 hours load testing** of unit on full load to show load carrying ability, stability of voltage and frequency, and satisfactory performance of dampers in ventilating system to provide adequate engine cooling. Record following at 15 minute intervals during the entire test:

.1 Kilowatts

.2 Amperes

.3 Voltage

.4 Frequency

.5 Oil Pressure

.6 Coolant Temperature

.7 Room Temperature

.8 Noise level at 3m from unit

.4 See 2.13.3 for stepping of loads

.5 Record noise level measurements in dB at various locations around the unit and area surrounding the exhaust port.

.6 At end of test run, check battery voltage to demonstrate battery charger has returned battery to full charged state.

5.3 FINAL TEST AT COMPLETION OF PROJECT

.1 After all electrical systems and equipment are installed and operational, a 1-hour test to be done.

.2 SAR Representative will be fully trained and have final manuals prior to this test.

.3 This test will include full operation of the electrical systems under normal power, and emergency power.

5.4 BREAKERS

.1 See drawings

.2 Two breakers required. One for building load and one for load bank testing.

5.5 WIRING

.1 Provide power and control wiring between generator and automatic transfer switch.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies materials and installation for automatic load transfer complete with double by-pass equipment which can monitor voltage on all phases of normal power supply, initiate cranking of standby generator unit, transfer loads and shut down standby unit when normal power is re-established.

.2 The Contractor shall furnish and install the low voltage automatic transfer switch having the ratings, features/accessories and enclosures as specified herein and as shown on the contract drawings.

1.2 RELATED SECTIONS

.1 26 32 13 - Power Generation Diesel

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C282 – Emergency Electrical power Supply for Buildings

.2 CSA C22.2 No.178 – 1978 (R2006), Automatic Transfer Switches.

.3 CSA C22.2 No. 5.1 Moulded Case Circuit Breakers

.2 Instrument transformers: to CAN3-C13.

.3 Contactors: to ANSI/NEMA ICS2.

.1

1.4 SCOPE OF WORK

.1 Provide and install a 5 breaker type, open transition automatic transfer switches with manual double bypass isolation, and having the ratings, features/accessories and enclosures as shown on the drawings and as specified herein:

.1 Bus rating: 600A 208V 3-phase 4-wire c/w double bypass.

.2 Coordination study to provide equipment kA rating.

Part 2 Assembly

.1 Automatic load transfer equipment to:

.1 Monitor voltage on phases of normal power supply.

.2 Initiate cranking of generator unit on normal power failure or abnormal voltage on any one phase below preset adjustable limits for adjustable period of time.

.3 Transfer load from normal supply to standby unit when standby unit reaches rated frequency and voltage pre-set adjustable limits.

.4 Transfer load from generator unit to normal power supply when normal power restored, confirmed by sensing of voltage on phases above adjustable pre-set limit for adjustable time period.

.5 Shut down generator unit after running unloaded to cool down using adjustable time delay relay.

.2 Manual By-Pass Switch

.3 Double By-Pass to allow either generator or normal power to isolate transfer switch from circuit.

2.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Include:

.1 Make, model and type.

.2 Load classification.

.3 Single line diagram showing controls and relays.

.4 Description of equipment operation including:

.1 Automatic starting and transfer to standby unit and back to normal power.

.2 Test control.

.3 Manual control.

.4 Automatic shutdown.

2.3 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for automatic load transfer equipment for incorporation into manual.

.2 Detailed instructions to permit effective operation, maintenance and repair.

.3 Technical data:

.1 Schematic diagram of components, controls and relays.

.2 Illustrated parts lists with parts catalogue numbers.

.3 Certified copy of factory test results.

Part 3 Products

3.1 MATERIALS

3.2 CIRCUIT BREAKER TYPE TRANSFER EQUIPMENT

.1 Circuit Breaker Type Transfer Equipment: to CSA C22.2 No.5.

.2 Rated: 208 V, 60Hz, 600A, 4 wire, solid neutral.

.1 Fault withstand rating: Based on coordination study kA symmetrical for 3 cycles with maximum peak value.

.2 Normal-three phase molded-case circuit breakers with thermal magnetic trip mounted on common base, designed for double throw action, motor operated, mechanically held and interlocked, floor mounted CSA enclosure.

.3 One emergency-three phase moulded-case circuit breaker with thermal magnetic trip, motor operated, and interlocked.

.4 Circuit breakers:

.1 Trip free in closed position.

.2 Interrupting rating: Based on coordination study.

.5 Dead front construction with access to relays and controls for inspection and maintenance, and manual operating lever for transfer switch.

.6 Main contacts - silver plated, protected by arc disruption means.

.7 Auxiliary contact: silver plated to initiate emergency generator start-up on failure of normal power.

.8 Solid neutral bar, fully rated.

.9 Fault withstand rating: Based on coordination study (symmetrical) for 3 cycles.

3.3 CONTROLS

.1 Selector switch - four position "Test", "Auto", "Manual", "Engine start".

.1 Test position - Normal power failure simulated. Engine starts and transfer takes place. Return switch to "Auto" to stop engine.

.2 Auto position - Normal operation of transfer switch on failure of normal power; retransfers on return of normal voltage and shuts down engine.

.3 Manual position - Transfer switch may be operated by manual handle but transfer switch will not operate automatically and engine will not start.

.4 Engine start position - Engine starts but unit will not transfer unless normal power supply fails. Switch must be returned to "Auto" to stop engine.

.2 Control transformers: dry type with 120V secondary to isolate control circuits from:

.1 Normal power supply.

.2 Emergency power supply.

.3 Relays: continuous duty, industrial control type, with wiping action contacts rated 10 A minimum:

.1 Voltage sensing: 3 phase for normal power and on one phase only for emergency, solid state type, adjustable drop out and pick up, close differential, 2V minimum undervoltage protection.

.2 Time delay: normal power to standby, adjustable solid state, 0 to 60s.

.3 Time delay on engine starting to override momentary power outages or dips, adjustable solid state, 0 to 60s delay.

.4 Time delay on retransfer from standby to normal power, adjustable 0 to 60s.

.5 Time delay for engine cool-off to permit standby set to run unloaded after retransfer to normal power, adjustable solid state, 20s intervals to 10 min.

.6 Frequency sensing, to prevent transfer from normal power supply until frequency of standby unit reaches preset adjustable values.

.4 Solid state electronic in-phase monitor.

3.4 ACCESSORIES

.1 Pilot lights to indicate power availability normal and standby, switch position, green for normal, red for standby, mounted in panel.

.2 Plant exerciser: 168h timer to start standby unit once each week for selected interval but does not transfer load from normal supply. Timer adjustable 0-168h in 15 min intervals.

.3 Auxiliary relay to provide 2 N.O. and 2 N.C. contacts for remote alarms.

.4 Instruments:

.1 Digital true rms, indicating type 2 % accuracy, flush panel mounting:

.1 Voltmeter: ac, scale 0 to 750V.

.2 Ampmeter: ac, scale 0 to 800A.

.3 Frequency meter: scale 55 to 65 Hz.

.5 Voltmeter selector switch: rotary, maintained contacts, panel mounting type, round notched handle, four position, labelled "OFF – Phase A – Phase B – Phase C".

.6 Potential transformers - dry type for indoor use:

.1 Ratio: 600 to 120.

.2 Rating: 600V, 60Hz.

.3 Accuracy rating: 5%.

.7 Ammeter selector switch: rotary, maintained contacts, panel mounting type, designed to prevent opening of current circuits, round notched handle, four position labelled "OFF - Phase A - Phase B - Phase C".

.8 Current transformers - dry type for indoor use:

.1 Ratio: 1000 to 5.

.2 Rating: 600 V, 60Hz.

.3 Accuracy rating: 5%.

.4 Positive action automatic short- circuiting device in secondary terminals.

3.5 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Control panel:

.1 For selector switch and manual switch: size4 nameplates.

.2 For meters, indicating lights, minor controls: size2 nameplates.

.3 The automatic transfer switch is e to be continuous rated as per drawings for 600A 3 phase – 4 wire - 208V operation, and are to be compatible with new emergency generator.

.4 The automatic transfer switches shall include standard components and provide control to:

.1 Select through a switch “with load” or “without load” to test as follows:

.1 “Without load” the generator set runs unloaded.

.2 “With load” the automatic transfer switch transfers load to the generator set as if normal source interruption occurred.

.2 Monitor each ungrounded line with a calibrated dial adjustable voltage solid state sensors and sense a decrease of voltage below a set point or loss of voltage on any phase of the normal power supply. Voltage sensors shall be temperature compensated.

.3 Signal the engine generator set to start in the event of power interruption. A solid state time delay shall delay this signal three seconds to avoid nuisance start-ups on momentary voltage dips or power outages. The maximum 15 second reaction time permitted under CSA standard C282 shall include the three second start delay.

.4 Retransfer the load to the line after normal power restoration. A time delay shall delay this retransfer to avoid short term normal power restoration (variable one to five minutes, set at one minute).

.5 Provide an automatic retransfer of the load from generating set to normal source if the generating set output interrupts after normal source restores voltage.

.6 Signal the engine generator to stop after load retransfer to normal source. A solid state time delay on stop shall permit the engine to run unloaded to cool down before shutdown.

.7 Provide a device to electrically disconnect the control sections from the transfer switch for maintenance service during normal operation.

.5 Selected automatic transfer switch shall be included in a factory assembly with bypass-isolation switch equipment. The bypass-isolation switch shall provide a safe means for manually bypassing the transfer switch from either source Normal or Emergency to the load, while under load if necessary, and to isolate the transfer switch from both sources for maintenance or repair.

.1 Ratings:

.1 Bypass-isolation switch equipment shall be ULC Listed and CSA approved, manually operated with continuous current rating, voltage and frequency ratings, and withstand and closing ratings equal to the transfer switch ratings at the specified conditions of ambient temperature, humidity and altitude.

.2 Construction:

.1 The bypass-isolation and transfer switch shall be mechanically held in each position. Switching mechanisms shall be break before make on all poles. The switch mechanism shall be an over centre toggle device which provides stored energy contact operation during both opening and closing. The speed of contact operation shall be independent of the force applied to the operating handles, which permits manual operation under load.

.3 Bypass Switches:

.1 Equipment shall provide manual bypass without load break to the source connected to the load by the transfer switch. Equipment requiring load break before bypass is not acceptable under this specification.

.2 Equipment shall provide for manual bypass operation to the source opposite that to which the transfer switch is connected. This shall cause the transfer switch to go automatically to a position disconnected from both sources.

.4 Interlocks:

.1 Positive mechanical interlocks shall prevent all possible source to source interconnections. Designs which depend on electrical interlocks to prevent source to source interconnections, or which intentionally interconnect the sources, are not acceptable.

.2 The interlock system shall assure a properly sequenced, mechanically guided bypass and isolation action.

.3 The equipment shall utilize automatic mechanical stops.

.6 Emergency generator supplier is to install automatic transfer switch, and make all necessary connections to facilitate a complete operational system, in conjunction with new emergency generator installation. Generator equipment supplier is to provide SAR Representative with written Verification Report complete with test results.

3.6 SOURCE QUALITY CONTROL

.1 Complete equipment, including transfer mechanism, controls, relays and accessories factory assembled and tested in presence of SAR Representative.

.2 Notify SAR Representative 10 days in advance of date of factory test.

.3 Tests:

.1 Operate equipment both mechanically and electrically to ensure proper performance.

.2 Check selector switch, in modes of operation Test, Auto, Manual, Engine Start and record results.

.3 Check voltage sensing and time delay relay settings.

.4 Check:

.1 Automatic starting and transfer of load on failure of normal power.

.2 Retransfer of load when normal power supply resumed.

.3 Automatic shutdown.

.4 In-phase monitor operation.

3.7 SPRINKLER PROOF

.1 Automatic Transfer Switch to be sprinkler proof.

Part 4 Execution

4.1 INSTALLATION

.1 Locate, install and connect transfer equipment.

.2 Check relays, solid state monitors and adjust as required to insure correct operation.

.3 Install and connect remote alarms.

4.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with this specification and as follows:

.1 Energize transfer equipment from normal power supply.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies materials and installation for emergency lighting systems.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.141-M1985 (R1999), latest addition Unit Equipment for Emergency Lighting.

1.3 PRODUCT DATA

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

.2 Data to indicate system components, mounting method, source of power and special attachments.

Part 2 Products

2.1 EQUIPMENT

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

.2 Supply voltage: 120V, ac.

.3 Output voltage: 24 V dc.

.4 Operating time: **30** min.

.5 Battery: sealed, maintenance free.

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

.7 Solid state transfer circuit.

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

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

.10 Lamp heads: integral on unit, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED, 4W.

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

.12 Finish: white.

.13 Auxiliary equipment:

.1 Ammeter.
.2 Voltmeter.
.3 Test switch.
.4 Time delay relay.
.5 Battery disconnect device.
.6 AC input and DC output terminal blocks inside cabinet.
.7 Bracket.
.8 Hardwire connection for AC.
.9 RFI suppressors.

Part 3 Execution

3.1 INSTALLATION

.1 Install unit equipment.

.2 Direct heads.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies materials and installation for exit signs complete with directional arrows.

1.2 TYPE OF EXIT SIGN

.1 Install specification grade LED type exit signs in general public areas where indicated on drawings.

1.3 PRODUCT DATA

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

.2 Product Data: submit manufacturer's product data sheets indicating dimensions, materials, and finishes, including classifications and certifications.

Part 2 Products

2.1 EXIT SIGN – PICTORIAL GREEN RUNNING MAN

.1 Thin line, LED type with white finish thermoplastic housing and battery back-up.

.2 All exit signs shall comply with CAN/CSA C860.

.3 Exit signs shall be complete with 10 year warranty.

2.2 MOUNTING TYPE

.1 Exit signs to be suitable for universal mounting. Allow for exit signs to be mounted as to best suit ceiling/wall type and architectural features:

- .1 Surface wall mounted
- .2 End wall mounted double face
- .3 Ceiling mounted single face
- .4 Ceiling mounted double face

.2 Exit signs to have direction arrows where indicated.

.3 Provide steel rod pendant supports for exit signs to mount to +3.5m A.F.F. in high ceiling areas as required.

Part 3 Execution

3.1 INSTALLATION

.1 Install exit signs as shown on plans complete with double face units where indicated.

.2 Connect to life safety emergency power circuit as indicated on the plans.

.3 Exit signs must be clear of all visual obstruction.

.4 Contractor to confirm locations before final installation.

3.2 LOCATION

.1 Review locations of exit signs with engineer and architect to ensure effectiveness and compatibility with decor before rough in. Failure to do so may result in relocation at no extra charge to the project.

3.3 MOUNTING HEIGHT

.1 Wall mounted signs shall be clear above doors and, if space allows, 2.4 metres to centre, but with 25mm clearance of ceiling.

.2 Ceiling mounted signs shall be mounted directly on ceiling, unless it is obstructed from view. Stem mount using two fixture rods (9.5mm white smooth type).

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies empty telecommunications raceway systems.

1.2 SYSTEM DESCRIPTION

.1 Empty telecommunications raceways system consists of outlet boxes, cover plates, terminal distribution, cabinets, conduits, pull boxes, sleeves and caps, fish wires, service fittings.

Part 2 Products

2.1 MATERIAL

.1 Conduits: in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Junction boxes and cabinets: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.3 Outlet boxes, conduit boxes, and fittings: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.4 Fish wire: polypropylene type.

Part 3 Execution

3.1 INSTALLATION

.1 Install empty raceway system, including distribution system, fish wire, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cabletroughs, bonding, miscellaneous and positioning material to constitute complete system.

.2 Conduit Specifications

.1 The inside radius of a bend in a conduit shall be not less than six times the internal diameter when the conduit is less than 50 mm in diameter and ten times the internal diameter when conduit is 50 mm in diameter or larger..

.2 All zone conduits shall be identified and labeled at both ends. Tags shall identify start and finish of conduit runs. Pull boxes shall be labeled on the exposed exterior.

.3 All metallic parts of the cable distribution supporting system shall be bonded together using a 6 AWG green jacketed stranded copper ground wire. The metallic components of the cable distribution system shall be bonded together at the MTR then bonded to their respective telecom ground bus bars.

.4 All conduits/sleeves that enter the IT Room shall be fitted with an approved ground bushing c/w ground lug and bonded together mechanically (one continuous piece preferred). This shall be connected to the approved building ground by means of a minimum No. 6 AWG or as indicated to the grounding bus bar.

.5 All conduits entering or exiting through the ceiling or walls of the IT Room shall protrude into the room 25-50mm.

.6 All conduit runs shall follow building grid lines and shall be concealed where possible.

.7 All conduits shall be thin wall EMT, reamed and bushed at both ends and bonded to the distribution system. Rigid PVC or flexible metallic or PVC conduits are NOT acceptable.

.8 Unless otherwise specified, all conduit runs shall be a maximum of 30 meters (100 ft) in length with a maximum of two 90 degree bends between pull points.

.9 A pull box shall be placed in conduit runs where the sum of the bends exceeds 180 degrees, where the overall length of the conduit run is more than 30m, or if there is a reverse bend in the run.

.10 Pull boxes shall be constructed and sized in accordance with Canadian Electrical Code and TIA/EIA standards of code gauge steel and shall have a rust resistant finish. Locations and sizes of all pull boxes shall be as indicated on the design submission.

.11 In all instances pull boxes shall be placed in straight sections of conduit run and shall not be used in lieu of a bend. Corresponding ends of the conduit are to be aligned with each other. Conduit fittings or pull elbows fittings shall not be used in place of pull boxes or bends.

.12 Pull boxes shall be installed at a reasonable height, in an exposed location and such that access for installation of cables is not prohibited. Pull boxes shall not be placed in a fixed false ceiling space, unless immediately above a suitably marked and hinged access panel. Provide indicator decals on ceiling T-bar rail or ceiling tiles showing location of pull box or splice box. Refer to the Design Authority for details.

.13 Conduit must enter the outlet boxes from the top or bottom.

.14 All conduit shall be installed in accordance with Canadian Electrical Code, Part 1 Section 12, applicable building codes and in accordance with TIA/EIA 569.

.15 The minimum size (inside diameter) for EMT conduit running between the IT Room and the Telecommunications outlet at an outlet location is twenty-five millimeters (25 mm).

.16 The maximum horizontal cable run distance not to exceed 90 metres. The cable length from the mechanical termination in the MTR room to the Telecommunications outlet. Where the horizontal distance exceeds 90 meters, provide additional rooms as required.

.17 Cable fill capacities of conduit, cable tray and raceways shall not be greater than 40%.

.18 A pull cord or fish tape shall be installed in all conduits.

.19 The telecommunications outlet conduit system shall be labelled green.

.20 Place pull boxes in readily accessible locations only.

.3 Outlet Boxes

.1 Outlet boxes shall be installed in locations identified The outlet box shall be installed at 300mm AFF or at the same height and within 300mm of the adjacent electrical duplex receptacles, unless otherwise noted on the building plans. Wherever possible, the face of the plastic ring should be installed flush with the finished wall.

.2 Back to back outlet boxes shall not be used.

.3 Outlet boxes must be equipped with a plaster ring to accommodate the installation of telecommunication face plates.

.4 Plaster rings will be specified as single or double gang to accommodate requirements.

.5 Plaster rings or raised adapter plates shall not reduce the size of the outlet such that two additional outlets could not be added in the future.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies materials and installation for fire detection and fire alarm systems.

1.2 REFERENCES

.1 NBC-latest edition, National Building Code of Canada.

.2 Government of Canada

- .1 TB OSH Chapter 3-03, latest edition, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-03, Standard for Fire Protection Electronic Data Processing Equipment.
- .2 TB OSH Chapter 3-04, latest edition, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-04, Standard for Fire Alarm Systems.

.3 Underwriters Laboratories of Canada (ULC)

- .1 CAN/ULC-S524-latest edition, Installation of Fire Alarm Systems.
- .2 ULC-S525- latest edition, Audible Signal Appliances.
- .3 CAN/ULC-S526- latest edition, Visual Signal Appliances, Fire Alarm.
- .4 CAN/ULC-S527- latest edition, Control Units.
- .5 CAN/ULC-S528- latest edition, Manual Pull Stations.
- .6 CAN/ULC-S529- latest edition, Smoke Detectors.
- .7 CAN/ULC-S530- latest edition, Heat Actuated Fire Detectors.
- .8 CAN/ULC-S531- latest edition, Smoke Alarms.
- .9 CAN/ULC-S536- latest edition, Inspection and Testing of Fire Alarm Systems.
- .10 CAN/ULC-S537- latest edition, Verification of Fire Alarm Systems.

1.3 DESCRIPTION OF SYSTEM

.1 System shall be an addressable, fully supervised, microprocessor-based, fire alarm system, utilizing digital techniques for data control and digital and multiplexing techniques for data transmission.

.2 System to carry out fire alarm and protection functions; including receiving alarm signals; initiating general alarm; supervising components and wiring; actuating annunciators and auxiliary functions; initiating trouble signals and signalling to base of security office.

.3 The system shall be fully addressable, zoned, non-coded single stage.

.4 System to be modular in design to allow for future expansion.

.5 Operation of system shall not require personnel with special computer skills.

.6 System to include:

- .1 Central Control Unit in separate enclosure with power supply, stand-by batteries, central processor with microprocessor and logic interface, main system memory, input-output interfaces for alarm receiving, annunciation/display, and program control/signalling.
- .2 Power supplies.
- .3 Initiating/input circuits.
- .4 Output circuits.
- .5 Auxiliary circuits.

.6 Wiring.

.7 Manual and automatic initiating devices.

.8 Audible and visual signalling devices.

.9 Class ‘A’

.10 Local and Remote annunciators and displays.

.7 Fire alarm system to be capable of interconnecting into a Simplex addressable panel to indicate a separate zone.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

.1 System:

.1 To TB OSH Chapter 3-04.

.2 Subject to Fire Commissioner of Canada (FC) approval.

.3 Subject to FC inspection for final acceptance.

.4 To Canadian Forces Fire Marshal approval.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Include:

.1 Layout of equipment.

.2 Zoning.

.3 Complete wiring diagram, including schematics of modules.

1.6 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for Fire Alarm System for incorporation into manual.

.2 Include:

.1 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.

.2 Copy of sound pressure levels for each space.

.3 Technical data - illustrated parts lists with parts catalogue numbers.

.4 Copy of approved shop drawings.

.5 List of recommended spare parts for system.

1.7 EXTRA MATERIALS

.1 Provide maintenance materials as recommended by the system manufacturer. Submit recommended spare parts list to Consultant for review in accordance with Section 01 33 00 - Submittal Procedures.

.2 Include four (4) spare glass rods for manual pull box stations if applicable.

.3 Include for six (6) additional spare audible devices, wired and installed within 30m of the nearest audible device. Devices will be utilised where sound level readings during verification are below Building Code requirements. Unused devices are to be turned over to the owner or credited to the contract.

1.8 MAINTENANCE

.1 Provide one year's free maintenance with two inspections by manufacturer during warranty period. Inspection tests to conform to CAN/ULC-S536. Submit inspection report to Consultant.

Part 2 Products

2.1 MATERIALS

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

.2 In accordance with applicable CAN/ULC standards.

2.2 SYSTEM OPERATION

.1 Single stage operation. Operation of any alarm initiating device to:

.1 Cause audible signal devices to sound throughout building.

.2 Transmit signal to the site central alarm panel via fire alarm transmitter.

.3 Cause zone of alarm device to be indicated on control panel and remote annunciator.

.2 Capability to program smoke detector status change confirmation on any or all zones in accordance with CAN/ULC-S527, Appendix C.

2.3 CONTROL PANEL

.1 Single stage operation.

.2 Zoned.

.3 Non-coded.

.4 Enclosure: CSA Enclosure 1, c/w lockable concealed hinged door, full viewing window, flush lock and 2 keys.

.5 Provide 120 volt circuit and ceramic heater for all exterior mounted annunciator panels, whether indicated or not.

.6 Supervised, modular design with plug-in modules:

.1 Alarm receiver with [trouble and alarm indications] [provision for remote supervised annunciation], for class A and B initiating circuits.

.2 Spare zones: compatible with smoke detectors and open circuit devices.

.3 Space for future modules.

.4 Latching type supervisory receiver circuits. Discrete indication for both off-normal and trouble.

.7 Components:

.1 Coded alarm receiver panel with trouble and alarm indications for class A and B initiating circuits.

.2 Single stage alarm pulse rate panels:

.1 Single stroke control type for output to signal control panel continuously.

.3 Common control and power units:

.1 Control panel containing following indications and controls:

.1 "Power on" LED (green) to monitor primary source of power to system.

.2 "Power trouble" indication.

.3 "Ground trouble" indication.

.4 "Remote annunciator trouble" indication.

.5 "System trouble" indication.

.6 "System trouble" buzzer and silence switch c/w trouble resound feature.

.7 System reset switch.

.8 "LED test" switch if applicable.

.9 "Alarm silence" switch to silence signals manually. If new alarm occurs after signals have been silenced, signals to resound.

.10 "Signals silenced" indication.

.2 Master power supply panel to provide 24Vdc to system from 120Vac, 60Hz input.

.3 Fire department connections:

.1 Plug-in module for signal to base central panel.

.4 Auxiliary relays: plug-in type, dust cover, supervised against unauthorized removal by common trouble circuit.

.1 Contacts: 2.0A, 120Vac, for functions such as release of door holders or initiation of fan shut down.

.2 Contact terminal size: capable of accepting 22-12AWG wire.

.5 Manufacturer: Simplex

2.4 POWER SUPPLY

.1 120V, ac, 60Hz input, 24Vdc output from rectifier to operate alarm and signal circuits, with standby power of gell cell batteries minimum expected life of 4 years, sized in accordance with BC Building Code.

2.5 MANUAL ALARM STATIONS

.1 Manual alarm pull stations: addressable, pull lever, wall mounted surface type, non-coded single pole normally open contact for single stage English signage.

.2 Manufacturer - Addressable manual pull station: Edwards, Notifier MPS-950B with NBG-LX.

.3 Provide steel protective guards for pull stations installed where required by Architect.

2.6 AUTOMATIC ALARM INITIATING DEVICES

.1 Heat detectors, fixed temperature, non-restorable, rated 57°C.

.2 Thermal detectors, addressable, fixed temperature: 57°C.

.3 Smoke detector: addressable ionization type.

.1 Dual chamber, ionization, twistlock, plug-in type with fixed wire-in base assembly with integral red alarm LED. Detector to be addressable type c/w electronics to communicate detector’s status and field adjustable address setting.

.4 Duct Smoke Detector

.1 Dual chamber, multisensor, twistlock, plug-in type with fixed wire-in base assembly with integral red alarm LED. Detector to be addressable type c/w electronics to communicate detector’s status and field adjustable address setting.

If shaft mounted or obstructed, provide remote indicating LED and access hatch in accordance with Section 26 05 00.

.5 Remote LED alarm indicator for concealed thermal and smoke detectors.

2.7 AUDIBLE SIGNAL DEVICE

.1 Bells: vibrating type, gongs of special alloy steel, 24Vdc, 150mm, 95dB.

.2 All audible devices must be programmed to a temporal pattern 3, as required by the BC Building Code.

2.8 REMOTE ANNUNCIATOR PANEL

.1 LED type with designation cards to indicate zone.

.2 LED's to annunciate alarm and trouble.

.3 Wired in multiple with main control panel.

.4 Supervised, including trouble signal for open circuit.

.5 LED test button.

.6 LCD read out

2.9 GRAPHIC DISPLAY

.1 Provide and install a passive Lamicoin graphic under plex glass.

2.10 VISUAL ALARM SIGNAL DEVICES

.1 Strobe type: flashing, red 24Vdc.

.2 Designed for surface mounting on ceiling or walls as indicated.

2.11 SPRINKLER SYSTEM CONNECTION

.1 Provide waterflow/tamper modules for connection to sprinkler system for monitoring of flow switches and valves.

.2 Provide input modules for connection of pressure switches for monitoring.

.3 Provide alarm/trouble indication of heat tracing system at the control panel and remote annunciator panel.

2.12 ISOLATION MODULES

.1 Addressable zone isolation modules.

2.13 ANCILLARY DEVICES

.1 Remote relay unit to initiate fan shutdown as indicated in mechanical schedule.

.2 Provide relay contact to Coast Guard Control Panel system to signal the status of the fire alarm system.

2.14 WIRE AND CABLE

.1 Conductor Insulation: Minimum rating 300 volts. Single conductor RW90XLPE (X-link).

.2 Multi-conductor cables 105°C with outer PVC jacket, colour coded, FAS rated.

.3 Conductor sizes as follows:

.1 To initiating circuits: #18 AWG minimum, and in accordance with manufacturer's requirements.

.2 To signal circuits: #16 AWG minimum, and in accordance with manufacturer's requirements.

.3 To control circuits: #12 AWG minimum, and in accordance with manufacturer's requirements.

.4 Size all fire alarm wiring for maximum 3% voltage drop at maximum load at last device in run.

.4 All wiring to be copper.

.5 All wiring to be tag identified at the points of connection.

.6 Provide a ground conductor with all system wiring and bond all metal parts including device boxes.

.7 All fire alarm system wiring to be in conduit except short drops from ceiling junction box to detectors mounted in T-Bar ceiling may be rated fire alarm system cable.

Part 3 Execution

3.1 INSTALLATION

.1 Install systems in accordance with CAN/ULC-S524 and TB OSH Chapter 3-04.

.2 Install main control panel and connect to ac power supply.

.3 Locate and install manual alarm stations and connect to alarm circuit wiring.

.4 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.

.5 Connect alarm circuits to main control panel.

.6 Locate and install signal devices, bells, chimes, horns and visual signal devices and connect to signalling circuits.

.7 Connect signalling circuits to main control panel.

.8 Install remote annunciator panels and connect to annunciator circuit wiring.

.9 Sprinkler system: wire alarm and supervisory switches and connect to control panel.

.10 Provide quantity of two (2) spare gongs.

.11 Provide quantity of one (1) spare manual pull stations and allow for installation within 10m radius of fire alarm system devices.

.12 Provide quantity of one (1) spare heat detectors and allow for installation within 10m radius of fire alarm system devices.

.13 Provide quantity of one (1) spare smoke detectors and allow for installation within 10m radius of fire alarm system devices.

3.2 FIRE ALARM ZONES

.1 See schedule on drawings.

3.3 FIELD QUALITY CONTROL

.1 Perform tests as described herein and in accordance CAN/ULC-S537.

.2 Fire alarm system:

.1 Test each device and alarm circuit to ensure manual stations, thermal and smoke detectors, and sprinkler system transmit alarm to control panel and actuate general alarm ancillary devices.

.2 Check annunciator panels to ensure zones are shown correctly.

.3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.

.4 Manufacturer's technician to verify all new devices and reconnected existing fire alarm system equipment and components in accordance with ULC Standard S537.

.5 Provide a Certification of Verification.

.6 After verification, demonstrate and spot test system as required by Consultant and Fire Commissioner.

.7 Provide Engineer with written verification report for review and include copies in maintenance manuals

.8 Class A circuits.

.1 Test each conductor on all circuits for capability of providing alarm signal on each side of single open-circuit fault condition imposed near midmost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

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

3.4 TRAINING

.1 Arrange and pay for on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

END OF SECTION

PART 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 Submittal Procedures.

.2 Section 01 35 43 Environmental Procedures.

.3 Section 01 45 00 Quality Control.

.4 Section 01 61 00 - Common Product Requirements.

.5 Section 31 11 23 Aggregate Base Courses.

.6 Section 32 12 16.01 - Asphalt Paving – Short Form.

.7 Section 32 16 15 - Concrete Walks, Curbs and Gutters.

1.2 REFERENCES

.1 Master Municipal Contract Documents (MMCD), Platinum Edition Volume II - 2009, British Columbia. Contractor to maintain a copy on-site at all times.

.2 Geotechnical Site Assessment, Proposed Reconstruction of Port Hardy Airport Terminal, prepared by AMEC Environment and Infrastructure, December 11, 2014

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

.1 ASTM C117-04, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D422-632002, Standard Test Method for Particle-Size Analysis of Soils.

.4 ASTM D698-00ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ^{3}) (600 kN- m/m ^{3}).

.5 ASTM D1557-02e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ^{3}) (2,700 kN- m/m ^{3}).

.6 ASTM D4318-05, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.5 Canadian Standards Association (CSA International)

.1 CAN/CSA-A3000-03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.1 CSA-A3001-03, Cementitious Materials for Use in Concrete.

.2 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.6 BC Ministry of Transportation and Highways Specification I-11, Fracture Count for Coarse Aggregate

.7 U.S. Environmental Protection Agency (EPA)/Office of Water

.1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 DEFINITIONS

.1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.

.1 Rock: solid material in excess of $1.00m^3$, and which cannot be removed by means of heavy duty mechanical excavating equipment available on site. Frozen material not classified as rock.

.2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.

.2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.

.3 Topsoil:

.1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

.2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.

.4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.

.5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

.6 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.

.7 Unsuitable materials:

.1 Weak, chemically unstable, and compressible materials.

.2 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136 : Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.

.2 Table:

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 - 100
0.02 mm	10 – 80
0.005 mm	0 - 45

.3 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.

.8 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.4 EXCAVATION AND DISPOSAL

.1 Contractor to submit to Departmental Representative for review and approval, location of proposed disposal facility prior to disposal of any material.

.1 Refer to Section 01 35 43 Environmental Procedures.

.2 Refer to Appendix A- Evaluation of Soil Vapours for a Proposed New Search and Rescue Station at the Victoria Coast Guard Base.

.3 Refer to Appendix B- Environmental Effects Determination and Archaeological Assessment, Golder, Sept 10 2018.

1.5 SUBMITTALS

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

.2 Quality Control: in accordance with Section 01 45 00 - Quality Control:

.1 Submit name of testing laboratory retained by Contractor for materials testing for review and approval by Departmental Representative.

.2 Submit to Departmental Representative testing inspection results report as described in PART 3 of this Section.

.3 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of fill materials and provide access for sampling.

1.6 QUALITY ASSURANCE

.1 Do not use soil material until written report of soil test results are reviewed and approved by Departmental Representative.

.2 Health and Safety Requirements:

.1 Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

.2 Divert materials from landfill to local facility for reuse.

1.8 EXISTING CONDITIONS

.1 Carefully examine existing mapping of site utilities prior to excavation.

.2 Buried services:

.1 Before commencing work verify location of buried services on and adjacent to site by either soil hydrovactor excavation or hand-digging methods.

.2 Remove obsolete buried services within 2 m of foundations: cap cut-offs.

.3 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.4 Prior to beginning excavation Work, establish location and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during Work.

.5 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.

.6 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing.

.7 Record location of maintained, re-routed and abandoned underground lines.

.8 Confirm locations of recent excavations adjacent to area of excavation.

.3 Existing buildings and surface features:

.1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, pavement, survey bench marks and monuments which may be affected by Work.

.2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.

PART 2 Products

2.1 MATERIALS

.1 Gravel to be composed of inert, durable material, reasonably uniform in quality and free from soft or disintegrated particles. In absence of satisfactory performance records over a five year period for particular source of material, soundness to be tested according to ASTM C88 or latest issue. Maximum weight average losses for course and fine aggregates to be 30% when magnesium sulphate is used after five cycles.

.2 All crushed gravel when tested according to ASTM C136 and ASTM C117 to have a generally uniform gradation and conform to MMCD gradation limits and 60% of the material passing each sieve must have one or more fractured faces. Determination of amount of fractured material shall be in accordance with BC Ministry of Transportation and Highways Specification I-11, Fracture Count for Coarse Aggregate, Method 'A', which determines fractured faces by count. The Plasticity Index for crushed gravel to not exceed 6.0.

.3 Granular base and sub-base to MMCD (Master Municipal Contract Documents 2009, British Columbia), Section 31 05 17 – Aggregates and Granular Materials.

.4 Granular pipe bedding to MMCD ((Master Municipal Contract Documents 2009, British Columbia), Section 31 05 17 – Aggregates and Granular Materials.

.5 Drain rock to MMCD ((Master Municipal Contract Documents 2009, British Columbia), Section 31 05 17 – Aggregates and Granular Materials.

.6 Structural fill to be in approved by a geotechnical engineer and Departmental Representative. Structural fill should consist of clean imported granular fill containing less than 5% silt and clay sizes.

.7 Portions of the excavated site material may be suitable for re-use as structural fill. Clean granular material, if any, encountered on the site should be stockpiled separately for review by the geotechnical engineer.

PART 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control drawings, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

.2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.3 PREPARATION/PROTECTION

.1 Protect existing features in accordance with applicable local regulations.

.2 Keep excavations clean, free of standing water, and loose soil.

.3 Where soil is subject to significant volume change due to change in moisture content, cover and protect as directed by Departmental Representative.

.4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction.

.5 Protect existing buried services.

3.4 STRIPPING OF TOPSOIL

.1 Begin topsoil stripping of areas as indicated after area has been cleared of brush, weeds, grasses and removed from site.

.2 Strip topsoil to depths as indicated.

.1 Do not mix topsoil with subsoil.

.3 Stockpile in locations as directed by Departmental Representative.

.1 Stockpile height not to exceed 2 m and should be protected from erosion.

.4 Retain topsoil for reinstatement except where soils have been deemed contaminated. Refer to Appendix A and B.

3.5 STOCKPILING

.1 Stockpile fill materials in areas designated by Departmental Representative.

.1 Maximum stockpile height: 3m.

.2 Stockpile granular materials in manner to prevent segregation.

.3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

3.6 SHORING, BRACING AND UNDERPINNING

.1 Contractor is responsible for the protection and temporary support of all project excavations.

.2 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 30 - Health and Safety Requirements and WorkSafe BC.

.1 Where conditions are unstable, Contractor to retain and pay costs for geotechnical engineer to review condition and provide recommendations

3.7 DEWATERING AND HEAVE PREVENTION

.1 Keep excavations free of water while Work is in progress.

.2 Provide for Departmental Representative review details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut- offs.

.3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.

.1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.

.4 Protect open excavations against flooding and damage due to surface run-off.

.5 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures to approved runoff areas or containment facilities and in manner not detrimental to public and private property, or portion of Work completed or under construction.

.1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

3.9 EXCAVATION

.1 All or any existing underground utilities are not necessarily shown on the Contract Drawings. Existing Underground utilities shall be located and all utility companies contacted, prior to installing any new underground services.

.2 Test holes may be required to be excavated to determine exact depths of existing utilities. Any discrepancy in elevation or location shall be referred to the Departmental Representative prior to construction.

.3 Advise Departmental Representative at least 7 days in advance of excavation operations. Excavate to lines, grades, elevations and dimensions as indicated.

.4 All trenches to conform to WorkSafeBC Guidelines and Regulations and MMCD standard drawing G4.

.5 Remove concrete, masonry, paving, walks, demolished foundations and rubble and other obstructions encountered during excavation offsite.

.6 Excavation must not interfere with bearing capacity of adjacent foundations and slabs. Contractor to notify Departmental Representative immediately where undermining of slabs of foundations occurs. Contractor responsible for devising and executing a remediation plan for filling all voids associated with undermining of slabs and foundations.

.7 Keep excavated and stockpiled materials safe distance away from edge of trenches as directed by Departmental Representative.

.8 Restrict vehicle operations directly adjacent to open trenches.

.9 Do not obstruct flow of surface drainage or natural watercourses.

.10 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.1 Subgrade for foundations and paved areas to be reviewed and approved by geotechnical engineer prior to placement of fill materials.

.2 Any soft/loose areas identified should be excavated and replaced with structural fill placed and compacted in 200mm lifts to 100% Standard Proctor Maximum Dry Density, or as directed by Geotechnical Engineer.

.11 Correct unauthorized over-excavation as follows:

.1 Fill with MMCD granular base material to not less than 100% Standard Proctor Density.

.12 Maintain subgrade surface in condition conforming to this section until succeeding material is applied or until subgrade is accepted by the Departmental Representative, including any dewatering required.

.13 Hand trim, make firm and remove loose material and debris from excavations.

.1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

.2 Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.

3.10 ROADWAY EXCAVATION, EMBANKMENT AND COMPACTION

.1 Complete all roadway excavation in conformance in conformance to the following MMCD sections: Section 31 24 13 – Roadway Excavation, Embankment and Compaction, Section 31 22 16 – Reshaping Granular Roadbeds, and Section 31 22 16.1 – Reshaping Existing Subgrade

3.11 BEDDING AND SURROUND OF UNDERGROUND SERVICES

.1 Place and compact granular material for bedding and surround of underground services as indicated.

.2 Place bedding and surround material in unfrozen condition.

3.12 BACKFILLING

.1 Do not proceed with backfilling operations until completion of following:

.1 Departmental Representative has inspected and approved installations.

.2 Departmental Representative has inspected and approved of construction below finish grade.

.3 Inspection, testing, approval, and recording location of underground utilities.

.4 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.

.2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.3 Do not use backfill material which is frozen or contains ice, snow or debris.

.4 Backfill materials:

.1 Boulevards and easements: for areas not subject to vehicle or building loading and outside ditch lines, backfill with approved native material Compact to 95% modified proctor density.

.2 Roads, foundations, buildings, driveways, concrete walks: backfill with imported granular material. Place backfill material in uniform layers not exceeding 200 mm compacted to 100% Standard Proctor Maximum Dry Density thickness up to grades indicated. Compact each layer before placing succeeding layer.

.5 When site excavated material granular backfill is proposed for use as trench backfill the contractor shall employ a professional geotechnical engineer with experience in geotechnical engineering for performance of in-place density and sieve testing. The site

material shall fall within one of the granular backfill material specifications as per MMCD Section 31 05 17.

.6 Install drainage system in backfill as indicated.

3.12 RESTORATION

.1 Existing underground utilities may need to be lowered or rose to suit the final design grades in accordance with minimum and maximum cover requirements for each utility.

.2 Upon completion of Work, remove waste materials and debris in accordance to Section 01 74 19 - Construction/Demolition Waste Management and Disposal, trim slopes, and correct defects as directed by Departmental Representative.

.3 Replace topsoil as indicated.

.4 Reinstate boulevard to elevation which existed before excavation.

.5 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.

1.9 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

PART 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 35 43 - Environmental Procedures

.3 Section 01 61 00 - Common Product Requirements.

.4 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.5 Section 32 12 16.01 - Asphalt Paving – Short Form.

.6 Section 32 16 15 - Concrete Walks, Curbs and Gutters.

1.2 REFERENCES

.1 ASTM International

.1 ASTM C117-04, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN- m/m³).

.5 ASTM D1557-09, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).

.6 ASTM D1883-07e2, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

.7 ASTM D4318-10, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 U.S. Environmental Protection Agency (EPA) / Office of Water

.1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

.4 Master Municipal Contract Documents (MMCD), Platinum Edition Volume II - 2009, British Columbia. Contractor to maintain a copy on-site at all times.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

1.4 ACTION AND INFORMATION SUBMITTALS

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

.2 Product Data:

.1 Submit proposed source and sieve analysis of all aggregate materials 2 weeks prior to commencing work.

PART 2 Products

2.1 MATERIALS

.1 Granular base and sub-base to MMCD (Master Municipal Contract Documents 2009, British Columbia), Section 31 05 17.

PART 3 Execution

3.1 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction, sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 PLACEMENT AND INSTALLATION

.1 Place granular base after sub-base and subgrade surface is inspected and approved in writing by Departmental Representative.

.2 Placing:

- .1 Construct granular base to depth and grade in areas indicated.
- .2 Ensure no frozen material is placed.
- .3 Place material only on clean unfrozen surface, free from snow and ice.
- .4 Begin spreading base material on crown line or on high side of one-way slope.
- .5 Place material using methods which do not lead to segregation or degradation of aggregate.
- .6 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.
- .7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .8 Remove and replace that portion of layer in which material becomes segregated during spreading.

.3 Compaction Equipment:

- .1 Ensure compaction equipment is capable of obtaining required material densities.
- .2 Compacting:
  - .1 Compact to density not less than 95% Modified Proctor Density.
  - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
  - .3 Apply water as necessary during compacting to obtain specified density.
  - .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved in writing by Departmental Representative.

.5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

.4 Proof rolling:

.1 For proof rolling use standard roller of 45,400 kg gross mass with four pneumatic tires each carrying 11,350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm.

.2 Obtain written approval from Departmental Representative to use non-standard proof rolling equipment.

.3 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.

.4 Where proof rolling reveals areas of defective subgrade:

.1 Remove base, sub-base and subgrade material to depth and extent as directed by Departmental Representative.

.2 Backfill excavated subgrade with common material and compact .

.3 Replace sub-base material and compact.

.4 Replace base material and compact in accordance with this Section.

.5 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by Departmental Representative and replace with new materials in accordance with this section at no extra cost.

.6 At the discretion of the Departmental Representative, nuclear densometer testing may be utilized for compaction testing rather than proof rolling. Location and frequency of densometer tests to be approved by the Departmental Representative.

3.3 TESTING

.1 Contractor to retain and pay for services of testing laboratory acceptable by the Departmental Representative for inspection and nuclear densometer testing of aggregate materials.

.2 Tests specified to be carried out by Contractor under the Departmental Representative's supervision.

.3 Contractor shall notify Departmental Representative in advance of planned testing.

.4 Contractor to pay costs for uncovering and making good work that is covered before required inspection or testing is completed and approved by Departmental Representative.

.5 Provide Departmental Representative with 2 copies of testing and commissioning reports as soon as they are available.

3.4 SITE TOLERANCES

.1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

3.5 PROTECTION

.1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by Departmental Representative.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 43 - Environmental Procedures

.3 Section 01 74 19 – Construction Waste Management and Disposal.

.4 Section 31 23 33.01 – Excavating Trenching and Backfilling.

.5 Section 32 11 23 – Aggregate Base Courses.

.6 Section 32 16 15 - Concrete Walks, Curbs and Gutters.

1.2 REFERENCES

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

.1 ASTM D1557-12e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft^3 (2,700 kN-m/m^3)).

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.5 – M91 (March 1999), Low Flash Petroleum Spirits Thinner.

.2 CAN/CSGB-1.74 – 2001, Alkyd Traffic Paint.

.3 Master Municipal Contract Documents (MMCD), Platinum Edition Volume II - 2009, British Columbia. Contractor to maintain a copy on-site at all times.

1.3 SAMPLES AND SUBMITTALS

.1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit asphalt mix design to Departmental Representative for review at least 1 week prior to commencing work.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction Waste Management and Disposal.

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

.3 Divert unused aggregate materials from landfill to facility for reuse as approved by Departmental Representative.

.4 Dispose of unused paint and paint thinner materials at official hazardous material collections site as approved by Department Representative.

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

.6 Divert unused asphalt from landfill to facility capable of recycling materials.

PART 2 Products

2.1 MATERIALS

.1 Prime coat: N/A

.2 Tack coat: CAN/CGCB – 16.2, Grade SS-1

.3 Asphalt cement: CGSB – 16.3-M 90, Grade 80-100

.4 Asphalt concrete: MMCD Upper Course #1 and 2

.5 Traffic paint: yellow and white to CAN/CGSB-1.74.

.6 Paint thinner: to CAN/CGSB-1.5.

PART 3 Execution

3.1 FOUNDATIONS

.1 Roadway foundations to be constructed in conformance to MMCD Section 31 24 13 – Roadway Excavation, Embankment and Compaction.

.2 Foundations for roadways and parking lots comprise:

.1 compacted granular subbase, thickness to match existing.

.2 compacted granular base, thickness to match existing.

.3 Compaction: compact each lift of granular material to 100% standard Proctor density. Maximum lift thickness: 200 mm.

3.2 PAVEMENT THICKNESS

.1 Pavement thickness for roadways and parking lots is to conform to the following gradation:

.1 Patching and in-fill to be consistent with thickness of existing paving.

.2 PAVEMENT REPAIR

.1 Repair all areas of paving damaged by excavation and construction up to edge of construction.

3.3 PAVEMENT CONSTRUCTION AND TESTING

.1 Construction of asphalt concrete to MMCD 32 12 16 – Hot-Mix Asphalt Concrete Paving.

.2 Surface preparation to MMCD 32 12 16 – Hot-Mix Asphalt Concrete Paving.

.3 Cold milling to MMCD 32 01 16.7 – Cold Milling.

.4 Contractor to retain and pay for services of geotechnical engineer and testing laboratory acceptable by the Departmental Representative for inspection and nuclear densometer testing of backfill materials and asphalt paving.

.1 Testing to include asphalt thickness and compaction at intervals acceptable to the Departmental Representative.

3.4 TRAFFIC MARKINGS

.1 Reinstate any parking space divisions and traffic markings removed or damaged by any of the Work.

.2 Paint parking space divisions and other pavement markings in accordance with manufacturers recommendations and as indicated.

.3 Use paint thinner in accordance with manufacturer's requirements.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 – Construction Waste Management and Disposal.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 01 35 43 - Environmental Procedures

.2 Section 03 20 00 Concrete Reinforcing.

.3 Section 03 30 00 Cast-In-Place Concrete.

.4 Section 31 23 33.01 Excavating, Trenching and Backfilling.

.5 Section 32 11 23 Aggregate Base Courses.

1.2 REFERENCES

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

.1 ASTM C117-04, Standard Test Method for Materials Finer than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

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

.4 ASTM D1557-12e1, Modified Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³(2,700 kN-m/m³)).

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-3.3-99(March 2004), Kerosene, Amend. No. 1, National Standard of Canada.

.2 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

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

.3 Canadian Standards Association (CSA International)

.1 CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA-G30.5-M1983 (R1998), Welded Steel Wire Fabric for Concrete Reinforcement

.4 Master Municipal Contract Documents (MMCD), Platinum Edition Volume II - 2009, British Columbia. Contractor to maintain a copy on-site at all times.

1.3 SUBMITTALS

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

.1 Submit concrete mix designs 2 weeks prior to construction.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

PART 2 Products

2.1 MATERIALS

.1 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in- Place Concrete and:

.1 Hand-formed and hand-placed concrete:

- Slump: 80mm
- Air entrainment: 5-8%
- Max. aggregate size: 20mm
- Min. cement content: 335 kg/m^3
- Min. 28 day strength: 32 MPa

.2 Extruded concrete:

- Slump: 0-25mm
- Air entrainment: 6-9%
- Max. aggregate size: 10mm
- Fineness modulus: 2.1 to 2.4
- Min. cement content: 335 kg/m^3
- Min. 28 day strength: 32 MPa

.2 Reinforcing steel: in accordance with Section 03 20 00 - Concrete Reinforcing.

.1 Welded steel wire fabric to CSA CSA-G30.5-M1983 (R1998)

.3 Joint filler and Curing Compound: in accordance with Section 03 30 00 - Cast- in-Place Concrete.

.4 Joint sealer to CAN/CGSB-19.24-M90, Type 1, Class B

.5 Granular base: material to following requirements:

.1 Granular base to MMCD (Master Municipal Contract Documents 2009, British Columbia), Section 31 05 17.

.6 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water-soluble soap.

.7 Fill material:

.1 Granular material as specified in section 32 11 23 321123 - Aggregate Base Courses

.8 Curing compound: to be spray applied, liquid type conforming to ASTM C309 containing a fugitive dye, applied in accordance with manufacturer's recommendations, or other during methods such as sheet material and burlap mats, subject to Departmental Representative approval.

PART 3 Execution

3.1 CONCRETE PAVING

.1 Complete concrete paving subject to vehicular loading in accordance with MMCD 32 13 13 – Portland Cement Concrete Paving.

3.2 GRADE PREPARATION

.1 Do grade preparation work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Construct embankments using excavated material free from organic matter or other objectionable materials.

.1 Dispose of surplus and unsuitable excavated material in approved location off site.

.3 Place fill in maximum 300 mm layers and compact to at least 95% Modified Proctor Density in compliance with ASTM D1557.

3.3 GRANULAR BASE

.1 Obtain Departmental Representative's approval of subgrade before placing granular base.

.2 Place granular base material to lines, widths, and depths as indicated.

.3 Compact granular base in maximum 300 mm layers to at least 95% Modified Proctor Density in compliance with ASTM D1557.

3.4 FORMWORK

.1 Use flexible forms for all curves less than 60m radius.

.2 Set forms to line and grade as shown on Contract Drawings free from waves or irregularities in line or grade.

.3 Adequately brace forms to maintain specified tolerances after concrete is placed.

.4 Treat forms lightly with approved form release agent and remove surplus agent.

3.5 CONCRETE

.1 Obtain Departmental Representative approval of granular base prior to placing concrete.

.2 Do not place concrete when air temperature appears likely to fall below 5 degrees Celsius within 24 hours unless specified precautions are taken and approved.

.3 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.4 Immediately after floating, give sidewalk surface uniform broom finish to produce regular corrugations not exceeding 2 mm deep, by drawing broom in direction normal to center line.

.5 Provide edging as indicated with 10 mm radius edging tool.

3.6 TOLERANCES

.1 .1 Finish surfaces to within 3 mm in 3 m as measured with 3 m straightedge placed on surface.

3.7 EXPANSION AND CONTRACTION JOINTS

.1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, at intervals of 3 m.

.2 Install expansion joints at intervals of 9 m.

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

3.8 ISOLATION JOINTS

.1 Install isolation joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.

.2 Use 13mm pre-molded hardboard joint material to form isolation joints joint filler in isolation joints.

.3 Seal isolation joints with sealant noted on drawings.

3.9 CURING

.1 Cure concrete by adding moisture continuously in accordance with CSA- A23.1/A23.2 to exposed finished surfaces for at least 1 day after placing, or sealing moisture in by curing compound as directed by Departmental Representative.

.2 Where burlap is used for moist curing, place two pre-wetted layers on concrete surface and keep continuously wet during curing period of at least 7 days.

.3 Apply curing compound evenly to form continuous film, in accordance with manufacturer's requirements.

3.10 BACKFILL

.1 Allow concrete to cure for 7 days prior to backfilling.

.2 Backfill to designated elevations with material as directed by Departmental Representative.

.1 Compact and shape to required contours as indicated.

3.11 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.

END OF SECTION

PART 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 Submittal Procedures.

.2 Section 01 74 11 Cleaning.

.3 Section 01 74 19 Construction Waste Management and Disposal.

.4 Section 03 30 00 Cast-In-Place Concrete.

1.2 REFERENCES

.1 ASTM International

.1 ASTM A53/A53M-10, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A90/A90M-09, Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.

.3 ASTM A121-07, Standard Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.

.4 A653/A653M-10, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.5 ASTM C618-08a, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

.6 ASTM F1664-08, Standard Specification for Poly(Vinyl Chloride) (PVC)-Coated Steel Tension Wire Used with Chain-Link Fence.

.7 ASTM A123/A123M-09, Standard Specification for Zinc (Hot Dip Galvanized) coatings on Iron and Steel Products.

.8 ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-138.1-96, Fabric for Chain Link Fence.

.2 CAN/CGSB-138.2-96, Steel Framework for Chain Link Fence.

.3 CAN/CGSB-138.3-96, Installation of Chain Link Fence.

.4 CAN/CGSB-138.4-96, Gates for Chain Link Fence.

.5 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.6 CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles

.7 CAN/CSA-G40.20-13/G40.21-13, General requirements for rolled or welded structural quality steel / Structural quality steel

.8 CAN/CSA-W59-13 - Welded steel construction (metal arc welding)

.3 CSA International

.1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA-A3000-08, Cementitious Materials Compendium.

.4 Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for fences, posts and gates and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 QUALITY ASSURANCE

.1 Manufacturer: A company specializing in the production of fencing systems.

.2 Installer: A minimum of three years' experience installing similar equipment and approved by manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.2 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Store and protect fence and gate materials from damage.

.3 Replace defective or damaged materials with new.

.3 Packaging Waste Management: remove for reuse packaging materials in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

PART 2 Products

2.1 MATERIALS

.1 Concrete mixes and materials: in accordance with CSA A23.1 and Section 03 30 00 - Cast-in-Place Concrete.

.1 Nominal coarse aggregate size: 20-5.

.2 Compressive strength: 20 MPa minimum at 28 days.

.3 Additives: fly ash to CSA A3000 ASTM C618.

.2 Chain-link fence fabric: to CAN/CGSB-138.1.

.1 Type 1, Class A, medium style, Grade 2.

.2 Height of fabric: as indicated.

.3 Posts, braces and rails: to CAN/CGSB-138.2, galvanized steel pipe.

.4 Top, bottom tension wire: to CAN/CGSB-138.2, single strand, galvanized steel wire.

.5 Tie wire fasteners: aluminum wire.

.6 Tension bar: to ASTM A653/A653M, 5 x 20 mm minimum galvanized steel.

.7 Gates: to CAN/CGSB-138.4.

.1 Provide wheels on swing gates.

.8 Gate frames: to ASTM A53/A53M, galvanized steel pipe, standard weight 45 mm outside diameter pipe for outside frame, 35 mm outside diameter pipe for interior bracing.

.1 Fabricate gates as indicated with electrically welded joints, and hot-dip galvanized after welding.

.2 Fasten fence fabric to gate with twisted selvage at top.

.9 Fittings and hardware: to CAN/CGSB-138.2, galvanized steel.

.1 Tension bar bands: 3 x 20 mm minimum galvanized steel or 5 x 20 mm minimum aluminum.

.2 Post caps to provide waterproof fit, to fasten securely over posts and to carry top rail.

.3 Overhang tops to provide waterproof fit, to hold top rails and an outward inward projection to hold barbed wire overhang.

.4 Projection of approximately 300 mm long to project from fence at 45 degrees above horizontal.

.5 Turnbuckles to be drop forged.

.6 Organic zinc rich coating: to CAN/CGSB-1.181 MPI #18.

2.2 ALUMINUM FENCING

.1 System of modular aluminum fencing panels and gates, fabricated from extruded aluminum tubular sections, top and bottom aluminum rails, field attached to aluminum posts.

.2 Vertical uprights, bracing, top track and bottom track to be 6061-T6 aluminum extrusion.

.1 Sized to match existing.

.2 Refer to details

.3 Posts- Fabricated of 6061-T6 aluminum extrusions to ASTM B22.

.1 Size to match existing

.2 Refer to details.

.4 Finish: Polyester powder coating.

.1 Colour- Black

2.3 FINISHES

.1 Galvanizing:

.1 For chain link fabric: to CAN/CGSB-138.1 Grade 2.

.2 For pipe: 550 g/m²minimum to ASTM A90.

.3 For other fittings: to ASTM A123/A123M.

PART 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for fence and gate installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

.1 Layout

.1 Contractor to provide full layout of the fences, gates and adjacent features and report any potential conflicts to the Departmental Representative prior to construction.

3.3 TOUCH UP

.1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas as indicated.

.1 Pre-treat damaged surfaces according to manufacturers' instructions for zinc-rich paint.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 – Construction Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1. GENERAL

1.1 SCOPE

.1 The electrical contractor is to provide and install a complete photovoltaic electricity production system using a combination of PV Panels/Inverters.

.2 PV panels shall be complete with custom fabricated mounting frames for roof mounting.

.3 System shall provide for extensive data logging and communications export to building management system for realtime and historical analytics.

1.2 QUALIFICATION OF PRODUCTS

.1 All products proposed as alternates must meet or exceed to efficiencies or performance of those specified.

.2 Alternates may also be approved with priority on Canadian or locally manufactured items.

1.3 CODES AND STANDARDS

.1 The system and its components shall be fully CSA approved for the uses as intended.

.2 Installation shall be by individuals or companies qualified in this type of installation with a proven track record of successful and operation projects.

1.4 SYSTEM DESCRIPTION

.1 The system is to consist of roof mounted PV panels with built- in inverters. Panels to be installed on a westerly slope roof (2 to 12).

.2 Inverters to be tied to grid system and connected to a panel indicated on drawing.

.3 Custom structural elements shall be provided by the panel supplier for mounting the PV panels to the sloped roof. Design of these mounts is the sole responsibility of the P.V contractor. Supports shall be robust in design and provide minimal or no visual impact. This design will require approval from the projects structural engineer in regards to it’s effect on the building.

.4 Inverters shall have ethernet connectivity with integral webserver and BAC net interface to building communication system for exporting data such as power output, inverter capacity, voltages, etc.

1.5 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data.

.2 Include:

.1 Detail assembly and internal wiring diagrams for panels, inverter and connectors.

.2 Overall system riser wiring diagram identifying all devices, sensors and cabling.

.3 Details for devices and connection requirements.

.4 Detail for panel mounting system on shingled roof (Slope 2 to 12).

2. PRODUCTS

2.1 PV PANELS

.1 Standard of acceptance for PV panels shall be Canadian solar 330P black Maxpower monocrystalline cell units at 243W max power output, or one with same or better performance.

2.2 MICRO INVERTER

.1 Provide micro inverter with trunk cable.

3. EXECUTION

3.1 INSTALLATION

.1 Install system in accordance with the Canadian Electrical Code and ULC requirements and all BC Hydro and utility requirements.

.2 Coordinate mounting of panels with structural and architectural trades such that mounting panels does not compromise the construction schedule. Panels shall be protected from damage until operational

.3 All wiring shall be rated for exterior use and approved by CSA for the application.

.4 Mount all communications devices and connect and test all wiring to ensure connectivity and appropriate operation.

.5 Provide complete demonstration of operation, maintenance and basic troubleshooting of complete system. Provide all documentation indicating operations, datalogging and access procedure to staff members.

.6 Verify correct operation of system and tune all equipment as possible for maximum efficient operation.

END OF SECTION

APPENDIX A

Evaluation of Soil Vapours for a Proposed New Search and Rescue Station Victoria B.C. Golder Associates- Sept 10 2018

10 September 2018 Reference No. 18101392-003-L-Rev0

Hans Damman
Fisheries and Oceans Canada
9860 West Saanich Road
Sidney, BC
V8L 4B2

EVALUATION OF SOIL VAPOURS FOR A PROPOSED NEW SEARCH AND RESCUE STATION AT THE VICTORIA COAST GUARD BASE, VICTORIA, BC

Dear Mr. Damman,

This letter provides the results of an assessment conducted by Golder Associates Ltd. (Golder) for Fisheries and Oceans Canada (F&OC) to evaluate the potential risk to future workers associated with the presence of soil vapours in the footprint and vicinity of a proposed new Search and Rescue (SAR) station to be constructed at the Canadian Coast Guard (CCG) Base in Victoria, BC (the Site). The Site location is shown on Figure 1.

An Environmental Effects Determination (EED), including archaeological assessment, is also being prepared for the Site under separate cover.

This assessment was conducted to evaluate the potential risks to future SAR workers via the inhalation pathway.

1.0 BACKGROUND

1.1 Site Use

The proposed SAR station consists of an approximately 360 m^2 slab-on-grade structure (referred to as the Project) and is shown on Figure 2 in the southeast corner of the Site. Currently, the Project is located in an area that partly encompasses a storage yard space, and also extends over a landscaped lawn. The Project will be used as a residence for SAR workers and minor maintenance and repair facility for SAR boats. The structure, based on plans dated April 2018 provided by F&OC, consists of a lower level, including meeting rooms, gear storage, first aid, mechanical room, and offices, and an upper level with individual sleeping quarters, a fitness room, living area, and kitchen. The south end of the facility will be the workshop space for SAR boats, with a large bay door access. SAR workers are expected to overnight at the facility during shift work. Use and access of the SAR building will be primarily limited to SAR workers; therefore, the primary receptors of concern were adult workers.

1.2 Previous Reports

Previous investigations have been conducted at the Site between 1994 and 2013 by Golder and others (Azimuth et al. 2007).

Environmental reports for the Site that were reviewed, and relevant information incorporated as part of the assessment, included:

- Risk Assessment Strategy – Specified 8 Major Facilities, Version 1.1 – Final Draft, prepared by Azimuth Consulting Group (Azimuth), Golder, and SNC-Lavalin and Morrow Consultants Inc. (SNC-Lavalin), dated 30 March 2007.
- 2008 Volume II-B. Supplemental Site Investigation in Support of Risk Assessment/Risk Management. Victoria Coast Guard Base, Victoria, BC, prepared by Golder, dated 31 March 2008.
- Risk Management Plan for Control of Residual Contamination in Soil, Sediment and Groundwater, Victoria Coast Guard Base, Version 1.0, prepared by SNC-Lavalin, draft dated 31 March 2014.

1.3 Site Conditions

Based on a review of the historical shoreline from aerial photographs, and shown on Figure 2, the majority of the Project appears to be located above historical bedrock outcrop shoreline (Azimuth et al. 2007), and only a portion of the Project footprint is located in areas of significant infilling (to the northwest).

The most recent investigation report for the Site (SNC-Lavalin 2014) re-assessed the areas of concern (AECs) at the Site based on the perspective of exposure pathways for human and ecological (terrestrial and aquatic) health based on the current land use at the time of the assessment. Based on the SNC-Lavalin (2014) evaluation, the footprint of the Project overlaps with AEC 4f (Site-wide fill material; former barge building area).

AEC 4f was identified as land that was created by infilling at the Former Barge Building Area which is now used as part of the storage yard. Potential contaminants of concern (PCOCs) included metals and polycyclic aromatic hydrocarbons (PAHs). A general description of fill material in the south end of the Site indicated industrial and demolition materials, including glass, brick, porcelain fragments, and metal filings (Azimuth et al. 2007).

Based on the results from the previous investigations at the Site, several soil samples have been collected in the vicinity of the Project and groundwater data is available from one monitoring well (MW1) located nearby. Soil vapour was assessed at the Site, but samples could not be obtained in AEC 4f due to the nature of the substrate.

Note that hazardous waste, based on Provincial regulations, was present at one location in soil (BH01-27), beneath the Project where PAH toxicity equivalent value (TEQ) exceeded 100 ppm in soil for the sample at 1.1-1.5 metres below ground surface (m bgs).

2.0 REGULATORY FRAMEWORK

The Project is located within the federal Victoria CCG Base, and therefore the federal guidelines have been applied preferentially. Where federal guidelines are not available, provincial standards were used. The pathway evaluated in this assessment was limited to the inhalation of vapours in the area of the Project which is based on the expected use of the future SAR station. The land use was considered commercial.

2.1 Federal

The *Canadian Environmental Protection Act* (CEPA), 1999 is a federal law that enables the Government of Canada to protect the environment and human health from the risks posed by harmful pollutants and to prevent new ones from entering the Canadian environment. Part 5 of CEPA 1999 focuses on understanding and reducing the risks posed by new and existing substances by providing the authority to determine which of these substances should be evaluated to determine whether they are "toxic", the authority to carry out assessments and, if appropriate, the authority to implement preventive or control measures to relevant aspects of the substance life cycle. Lists of substances include, for example: domestic substances list; priority substances list; and, toxic substances list. The National Pollutant Release Inventory (NPRI) is a legislated, nation-wide, publicly-accessible inventory of pollutants released, disposed of and recycled by facilities in Canada.

The primary documents used to assess environmental quality on federal lands are the Canadian Council of Ministers of the Environment (CCME) Environmental Quality Guidelines and Canada-wide Standards for Petroleum Hydrocarbons (CWS-PHC) in Soil.

2.1.1 Soil Guidelines

The CCME soil quality guidelines (CCME 1999, and updates) are divided into categories based on land use. The categories provided include agricultural, residential/park, and commercial/industrial land use. The CWS-PHC in soil standards (CCME 2008) are divided into the same land use categories as the CCME soil quality guidelines, but further divide each specific land use into two standards based on soil texture. The two categories of soil texture are coarse-grained (e.g., sand, gravel) and fine-grained (e.g., clay, silt) soils. Pathway specific guidelines are also provided as check values (e.g., direct contact, inhalation of vapours).

The available analytical soil results were screened against the check values for indoor vapour inhalation for slab-on-grade construction, using the more stringent of coarse and fine-grained soil types, where applicable.

2.1.2 Groundwater Guidelines

The applicable federal guidelines for groundwater include the FIGQG (Government of Canada 2016), which provides both Tier 1 (most conservative of all pathways), and Tier 2 (pathway-specific) guidelines. Pathways evaluated in the Tier 2 guidelines include inhalation (indoor air), direct contact for soil organisms, and freshwater and marine aquatic life. Where applicable, the guidelines are specified based on soil texture (i.e., coarse- or fine-grained).

The available analytical groundwater results were screened against the Tier 2 guidelines for inhalation, using the more stringent of coarse and fine-grained soil types, where applicable.

2.1.3 Vapour Guidelines

Federal vapour guidelines have not been developed. Therefore, the provincial CSR vapour standards and guidance have been used.

2.2 Provincial

In BC, environmental matters pertaining to contaminated sites generally fall under the jurisdiction of the Ministry of Environment and Climate Change Strategy (BC ENV). The *Environmental Management Act* (EMA; SBC 2003, Chapter 53 assented to 23 October 2003, updated to 30 October 2017) is the primary environmental statute that addresses waste and air management, contaminated sites management and environmental emergency planning and spill response in BC. The EMA sets out requirements and processes for obtaining authorizations (e.g., permits, Approvals, Operational Certificates, Codes of Practice) for waste and air management and gives authority for issuing regulatory instruments for contaminated sites (e.g., Approvals in Principle, Certificates of Compliance). Regulations pursuant to the EMA provide further, more detailed procedures and standards pertaining to requirements.

The two key regulations under the EMA that relate to the assessment and remediation of contaminated sites are the Contaminated Sites Regulation (CSR; BC Reg. 375/96, O.C. 1480/96 and M271/2004, as updated [includes amendments up to BC Reg. 253/2016 and BC Reg. 196/2017, updated 1 November 2017]); and the Hazardous Waste Regulation (HWR; BC Reg. 63/88, O.C. 268/88, as updated [includes amendments up to BC Reg. 243/2016 and BC Reg. 195/2017, updated 1 November 2017]).

The HWR includes standards for defining hazardous waste substances (e.g., leachate toxic substances, total concentrations of substances), administrative requirements for management, as well as siting, performance and operating requirements for various types of hazardous waste facilities. Previous amendments to the CSR and the HWR (in effect 19 July 2016) decoupled the CSR and HWR for the management of contaminated sites, such that the role of the HWR in contaminated sites is limited to cases of off-Site transport and disposal of material meeting the criteria of hazardous waste.

The CSR soil and groundwater standards do not provide pathway-specific standards related to vapour and indoor air because vapour-specific standards have been developed. Therefore, soil and groundwater evaluation at the Site used the available federal pathway-specific guidelines.

2.2.1 Vapour Standards

The CSR generic numeric vapour standards are provided in Schedule 3.3. These vapour standards represent the acceptable concentration in the breathing zone for the protection of human health for various land uses, including agricultural/urban park/residential, commercial, industrial, and parkade.

The provincial guidance for evaluating volatile contamination at a site is outlined in Technical Guidance 4 (BC ENV 2017a), with the application of attenuation factors outlined in Protocol 22 (BC ENV 2017b).

In accordance with Protocol 22, vapour attenuation was applied to the soil vapour samples collected at the Site to predict indoor and outdoor vapour concentrations, as follows:

$$C_{air} = C_{vapour} * \alpha$$

Where α is the vapour attenuation factor, C_{air} is the estimated air concentration of the substance, and C_{vapour} is the measured or predicted soil vapour concentration of the substance. For indoor air, the vapour attenuation factor takes into account the attenuation of soil vapours that occurs through migration in the vadose zone (unsaturated soil above the water table) and the building foundation and mixing of vapours in indoor air. Vapour attenuation factors for indoor air are based on the land use of the site, soil vapour sample location, and the distance between the soil vapour sample and building. The soil vapour concentration may be measured or estimated from measured soil and/or groundwater concentrations, subject to the criteria listed in TG 4.

The outdoor air exposure scenario was assessed following attenuation based on Protocol 22 for the modelled soil vapour concentration. The CSR vapour standards themselves were not applied in this assessment.

3.0 VAPOUR PATHWAY EVALUATION

3.1 Identification of Contaminants of Potential Concern

The analytical soil and groundwater data from the previous reports for sample locations in the vicinity of the Project was reviewed. No soil vapour data was available in the vicinity of the Project area. Soil and groundwater data from all depths and within a distance of 30 metres (m) from the Project were reviewed to evaluate the presence of volatiles, defined as those parameters having CSR Schedule 3.3 vapour standards[1], within and around the Project location. As discussed above, soil results were screened against the CCME indoor vapour inhalation for slab-on-grade construction, using the more stringent of coarse and fine-grained soil types, where applicable. Groundwater data was reviewed against the FIGQG Tier 2 inhalation pathway guidelines.

In total, there were nine sample locations within 30 m of the Project that had been analyzed for the following volatiles: benzene, ethylbenzene, toluene, xylenes (BTEX), petroleum hydrocarbons (including, CWS-PHC Fractions F1 and F2, volatile petroleum hydrocarbons [VPH] and light extractable petroleum hydrocarbons [LEPH]) and naphthalene (Figure 2). As discussed in Section 3.1, the source of contamination in the Project area was site wide poor-quality fill. The fill material in the top 1 m in the Project area appeared to have non-detect or only marginal detections of volatiles compared to the deeper fill quality. The highest concentrations of volatiles were measured in samples collected below 1 m.

Table 1 summarizes the volatile contaminants detected in soil. Sample locations in the vicinity of the Project are shown on Figure 2.

[1] The only exception to this was the inclusion of petroleum hydrocarbons in the LEPH/F2 range. According to the CSR, petroleum hydrocarbons in the LEPH/F2 range would not be considered volatile; however, CCME does consider these as a volatiles.

Table 1: Summary of Detected Volatile Parameters in Soil

Parameter	CCME Commercial Guideline (mg/kg)	Basis of Guideline	Soil Exceedance Concentrations (mg/kg) (Location, Depth [m bgs])	Number of Samples Analyzed in Project Vicinity	Depth Range of Samples Analyzed in Project Vicinity (m bgs)	Retained as COPC?
F2	F2	Indoor air	790 (BH01-27 [1], 1.1–1.5)	8	0.2–4.4	No
Naphthalene	Naphthalene	-	76 (BH01-27[1], 1.1–1.5) 77 (MW1, 4.1–4.4) 42.8 (BH01-56, 0.7-1.4)	17	0.1–4.4	**Yes**

Notes:

CCME = Canadian Council of Ministers of the Environment; F2 = hydrocarbon fraction F2; m bgs = metres below ground surface; mg/kg = milligrams per kilogram; NG = no guideline.

1. Note this location contains PAHs above Hazardous Waste Levels.

Only one monitoring well was located within 30 m of the Project (MW1), which was located approximately 10 m west of the north end of the Project. Volatile parameters analyzed in groundwater at this location included BTEX, VPH, LEPH (similar to F2), and naphthalene. These parameters were not detected above the laboratory detection limit in the most recent samples collected (September 2004 and August 2007), and therefore met the applicable FIGQGs for inhalation. Further, as discussed in Section 1.3 and shown on Figure 2, the Project mostly overlies historical bedrock outcrop, whereas only the area nearer to MW1 transitions to deeper historical fill.

No soil vapour samples had been collected in the vicinity of the Project area as previous attempts to collect soil vapour had been unsuccessful (SNC-Lavalin 2014). Therefore, the identification of COPCs was based on the soil and groundwater data.

A vapour pathway specific criterion was not available for naphthalene in soil; therefore, naphthalene was retained as a COPC for further assessment. The maximum concentration of F2 in soil was less than the CWS-PHC standard for the indoor air vapour inhalation pathway and was therefore not considered to pose a risk to the Project. No volatiles were detected or exceeded the FIGQGs; therefore, no COPCs were retained in groundwater.

3.2 Vapour Risk Assessment

Given that soil vapour data was not available in the vicinity of the Project area, a modelling approach was used to predict concentrations of naphthalene in soil vapour and indoor and outdoor air. Soil vapour modelling is an accepted approach both federally and provincially; however, the limitations of modelling is well recognized. For example, due to the number of conservative assumptions that go into modelling from soil to soil vapour and air, the conservatism used at each step is compounded.

3.2.1 Exposure Assessment

3.2.1.1 Modelled Concentrations in Soil Vapour

The maximum concentration of naphthalene in soil (77 mg/kg) was modelled for partitioning to soil vapour using the Spreadsheet Tool for Human Health Detailed Quantitative Risk Assessment (DQRA) (Health Canada 2009) (see Table 2).

The DQRA model (Health Canada 2009) was used to estimate the partitioning of naphthalene from soil to soil vapour (used for both indoor and outdoor air assessments), and to estimate the attenuation factor for naphthalene from soil vapour to indoor air. Default assumptions provided in the DQRA model were used, with the exception of the following:

- The depth to soil contamination used in the model was 1.0 metre below ground surface (m bgs) which was based on the stratigraphy and chemical results from the soil samples collected within the Project area (the two highest concentrations were measured in two samples from 1.1 and 4.1 m bgs). The third highest concentration of naphthalene in soil was measured at BH01-56 at a depth of 0.7 to 1.4 m; however, the contamination did not extend further into the surface as the shallow sample collected from 0.1 to 0.6 m had only marginal concentrations of naphthalene (0.2 mg/kg). Although this sample straddled the 1 m depth interval (over a total 0.7 m depth range), based on the results from the other eight samples collected within the top 1 m in the Project area, naphthalene contamination is not anticipated to extend into the top 1m and for modelling purposes the depth to contamination was set to 1.0 m bgs.
- The biodegradation adjustment factor (10-times), was applied for naphthalene as this is applicable based on the CCME guidance (2014) for contamination at least 1 m bgs.

As a check for outdoor air exposure, the modelled soil vapour concentration was attenuated for outdoor air using the available attenuation factors provided in CSR Protocol 22.

Table 2 provides the modelled naphthalene concentrations from soil to indoor and outdoor air.

Table 2: Summary of Modelled Naphthalene Concentrations and Attenuation to Indoor and Outdoor Air

Parameter	Pathway	Maximum Soil Concentration (mg/kg)	Modelled Concentration in Soil Vapour (mg/m^3)	Applied Attenuation Factor	Concentration in Air (mg/m^3)
Naphthalene	Indoor Air	77	178	DQRA Model 3.7×10^{-5}	6.6×10^{-3}
	Outdoor Air			CSR Protocol 22 1.5×10^{-6}	2.7×10^{-4}

Notes:
mg/kg = milligrams per kilogram; mg/m^3 = milligrams per cubic metre.

3.2.1.2 Receptor Characteristics

Receptor characteristics used to evaluate indoor and outdoor air exposure for the Project are shown in Table 3 and were based on Site-specific information provided by F&OC. The Site access is controlled and fenced and will therefore only be accessed by adult workers at the CCG Base. Based on information provided by the CCG, SAR workers would consist of adult shift workers working three-week shifts (three weeks on followed by three weeks off).

During a 3-week working shift, workers would be on call 24 hours per day and were assumed to live on the upper floor of the SAR building during this time. Based on the above, a SAR worker was assumed to be on site 24 hours/day, 7 days per week, for 26 weeks per year. Outdoor exposure was assumed to be up to 3 hours per day, but the majority of time was considered to be indoors at the SAR base. These exposure parameters are considered conservative, as workers are unlikely to spend all their time at the SAR base.

Table 3: Receptor Characteristics

Parameter	SAR Worker
Hours per day indoors (hours/day)	24
Hours per day outdoors (hours/day)	3
Days per week exposed (days/week)	7
Weeks per year exposed (weeks/year)	26

To estimate non-cancer risks to the SAR worker in indoor air, an exposure of 24 hours per day and 7 days per week for 26 weeks per year was applied (based on working a 3-week shift rotation). For estimating non-cancer risks in outdoor air, an exposure of 3 hours per day, 7 days per week for 26 weeks per year was applied.

Therefore, the indoor air exposure term for non-carcinogenic effects ($ET_{V\text{-}NC}$) is:

$ET_{V\text{-}NC}$ = 24 hours/24 hours × 7 days/7 days × 26 weeks/52 weeks

$ET_{V\text{-}NC}$ = 0.5

Therefore, the outdoor air exposure term for non-carcinogenic effects ($ET_{V\text{-}NC}$) is:

$ET_{V\text{-}NC}$ = 3 hours/24 hours × 7 days/7 days × 26 weeks/52 weeks

$ET_{V\text{-}NC}$ = 0.06

3.2.2 Toxicity Assessment

Toxicity assessment involves identification of the potentially toxic effects of chemicals and provides the basis for evaluating what is an acceptable exposure and what level of exposure may adversely affect human health. It is a measure of the potential for adverse effects to carcinogenic (non-threshold) and non-carcinogenic (threshold) chemicals.

In accordance with Health Canada (2010) and US EPA IRIS (US EPA 2018), naphthalene is assessed as a threshold-acting chemical (non-carcinogen).

Health Canada (2010) does not list a reference concentration for inhalation exposure (RfC) for naphthalene (listed as under review). Therefore, as shown in Table 4, the RfC selected was taken from the United States Environmental Protection Agency (US EPA) Integrated Risk Information System (IRIS) database (US EPA 2018).

Table 4: Toxicity Reference Value

Parameter	Reference Concentration for Inhalation Exposure (RfC)[1]	Target Organ/Effect
Naphthalene	0.003 mg/m^3	Nasal effects in respiratory and olfactory epithelium.

Notes:
mg/m^3 = milligrams per cubic metre; RfC = reference concentration.

3.3 Risk Characterization

For a threshold-acting chemical (evaluation of non-carcinogenic effects), the risk characterization is expressed as a Hazard Quotient (HQ), such that HQ = estimated exposure / reference concentration. Health Canada (2012) generally uses an HQ of 0.2 for the indication of negligible risk, which is conservative to allow for contributions of exposure to come from multiple pathways. However, this assessment applied an HQ of 1.0 as the only exposure pathway through which future SAR workers could come into contact with contamination in the Project area is limited to the inhalation of vapours. Due to the conservative nature of the assumptions, an HQ greater than 1.0 does not necessarily mean risks are unacceptable; however, it would indicate that further assessment would be required.

The HQ for naphthalene for the inhalation pathway for a future SAR worker is calculated as follows:

$$\text{Hazard Quotient (HQ)} = \frac{\text{AC (mg/m}^3\text{)} \times \text{ET}_{\text{V-NC}}}{\text{RfC (mg/m}^3\text{)}}$$

Where:
AC = attenuated soil vapour concentration (mg/m^3)
$\text{ET}_{\text{V-NC}}$ = exposure term for non-carcinogenic effects
RfC = reference concentration

For indoor air, the HQ for inhalation of naphthalene based on the indoor air exposure term for the future SAR worker is:

$$\text{HQ}_{\text{SV}}\text{ (naphthalene)} = \frac{6.64 \times 10^{-3}\text{ mg/m}^3 \times 0.5}{0.003\text{ mg/m}^3}$$

HQ_{SV} (naphthalene) = 1.1

For outdoor air, the HQ for inhalation of naphthalene based on the outdoor air exposure term for the future adult SAR worker is:

$$HQ_{SV}\text{ (naphthalene)} = \frac{2.67 \times 10^{-4}\ mg/m^3 \times 0.06}{0.003\ mg/m^3}$$

HQ_{SV} (naphthalene) = 0.005

The indoor air exposure scenario resulted in an HQ marginally greater than 1.0, whereas the outdoor air exposure scenario resulted in an HQ well below 1.0.

Although the HQ for indoor air exposure was marginally above the target HQ of 1.0, risks to the future adult SAR worker were considered to be acceptable for the following reasons:

- The SAR worker is unlikely to be present in the SAR building 24 hours per day, 7 days per week, for each of their three-week shifts, given that the SAR worker will conduct a variety of duties during this time (both indoor and outdoor), and will also be away from the SAR station when responding to calls. For example, a conservative assumption that they spend 2 hours per day off Site at a call (reducing their exposure to 22 hours/day) would reduce the HQ to 1.0.
- The soil vapour to indoor air attenuation factor applied does not account for additional dispersion that may occur within the second-floor residence quarters of the SAR building. This would further reduce the concentration that workers would be exposed to.
- The soil vapour modelling conducted to predict naphthalene concentrations in soil vapour is very conservative and would overestimate risk. For example:
  - The naphthalene present in soil in the vicinity of the SAR building is associated with fill material and is not uniformly distributed in soil across the footprint of the building. The maximum concentration measured in soil was used, which is conservative and would overestimate the soil vapour concentration, as naphthalene was much lower in other samples collected in the area.
  - Vapour samples would provide a more realistic and less conservative estimate of the potential intrusion of naphthalene into the SAR building; however, soil vapour sampling had been previously attempted in AEC 4f but was unable to be assessed due to ground conditions.

Based on the input of several conservative assumptions, the marginal exceedance of the HQ for indoor air is not considered to pose a risk to future SAR workers.

It is our understanding that as part of the construction of the SAR building, soil within the footprint of the building will be removed. The removal of fill material from underneath the building would also improve the conditions.

3.3.1 Uncertainty Analysis

The assessment of potential risks to SAR workers at the Project location within the Site was evaluated using generally conservative assumptions. Table 5 outlines the sources of uncertainty for the human health risk assessment for exposure to vapours via inhalation.

Table 5: Evaluation of Uncertainty in the Soil Vapour Assessment

Assumption	Uncertainty	Under/ Overestimate of Risk	Rationale
Use of maximum soil concentration.	Moderate	Overestimate	The maximum measured soil concentration was selected to estimate the air concentration in the breathing zone. This will overestimate risk since over half of the samples collected in the area had much lower concentrations.
Modelling of soil vapour concentrations	High	Overestimate	Modelling is generally conducted using conservative assumptions. Due to the number of assumptions that go into modelling from soil to soil vapour to air concentrations, the conservatism used at each step is compounded. Based on this, the predicted concentrations of naphthalene in soil vapour and indoor air are anticipated to overestimate concentrations. Typically, measuring concentrations in soil vapour is the preferred approach; however, past attempts to collect soil vapour had been unsuccessful. In addition, based on the nature of the contamination at the site (poor quality fill) it wasn't anticipated that there would be high concentrations of vapours.
Exposure assumptions	Low to moderate	Overestimate	The assumptions were based on Site-specific exposure conditions and are still considered conservative. The SAR worker was assumed to be present within the SAR building 24 hours a day, 7 days a week, and 26 weeks of the year, which is likely an overestimate for the indoor air exposure scenario. This was based on the SAR worker being present at the Project area over three week shifts but does not account for the proportion of time spent outdoors or away from the SAR station when responding to calls.
TRVs (non-carcinogens)	Low (based on humans) to high (based on animals)	Overestimate	Toxicity data are based on sensitive endpoints. Uncertainty and safety factors are applied to account for inter and intra species variability.
Use of an HQ of 1.0	Low	Neutral	An HQ of 1.0 was considered appropriate as the only exposure pathway through which future SAR workers could come into contact with soil contamination in the Project area is limited to the inhalation of vapours.

Notes: HQ = hazard quotient; TRV = toxicity reference value

4.0 CONCLUSIONS AND RECOMMENDATIONS

Golder completed an evaluation of the potential exposure of future SAR workers to vapours in and around the proposed SAR station at the Victoria CCG in Victoria, BC. The evaluation identified that risks to a SAR worker from vapours originating from soil beneath the SAR station, would not result in unacceptable risk. Based on the conservatism included in the assessment, the marginal exceedance of the HQ for indoor air is not considered to pose a risk to future SAR workers. Furthermore, the removal of fill material from underneath the building during construction of the SAR building would also improve the conditions.

Based on Provincial regulations, hazardous waste is present at one location (BH01-27), beneath the Project where PAH toxicity equivalent value (TEQ) exceeded 100 ppm in soil for the sample at 1.1-1.5 m bgs. As noted in Section 2.2, the role of the HWR in contaminated sites is limited to cases of off-Site transport and disposal of material meeting the criteria of hazardous waste. Therefore, it is considered that the material may remain undisturbed in its current location. However, it is our understanding that some removal of soil maybe required during construction of the SAR station. If this area is going to be excavated, we recommend that appropriate segregation and disposal of this material be considered.

5.0 CLOSING

We trust that this report meets your immediate requirements. Should you have any questions or concerns, please do not hesitate to contact the undersigned at 604-296-4200.

Yours very truly,

Golder Associates Ltd.

Jennifer Cook, BSc
Environmental Scientist

COLLEGE OF APPLIED BIOLOGY
Christine Thomas
10 Sept 18

Christine Thomas, MSc, RPBio
Principal, Senior Environmental Scientist

JC/CT/syd

Attachments: Figures 1 and 2
Attachment A: Vapour Model

https://golderassociates.sharepoint.com/sites/26648g/deliverables/issued to client_for wp/18101392-003-l-rev0/18101392-003-l-rev0-env contam assess vic base sar-10sep_18.docx

6.0 REFERENCES

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LEGEND

- PROPOSED SEARCH AND RESCUE BUILDING
- SITE BOUNDARY
- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- RAILWAY
- WATERCOURSE
- FIRST NATIONS RESERVE
- WOODED AREA
- RESIDENTIAL AREA
- WATERBODY

0 1 2

1:50,000 KILOMETRES

REFERENCES

1. ROAD, RESIDENTIAL AREAS, WATERCOURSE, WATERBODY AND WOODED AREAS OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. INSET MAP DATA OBTAINED FROM ESRI.

COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
FISHERIES AND OCEANS CANADA

PROJECT
VICTORIA COAST GUARD BASE
SEARCH AND RESCUE BUILDING, SOIL VAPOUR EVALUATION

TITLE
KEY PLAN

CONSULTANT
GOLDER

YYYY-MM-DD	2018-09-06
DESIGNED	JC
PREPARED	CD
REVIEWED	JC
APPROVED	CT

PROJECT NO.	PHASE	REV.	FIGURE
18101392	1000	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

25mm

0

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LEGEND

- SAMPLE LOCATION WITHIN 30M OF PROPOSED SEARCH AND RESCUE BUILDING
- HISTORICAL SHORELINE (1928)
- PROPOSED SEARCH AND RESCUE BUILDING
- SITE_BOUNDARY
- 30M OFFSET FROM PROPOSED SEARCH AND RESCUE BUILDING
- PROPERTY BOUNDARY

0 20 40

1:750 METRES

REFERENCE(S)

1. ORIGINAL SHORELINE AND IMAGERY PROVIDED BY DEPARTMENT OF FISHERIES AND OCEANS CANADA.

DATUM: NAD83, PROJECTION: UTM10

CLIENT
FISHERIES AND OCEANS CANADA

PROJECT
VICTORIA COAST GUARD BASE
SEARCH AND RESCUE BUILDING, SOIL VAPOUR EVALUATION

TITLE
SAMPLE LOCATIONS WITHIN 30M OF PROPOSED PROJECT

CONSULTANT
GOLDER

YYYY-MM-DD	2018-09-06
DESIGNED	JC
PREPARED	CD
REVIEWED	JC
APPROVED	CT

PROJECT NO.	PHASE	REV.	FIGURE
18101392	1000	0	2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

1 in
0

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ATTACHMENT A

Vapour Model

Input Parameters
Victoria Coast Guard Base SAR Station, Victoria, BC
Fisheries and Oceans Canada

HEALTH CANADA DQRA SPREADSHEET
USER INPUT SHEET

User Name:	Golder	Site:	Victoria Coast Guard Base SAR station
Proponent:	F&OC	File #:	18101392 / 1000
Date:	7-Jun-18	Comment:	

PROBLEM FORMULATION

Potential Land Uses (Yes/No)

		Default
Agricultural	No	Yes
Residential/urban parkland	No	Yes
Commercial	No	Yes
Industrial	No	Yes
Occupational - Outdoors	Yes	Yes
Recreational	No	Yes
Other		No
specify:	Commerical shift worker	

Exposure Scenario Commercial — Occupational - Outdoors

Receptor Groups (Yes/No)

		Default
General public or residents	No	Yes
Employees		Yes
Canadian native communities		No
Other		No
specify:		

Operative Pathways (Yes/No)

		Default
Inadvertent ingestion of soil	No	Yes
Inhalation of soil particles	No	Yes
Inhalation of indoor contaminant vapours		Yes
Inhalation of outdoor contaminant vapours		Yes
Ingestion of drinking water	No	Yes
Dermal contact with soil	No	Yes
Dermal contact with water	No	Yes
Ingestion of contaminated food		No

Vapour Transport Modelling

Vapour source for exposure calculations	Soil	Most Conservative
Model applied for soil to indoor air		Health Canada
Model applied for groundwater to indoor air		Health Canada
Model applied for soil vapour to indoor air		Health Canada

Active Critical Receptors (Yes/No)

		Default
Infant	No	No
Toddler	No	No
Child	No	No
Teen	No	No
Adult	No	Yes
Other		Yes
specify:	Commerical shift worker	

Contaminant Concentrations

Chemical Name	required	Naphthalene					
Soil (mg/kg)	required	77					
Mole Fraction in Soil (unitless)	optional						
Groundwater - source (mg/L)	optional						
Mole Fraction in Groundwater (unitless)	optional						
Drinking water (mg/L)	optional						
Bathing/swimming water (mg/L)	optional						
Indoor air - vapours (mg/m^3)	optional						
Outdoor air - vapours (mg/m^3)	optional						
Outdoor air - particulate (mg/m^3)	optional						
Soil vapours (> 1 m below foundation) (mg/m3)	optional						
Subslab/shallow soil vapour (<1 m) (mg/m3)	optional						
Root vegetables (mg/kg wet weight)	optional						
Other vegetables (mg/kg wet weight)	optional						
Fish (mg/kg wet weight)	optional						
Wild game (mg/kg wet weight)	optional						

Risk Assessment Endpoints

		Default
Acceptable hazard index:	1	0.2
Acceptable cancer risk:		1.00E-05

Precluding Conditions for Fate and Transport Models

Are non-aqueous phase liquids (NAPL) present?	No
Is groundwater contamination present in fractured bedrock?	No
Is groundwater contamination migrating through a confined aquifer?	No
Is there active pumping or drawdown of groundwater at the site?	No
Is contamination present within 1 m of building foundation?	No
Do any buildings within 5 m of contamination have earthen foundations?	No
Are any buildings constructed on very high permeability media?	No
Are there preferential vapour flow pathways connecting contamination to a building?	No

Attachment A: Vapour Model
Input Parameters
Victoria Coast Guard Base SAR Station, Victoria, BC
Fisheries and Oceans Canada

Fate and Transport Model Input

	Value	Default	Models Affected	
Soil Type		coarse-grained	PS, V-H, V-C, V-O, GW	
Significant vehicle traffic on unpaved roads?		No	P-O	
Site Characteristics				
Source Length (m)		10	GW, V-O	
Source Width (m)		10	GW, V-O	
Depth to Groundwater (m)		3	GW, V-O	
Depth from Surface to Contamination (m)		0	GW, V-O	
Thickness of Contamination (m)		3	GW	
Distance - Contaminated Soil to Building (m)		1	V-H, V-C	
Distance - Contaminated GW to Building (m)		1	V-H, V-C	
Depth Below Building to Vapour Sample (m)	1	1	V-H, V-C	
Distance to potable water user (m)		0	GW	
Distance to Bathing/Swimming Water (m)		0	GW	
Particulate Concentration in Air (ug/m^3)		0.76	P-O	
Hydrological Parameters				
Recharge (m/y)		0.28	GW	
Soil/Groundwater Characteristics	coarse-grained			
Vadose Zone				
Dry Bulk Density (g/cm3)		1.700	PS, V-C	
Water Content (g/g dry wt)		0.070	PS, V-C	
Capillary Zone				
Thickness of Capillary Zone (cm)		5	V-C	
Water Content (g/g dry wt)		0.070	V-C	
Aquifer/Contaminated Zone				
Saturated Hydraulic Conductivity (m/y)		320	GW	
Hydraulic Gradient (m/m)		0.028	GW	
Organic Carbon Fraction (g/g)		0.005	PS, GW	
Soil Temperature (^{o}C)		21	PS, PGW	
Depth of unconfined aquifer (m)		5	GW	
Vapour Transport Properties				
Soil Vapour Permeability (cm^2) - CCME model		6.00E-08	V-C	
Building Type	Commercial/Industri	Commercial/Industrial	V-H, V-C	
Building Characteristics	Commercial/Industrial			
Building length (m)		20	V-C	
Building width (m)		15	V-C	
Building mixing height (m)		3	V-H, V-C	
Thickness of building foundation (cm)		11.25	V-C	
Depth to base of foundation (m)		0.1125	V-C	
Air exchanges per hour		0.9	V-C	
Pressure differential (Pa)		20	V-C	
Crack Area (cm^2)		1846	V-C	
Additional Vapour Intrusion Parameters (Health Canada model)				
Apply biodegradation adjustment?	Yes	No	V-H	Biodegradation adjustment will be applied for petroleum hydrocarbons if contaminant depth is sufficient
Apply groundwater mass flux check?		No	V-H	
Apply source depletion check?		No	V-H	
Additional Groundwater Model Parameters				
Apply biodegradation during transport?		No	GW	

Optional Sections

User-defined Chemicals

Note: user-defined chemicals should be named in this section before being selected in the 'Contaminant Concentrations' table above

		Chemical 1	Chemical 2	Chemical 3
Name				
CAS Number				
Chemical class (organic/inorganic)				
Tolerable daily intake (mg/kg/d) - infant	*Enter all applicable and appropriate toxicity benchmarks; values must be referenced and justified in the PQRA report.*			
Tolerable daily intake (mg/kg/d) - toddler				
Tolerable daily intake (mg/kg/d) - child				
Tolerable daily intake (mg/kg/d) - teen				
Tolerable daily intake (mg/kg/d) - adult				
Tolerable concentration (mg/m^3)				
Oral slope factor $(mg/kg/d)^{-1}$				
Inhalation slope factor $(mg/kg/d)^{-1}$				
Inhalation unit risk $(mg/m^3)^{-1}$				
Relative dermal absorption factor				
Organic carbon partitioning coefficient (mL/g) - Koc				
Log Kow (unitless)				
Henry's Law constant at 25°C (unitless) - H'				
Henry's Law constant at 25°C (atm-m3/mol) - H				
Water Solubility at 25°C (mg/L)				
Molecular Weight (g/mol)				
Diffusivity in air (cm2/s)				
Diffusivity in water (cm2/s)				
Vapour Pressure at 25°C (atm)				
Normal Boiling Point (K) - optional				
Critical Temperature (K) - optional				
Enthalpy of Vaporization @ Boiling Point (cal/mol) - optional				
Biodegradation Adjustment Factor (unitless)				
Half-Life - unsaturated zone (days)				
Half-Life - saturated zone (days)				

Note: values in grayed cells will not be used; Health Canada default values are applied.

User-defined Receptor

Name	Commerical shif	Defaults
Age group	Adult	Toddler
Body weight (kg)		70.7
Soil ingestion rate (g/d)		0.02
Inhalation rate (m^3/d)		15.8
Water ingestion rate (L/d)		1.5
Skin surface area (cm^2)		
- hands		890
- arms		2500
- legs		5720
- total		17640
Soil loading to exposed skin (g/cm^2/event)		
- hands		0.0001
- surfaces other than hands		0.00001
Food ingestion (g/d)		
- root vegetables		188
- other vegetables		137
- fish		111
- wild game		0
Evaluate Cancer Risks (Yes/No)?		Yes

User-defined Land-Use / Exposure Scenario

Scenario name	Commerical shift worker	Defaults	
Hours per day (indoors)	24	22.5	Total hours > 24
Hours per day (outdoors)	3	1.5	
Days per week	7	7	
Weeks per year	26	52	
Dermal exposure events/day		1	
Water contact events per day		1	
Duration of water contact event (h)		1	
Days/year contaminated food ingestion		365	
Exposure duration (years)		60	
Years for carcinogen amortization		60	

FATE AND TRANSPORT MODEL CALCULATION SHEET - PQRA VAPOUR INTRUSION MODEL

INPUT PARAMETERS

Soil Properties at Vapour Contamination Source

Parameter (from input sheet)	Symbol	Unit	Value
Soil Type		dimensionless	coarse-grained
Total Porosity - **calculated**	θ	dimensionless	0.36
Water-Filled Porosity - **calculated**	θ_w	dimensionless	0.12
Air-Filled Porosity - **calculated**	θ_a	dimensionless	0.24
Organic Carbon Fraction	foc	kg OC/kg soil	0.005
Soil Dry Bulk Density	ρ	kg/L	1.7
Darcy Velocity	Y	m/y	9.0
Soil Temperature	T	°C	21

Building Dimensions

Building Dimensions (from input sheet)	Symbol		Value
Building length		(m)	20
Building width		(m)	15
Building mixing height		(m)	3
Mixing height adjustment factor		dimensionless	1
Building air exchange rate		exch/h	0.9
Air exchange adjustment factor		dimensionless	1
Depth to foundation slab		(m)	0.1125
Building footprint area - **calculated**		(m^2)	3.00E+02
Building volume - **calculated**	V_b	(m^3)	9.00E+02

Vapour Migration Distances

Parameter (calculated)		Unit	Value
Soil Contamination to Foundation		m	1
Groundwater Contamination to Foundation		m	1
Soil Vapour Sample to Foundation		m	1

Chemical Properties

Parameter (from chemical sheet)	Symbol	Unit	Naphthalene
log(Koc)	log K_{oc}	mL/g	3.05E+00
Henry's Law Constant	H	atm-m^3/mole	4.24E-04
Henry's Law Constant Reference Temperature	$TR_{H,R}$	K	2.98E+02
Water Solubility	S	g/m^3 (25°C)	3.10E+01
Biodegradation Adjustment Factor		dimensionless	1.00E+01
Molecular Weight	MW	g/mole	1.28E+02
Vapour Pressure	V	atm	1.03E-04
Vapour Pressure Reference Temperature	$TR_{V,R}$	K	2.98E+02
Normal Boiling Point	T_B	K	4.91E+02
Critical Temperature	T_C	K	7.48E+02
Enthalpy of Vaporization at Normal Boiling Point	$DH_{v,b}$	cal/mol	1.04E+04

Constants

Parameter	Symbol	Unit	Value
Gas Constant	R3	m^3-atm/K-mol	8.21E-05
Gas Constant	R1	j/mol-K	8.31E+00
Gas Constant	R2	cal/K-mol	1.99E+00

CALCULATIONS

Temperature Corrected Henry's Law Constant

Parameter	Symbol	Unit	Naphthalene
Method 1			
Dimensionless H' for 25°C	H'ts	dimensionless	1.73E-02
Method 2			
Tb/Tc Factor	Tb/Tc	dimensionless	6.56E-01
n Factor	n	dimensionless	3.70E-01
Enthalpy of Vapourization at average soil temp	ΔH_{ts}	cal/mol	1.28E+04
Temperature Corrected H'	H'ts	dimensionless	1.31E-02
Temperature Corrected H' - Value Used	H'ts	dimensionless	1.31E-02

Temperature Corrected Vapour Pressure

Parameter	Symbol	Unit	Naphthalene
Enthalpy of Vapourization at Normal Boiling Point	ΔH_1	j/mole	4.34E+04
Temperature Corrected Vapour Pressure	P'	atm	8.02E-05
Vapour Pressure - Value Used	P'	atm	8.02E-05

Soil Vapour Concentration Predicted from Soil Concentration

Parameter	Symbol	Unit	Naphthalene
Soil Concentration (input sheet)	C_s	mg/kg	7.70E+01
Mole Fraction (input sheet)	X	dimensionless	1.00E+00
Soil Saturation Concentration	C_{sat}	mg/kg	1.76E+02
Max Theoretical Soil Vapour Concentration	C_v^{max}	mg/m^3 or ug/L	4.26E+02
Soil Vapour Concentration, 3-phase model	$C_v^{3\text{-phase}}$	mg/m^3 or ug/L	1.78E+02
Soil Vapour Concentration	C_v	mg/m^3 or ug/L	1.78E+02
No Source Depletion Adjustment			
Soil Alpha	α_g	dimensionless	3.74E-05
Predicted Indoor Air Concentration	Cair	mg/m^3	6.64E-03
Source Depletion Adjustment			
Thickness contaminated zone (input sheet)	Ts	m	3.00E+00
Volume Building	V_b	m^3	9.00E+02
Ventilation Rate	VR	m^3/min	1.35E+01
Flux per Unit Area Building	$Flux_v$	mg/min-m2	2.99E-04
Contamination Mass per Unit Area Building	$Mass_a$	mg/m2	3.93E+05
Time for Contamination Source Depletion	$Time_d$	years	2.50E+03
Total years exposed (carcinogens only)	D4	years	6.00E+01
Adjusted Predicted Indoor Air Concentration	Cair'	mg/m^3	Depletion time>ED
Final Predicted Indoor Air Concentration	Cair	mg/m^3	6.64E-03
(dose or air concentration amortized over exposure duration)			

Soil Vapour Concentration Above Water Table Predicted from Groundwater Concentration

Parameter	Symbol	Unit	Naphthalene
Groundwater Concentration (input sheet)	C_g	mg/L	Missing Data
Mole Fraction (input sheet)	X	dimensionless	1.00E+00
Effective Solubility	C_{sol}	mg/L	3.10E+01
Max Theoretical Soil Vapour Concentration	C_v^{max}	mg/m^3 or ug/L	4.26E+02
Soil Vapour Concentration	C_v	mg/m^3 or ug/L	Missing Data
No Groundwater Mass Flux Adjustment			
Groundwater Alpha	α_g	dimensionless	2.05E-04
Predicted Indoor Air Concentration	Cair	mg/m^3	Missing Data
Groundwater Mass Flux Adjustment			
Darcy Velocity (Specific Discharge)	U	m/year	8.96E+00
Volume Building	V_b	m^3	9.00E+02
Ventilation Rate	VR	m^3/min	1.35E+01
Volatilization Flux	$Flux_v$	mg/min	Missing Data
Groundwater Flux	$Flux_g$	mg/min	Missing Data
Adjusted Groundwater Alpha	α_g'	dimensionless	Missing Data
Adjusted Predicted Indoor Air Concentration	Cair'	mg/m^3	Missing Data
Final Predicted Indoor Air Concentration	Cair	mg/m^3	Missing Data

Indoor Air Attenuation Factors
Victoria Coast Guard Base SAR Station, Victoria, BC
Fisheries and Oceans Canada

Measured Soil Vapour Concentration

Parameter	Symbol	Unit	Naphthalene
Soil Vapour Concentration	C_v	mg/m^3 or ug/L	Missing Data
Soil Alpha	α_g	dimensionless	3.74E-04
Predicted Indoor Air Concentration	Cair	mg/m^3	Missing Data

Measured Subslab/Shallow Soil Vapour Concentration

Parameter	Symbol	Unit	Naphthalene
Subslab Vapour Concentration	C_v	mg/m^3 or ug/L	Missing Data
Soil Alpha	α_g	dimensionless	1.00E-02
Predicted Indoor Air Concentration	Cair	mg/m^3	Missing Data

	Symbol	Unit	Naphthalene
Applied Indoor Air Concentration	Cair	mg/m^3	0.006639746
Source			Soil

CALCULATION OF ALPHA

Soil Classification ***sand***

Vapour Attenuation Factor ("alpha" = 1/dilution factor)		**Groundwater**	**Soil Vapour**	**Soil**
Vapour attenuation factor (Residential)- **Calculated**		1.06E-03	2.83E-03	2.83E-03
Vapour attenuation factor (Commercial) - **Calculated**		2.05E-04	3.74E-04	3.74E-04
Vapour Attenuation Factor ("alpha" = 1/dilution factor)		2.05E-04	3.74E-04	3.74E-04
Adjustment for Biodegradation (optional)	Min dist. (m)	3	3	1
Building eligible for biodegradation adjustment?	10X	No	No	Yes
		Biodegradation adjustments applied for applicable chemicals and scenarios		
Adjustment for Building Height (optional) - Currently Not Allowed				
Adjusted Vapour Attenuation Ratio - **Calculated**		2.05E-04	3.74E-04	3.74E-04
Adjustment for Building Ventilation Rate (optional)				
Adjusted Vapour Attenuation Ratio - **Calculated**		2.05E-04	3.74E-04	3.74E-04
		Groundwater	**Soil Vapour**	**Soil**
Final Vapor Attenuation Ratio Used for Calculations		2.05E-04	3.74E-04	3.74E-04
		Groundwater	**Soil Vapour**	**Soil**
Attenuation Ratios from CCME Model	Naphthalene	1.94E-04	1.94E-04	1.94E-04
	0	NA	NA	NA
	0	NA	NA	NA
	0	NA	NA	NA
	0	NA	NA	NA
	0	NA	NA	NA

Calculated Alpha Values

Source	Scenario	Soil Type	Alpha
Groundwater	Residential	sand (coarse-grained)	0.00106
		loamy sand	0.000515
		sandy loam	0.000157
		loam (fine-grained)	0.000101
	Commercial	sand (coarse-grained)	0.000205
		loamy sand	0.0000958
		sandy loam	0.0000397
		loam (fine-grained)	0.0000263
Soil Vapour	Residential	sand (coarse-grained)	0.002825
		loamy sand	0.00266
		sandy loam	0.00228
		loam (fine-grained)	0.00175
	Commercial	sand (coarse-grained)	0.000374
		loamy sand	0.000363
		sandy loam	0.000334
		loam (fine-grained)	0.000286
Soil	Residential	sand (coarse-grained)	0.002825
		loamy sand	0.00266
		sandy loam	0.00228
		loam (fine-grained)	0.00175
	Commercial	sand (coarse-grained)	0.000374
		loamy sand	0.000363
		sandy loam	0.000334
		loam (fine-grained)	0.000286

APPENDIX B

Environmental Effects Determination and Archaeological Assessment, Canada Coast Guard and Rescue Station Construction, Victoria B.C.

Golder Associates- Sept 10 2018

REPORT

Environmental Effects Determination and Archaeological Assessment

Canada Coast Guard - Search and Rescue Station Construction, Victoria, BC

Submitted to:

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10 September 2018

Distribution List

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Study Limitations

This report was prepared for the exclusive use of the Fisheries and Oceans Canada (F&OC), its assignees and representatives including Canada Coast Guard, and is intended to serve as an Environmental Effects Determination (EED) for F&OC's proposed Search and Rescue station building construction in the City of Victoria, BC (the Project). This report is intended to provide an overview level reconnaissance-based environmental determination of potential effects of the proposed Project on terrestrial habitats. This report is not intended to identify or evaluate potential effects outside of the Project study area.

The inferences concerning the conditions of the proposed building site are based on information obtained from a limited review of available literature, and field investigation conducted by Golder staff on 6 June 2018. The inferences concerning the potential effects of site preparations and construction of the station are based on a Project footprint information provided by F&OC to Golder. Detailed information on station design and construction methodology are not available at this time. In developing this EED, Golder has relied in good faith on information provided by the F&OC and other government agency resources. We accept no responsibility for any deficiency or inaccuracy contained in this report as a result of our reliance on the aforementioned information.

The findings and conclusions documented in this Report have been prepared for specific application to this Project and have been developed in a manner consistent with the level of care normally exercised by environmental professionals currently practicing under similar conditions in the jurisdiction. Golder makes no other warranty, expressed or implied.

Any use which a third party makes of this Report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Golder accepts no responsibility for damages, if any suffered, by any third party as a result of decisions made or actions based on this Report.

The Cultural Heritage Resources field assessment was limited to the west side of the existing chain link fence, due to access constraints for the backhoe. As a result, interpretations regarding potential Project effects to Cultural Heritage Resources east of the fence are limited to a review of existing borehole and geotechnical test pit data and extrapolation of the results of the field assessment west of the fence.

Further, the assessment considered only the proposed SAR Building footprint and immediately adjacent areas. Associated developments, such as the installation of underground services, have not been assessed. Given the known presence of archaeological site DcRu-75 on and surrounding the Victoria Base property, there is potential for localized or re-deposited archaeological shell midden and other materials, including ancestral human remains, to exist in the Project area.

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1.0 INTRODUCTION

Fisheries and Oceans Canada (F&OC) has proposed to develop a new Search and Rescue station (SAR station; the Project) in the southeast corner of the existing Canada Coast Guard (CCG) base at 25 Huron Street, Victoria, BC (the Site). The Project area is currently used as a materials lay-down area by CCG and surface storage for off-shore buoys and related equipment.

This Environmental Effects Determination (EED) has been prepared to assist F&OC in their role as the Responsible Authority in determining an approach to address potential impacts to resources at the Site and to determine whether the Project is likely to result in significant adverse environmental and cultural effects. The EED considers the potential environmental impact of Project related activities and presents related mitigation strategies and best management practices, where possible. A summary of potential residual impacts which remain after mitigation measures have been applied is presented with recommendations for planning and construction approaches for the Project.

1.1 Project Location

The Site is located at 25 Huron Street, Victoria, BC. The Site lies immediately east of Victoria's Outer Harbour and is enclosed by fencing. All portions of the Site are above the marine higher high water (Figure 1). The Project area is situated in the southeast corner of the Site and lies partially within an existing fenced area (1.5 m-high chain link fence) accessible through limited entry secured access. The eastern half of the Site is accessible from Dallas Road.

1.2 Project Description

The Project consists of land preparation and construction of a new two-storey Search and Rescue operations and storage facility. Final construction details are dependent upon results from a geotechnical survey; however, the proposed overall footprint of the building is approximately 360 m^2 (28.2 m by 12.8m) (Appendix A)[1]. The building is expected to be a slab-on-grade structure and will consist of living facilities and maintenance workshop. Project activities include:

- Removing existing equipment and stored items from the Site to other laydown areas at the CCG base.
- Removing vegetation and clearing the Site in preparation for construction. This includes decommissioning and removing any existing plumbing, electrical, or other at surface or buried utility that may be impacted by Project construction.
- Removal of existing fencing which currently bisects the Project area and erect temporary fencing to demarcate the Project Site.
- Preparation and construction of a concrete slab and foundation for the SAR building.
- Construction of the SAR operations and storage building (footprint = 350 m^2).

[1] The location of the proposed SAR building in Figure A1.1 was revised and is now located approximately 6 m further east. The revised location is accurately reflected in Golder Figures 3 and 4.

1.3 Project Schedule

The Project is expected to require approximately six to ten months to complete, including Site preparation and construction. Golder understands the Project planning and execution will take into consideration federal and provincial least risk windows for development. A start date for on-site Project activities has not been confirmed; however, work is proposed to begin early 2019.

2.0 REGULATORY FRAMEWORK

2.1 Local and Provincial Regulatory Framework

The Project is located on federally administered lands and is not expected to affect freshwater systems (See Section 3.4.4.) or other ecological systems under provincial jurisdiction. Environment related provincial permits and approvals may be required to dispose of contaminated materials, if any, off the CCG Base. Removal of trees is not anticipated; however, municipal approvals may be required to connect to the municipal utility system (i.e., sewer).

2.2 Federal Regulatory Framework

The following federal legislation is applicable to the Site:

- *Canadian Environmental Assessment Act (GC 2012)*

  The Project meets the definition of physical activity on federal lands. Under CEAA 2012, it is the responsibility of Responsible Authority to assure that a physical activity on federal lands does not result in undue residue effects to the environment.

- *Canadian Environmental Protection Act (GC 1999)*

  The *Act* contributes to sustainable development through the management and prevention of risks associated with toxic substances. The *Act* works to protect the environment, human life and health and covers all phases of the Project. Spills and deleterious releases at the Site, accidental or otherwise, that may occur during construction would be regulated under this legislation.

  Section 4 of CEAA 2012 states that one of the purposes of the *Act* is “to ensure that projects are considered in a careful and precautionary manner before federal authorities take action in connection with them, in order to ensure that such projects do not cause significant adverse environmental effects” (Government of Canada 2012 s.4[1][a]). Sections of CEAA 2012 that are most relevant to assessing the effects of Project-related changes to the heritage environment are sections 5(1)(c)(ii) and 5(2)(b)(ii), which address “physical and cultural heritage” and sections 5(1)(c)(iv) and 5(2)(b)(iii), which address environmental effects on “any structure, site or thing that is of historical, archeological, paleontological or architectural significance”. In the absence of comprehensive federal statute directing the assessment and management of cultural heritage resources on federal lands, CEAA 2012 is generally viewed as the federal statute with the broadest application to archaeology.

  In British Columbia, archaeological assessments on federal lands are usually conducted in general accordance with the provincial Heritage Conservation Act (RSBC 1996] Chapter 187) and the British Columbia Archaeological Impact Assessment Guidelines (Province of British Columbia 1998).

- *Fisheries Act (GC 2012)*

  Section 35 of the federal *Fisheries Act (2012)* require that "no person shall carry on any work, undertaking, or activity that results in serious harm to fish that are part of a commercial, recreational or aboriginal fishery, or to fish that support such a fishery.

- *Species at Risk Act (GC 2002)*

  The purposes of the *Species at Risk Act* (*SARA*) is to prevent rare and endangered wildlife species from potential negative effects resulting from human activity.

- *Migratory Birds Convention Act (GC 1994)*

  The *Migratory Birds Convention Act* and the associated Migratory Birds Regulations' purpose is to protect and conserve species included in the Convention and their eggs and nests.

3.0 IDENTIFICATION AND DESCRIPTION OF VALUED COMPONENTS

Valued Components (VCs) are environmental attributes or resources that are of ecological or social significance or importance. The potential for project interaction with VCs was assessed on consideration of:

- Information provided by F&OC.
- Review of Project related activities (e.g., design drawings).
- Review of publicly available background information.
- Evaluation of the environmental and social setting through site observations and professional judgment based on experience.

Due to small footprint of the Project, limited degree of development, and location of the Project on federally controlled lands, public consultation was not included as part of this EED.

3.1 Background Review

Golder undertook a desktop review of existing information to characterize cultural and biological resources and their potential presence in the Project area. Government and non-government resource databases were accessed for current information pertaining to environmental resources in the Project area. These resources included:

- Community Mapping Network – Sensitive Habitat Inventory and Mapping (SHIM) (CMN 2018).
- Capital Regional District's (CRD) Harbours Atlas (CRD 2018).
- Wildlife Tree Stewardship Atlas (WiTS 2018).
- Ministry of Environment (MOE) BC Species and Ecosystems Explorer – Species and Ecosystems Search (MOE 2018a). The Species and Ecosystems search includes records on rare and endangered species that have been identified or may potentially occur within the vicinity of the Project.

- BC Conservation Data Centre (CDC), including records on provincially and federally listed rare and endangered species that have been identified or may potentially occur within the vicinity of the Project (CDC 2018).
- Habitat Wizard Database (BC 2018a).
- Invasive Alien Plant Program (BC 2018b).
- The Provincial Heritage Register, accessed via the Remote Access to Archaeological Data online portal (https://arcmaps.gov.bc.ca/ess/sv/raad/Index2.html) accessed on 12 June 2018.
- Previous Golder archaeology reports relevant to the Project.
- The Capital Regional District Region Map, showing historical Garry Oak habitat at AD 1800.

The purpose of the resource review was to characterize the Site's Valued Components (VCs) and species of special conservation status potentially occurring in the Project area.

3.2 Identification of Species at Risk and Regionally Important Species

Species at risk information in BC is available from both provincial and federal sources. Provincially, data on known species at risk occurrences (referred to as element occurrences) are available through the BC CDC. The CDC assigns a Provincial rank or listing of red, blue or yellow to a species based on its status within BC. Red-listed species are considered to be endangered or threatened in BC. Blue listed species are considered to be of Special Concern (formerly Vulnerable) in BC. Yellow listed species are those that are ranked as apparently secure or having the least risk of being lost and therefore are not considered species at risk.

Federally, species ranking is conducted by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), established under Section 14 of the *Species at Risk Act* (SARA). Schedule 1 of SARA provides the official list of species at risk. Under the COSEWIC system, species are ranked as Extinct (X), Extirpated (XT), Endangered (E), Threatened (T), Special Concern (SC), Data Deficient (DD), or Not at Risk. A definition of each federal and provincial conservation status is provided in Table 1.

A rare and endangered aquatic species search was conducted using the British Columbia Conservation Data Centre's (CDC) BC Species and Ecosystems Explorer for species with ranges overlapping with the Project area.

Table 1: Conservation Status Definitions for Species at Risk

Agency	Status	Definition
COSEWIC (Federal)	Endangered (E)	A species facing imminent extirpation (no longer exists in Canada) or extinction (no longer exists).
	Threatened (T)	A species likely to become endangered if limiting factors are not reversed.
	Special Concern (SC)	A species that is particularly sensitive to human activities or natural events but is not endangered or threatened.
BC CDC (Provincial)	Red	Includes any indigenous species or subspecies that have, or are candidates for, Extirpated, Endangered, or Threatened status in British Columbia. Extirpated taxa no longer exist in the wild in BC but do occur elsewhere. Endangered taxa are facing imminent extirpation or extinction. Threatened taxa are likely to become endangered if limiting factors are not reversed. Not all Red-listed taxa necessarily become formally designated. Placing taxa on these lists flags them as being at risk and requiring investigation.
	Blue	Includes any indigenous species or subspecies considered to be of Special Concern (formerly Vulnerable) in British Columbia. Taxa of Special Concern have characteristics that make them particularly sensitive to human activities or natural events. Blue-listed taxa area at risk but not Extirpated, Endangered, or Threatened.

3.3 Site Visit

Biophysical resources and general physical features within and immediate adjacent to the Site were reviewed by Golder on 4 June 2018. The purpose of the Site visit was to verify reviewed background information and fill information gaps. The survey was conducted at a reconnaissance level and was limited to the Project footprint plus a 15-m buffer. Information collected during the site visit included Site physical features (i.e., topography, waterbodies), biological features (i.e., vegetation and wildlife), and general Site context (i.e., general proximity to community). Features recorded included:

- Site topography
- General Site conditions and uses
- Proximity to marine and freshwater features
- Vegetation characteristics
- Unique habitat and ecosystems that may support federally or provincially listed species
- Incidental observations of wildlife or evidence of wildlife use

Photos of the Site and surrounding area are included in Appendix B. Queried results for at-risk species are presented in Table 3 and Appendix C.

3.4 Description of VCs

VCs were selected based on their potential to interact with the Project and Project activities. Candidate VCs with no potential to interact with the Project were not carried through the assessment. Human health was not carried through the assessment as a VC as the Site is located within a fenced area and is not accessible to the public.

Identified VCs that have the potential to be affected by the Project are outlined in Table 2. Valued Components associated with the operational phase of SAR station are not considered in this EED.

Table 2: Environmental Interaction Matrix

Project Activities and Physical Works	Air and Climate	Surface and Groundwater Quality	Soils and Terrain	Biological Resources	Archaeological, Heritage, and Cultural Resources	Land and Resource Use
Site Preparation and Excavation	X	X	X	X	X	X
Project Construction	X	X	X	X	X	X

Notes: X = Likely interaction, potential effects to be assessed

3.4.1 Air and Climate

The Victoria CCG base at 25 Huron Road is located on the eastern shoreline at the entrance to Victoria's Outer Harbour. The Site lies within the Municipality of Victoria and is surrounded by various commercial properties and residences. Air quality at the Site is expected to be typical of a coastal urban community. Local air quality may be impacted at various times of the year by natural or anthropogenic sources including dust, noise, and exhaust.

3.4.2 Surface and Groundwater Quality

No surface water channels were identified at the Site. Groundwater gradients are expected to reflect local bedrock topography. Waters are expected to flow towards the ocean (i.e., southwest). The Site is located approximately 30 m from the Victoria Harbour shoreline.

3.4.3 Soils and Terrain

The natural coastline in the local area is characterized by bedrock outcrops with pocket mixed-gravel beaches. The existing shoreline within and adjacent to the Site has been extensively modified and little evidence of natural features are visible. No natural features were observed within or immediately adjacent to the Project location.

The CCG base has also undergone extensive alteration. The Site has been in-filled and leveled. Most of the base has been paved with asphalt and concrete. No buildings or large debris are present at the Site and the area has, until recently, been used to store materials for the CCG base. A portion of the Site is covered by asphalt the remaining area is covered by maintained grass. Ground disturbance from geo-technical investigations conducted

the week prior to the Site visit was observed at each corner of the Site. Soils discarded from the drilling activities suggest that the soils at the Site consist of organic material, angular-shaped cobble, and gravel. A chain-link fence runs through the Site and the boulevard side of the fence had been recently mowed.

Anthropogenic debris was observed at the Site including textiles, concrete, plastic, rubber sheeting, creosote-treated wood, rope, and metal.

3.4.4 Biological Resources

The Biogeoclimatic Ecosystem Classification system identifies the location of the Site as part of the Coastal Douglas Fir moist maritime zone. In general, the Mediterranean-type climate and long growing season within this zone supports many rare species of plants and animals as well as a variety of productive ecosystems. It is also within an area of British Columbia where the greatest loss of natural systems has occurred and continues to occur (SEI 2018).

The following subsections describe the biological resources of the site through summarizing background review results.

3.4.4.1 Background Review Results

A detailed background review was undertaken as part of the VC identification and assessment. The following section summarizes the results of the background review.

The Community Mapping Network's (CMN) database and online inventory includes multiple inputs up to 2016. Authorized contributors have added data for the BC coast. Source data for the Victoria area includes data sets from federal and provincial add-ins from surveys completed from 1999 through 2004 as well as other unidentified sources. The Sensitive Habitat Inventory and Mapping (SHIM) tool hosted by the CMN displays no recorded sightings of species at risk within 500 m of the Site. No culverts, sites of concern, wildlife trees or other identified SHIM features (CMN 2018) were identified at or near the Site.

The Wildlife Tree Stewardship Atlas (WiTS) was initially created by Environment Canada, the BC Ministry of Environment, BC Hydro, BC Nature (The Federation of BC Naturalists), and the Community Mapping Network. WiTS was designed to support the protection of nest trees covered under Section 34 of the *Provincial Wildlife Act*. Nest trees recorded in the registry do not represent all bald eagle (*Haliaeetus leucocephalus*) and osprey (*Pandion haliaetus)* nest trees - only those documented and submitted to the Atlas. The nearest registered bald eagle nest tree is approximately 1.5 km east of the Site in Beacon Hill Park and no osprey nests have been identified within 4 km (WiTS 2018). A known great blue heron (*Ardea Herodias fannini*) rookery is located approximately 1.5 km east in Beacon Hill Park (Figure 2).

The Capital Regional District's (CRD) web-based regional map and associated ecological and geographic data layer (Harbours Atlas) displays habitat and ecosystem data sets. CRD Harbours Atlas identified no features within 400 m of the Site. Features worth noting within one kilometre (km) of the Site include purple martin (*Progne subis*) nesting habitat (nesting boxes on pilings at West Bay Marina [MOE 2018b]) approximately one km north of the Site, a river otter (*Lontra canadensis*) latrine site approximately 400 m south at Ogden Point, and potential sharp-tailed snake (*Contia tenius*) habitat and sensitive ecosystem habitat (garry oak) on federal land near McLoughlin Point across the entrance to Victoria Harbour (Figure 2; CRD 2018).

BC's Ministry of Environment's (MOE) online Habitat Wizard is an on-line map-based tool that allows users to spatially access information on wildlife and ecosystems. The tool does not identify critical habitat for federally listed species at the Site nor is the area registered as important wildlife habitat (BC 2018a). Unidentified invasive plants are known to occur within 200m of the Site, however, none were recorded to occur on the CCG base.

BC CDC[2] Species Ecosystem Explorer was queried for potential plant and animal interactions within the Capital Regional District (Appendix C; CDC 2018). Search results indicated that 69 identified species at risk have potential to occur within the Capital Regional District. Of the 69 identified species, 30 were animals and 39 were plants (including mosses). Of the 69 species 27 were identified as Garry Oak Ecosystem specific species (7 animals and 20 plants). No Garry oak (*Quercus garryana*) trees or associated ecosystems (i.e., meadows) were observed at the Site. The potential for species at risk at the site are discussed in more detail in Section 3.4.3.3 considering the habitat available at the site.

The BC Conservation Data Centre (CDC) maps known element occurrences (an area of land and/or water where a species or ecosystem is known to have been) of red- and blue-listed species and ecosystems (CDC 2018). The Government of BC hosts a public online spatial mapping tool named iMapBC which analyzes and displays geographic datasets. Layers available include administrative boundaries, physical features, and biological resources (MOE 2018b). Search results indicated that the Site lies within the home range of several sensitive species; threaded vertigo (*Nearctula* sp. [gastropod]), purple martin nest boxes at the entrance to West Bay Marina (10 to 12 mating pairs sighted in 2003), and 54 active great blue heron nests in Beacon Hill Park in 2015 (MOE 2018b) were recorded. No masked occurrences were identified at the Site.

Invasive Alien Plant Program identified several outcrops of knotweed (*Fallopia* spp.) present in James Bay. The nearest identified invasive plant occurrence is approximately 200 m from the Site (BC 2018b; Figure 2). These recordings coincided with the locations of invasive plant placemarks noted in MOEs Habitat Wizard (BC 2018a)

The provincial Sensitive Ecosystem Inventory for eastern Vancouver Island and the Gulf Islands was reviewed. No identified sensitive ecosystems are registered in James Bay. The nearest sites identified within the inventory are on federal land at McLoughlin Point in Esquimalt (approximately 700 m west) and within Beacon Hill Park (1.5 km east) (Figure 2; SEI 2018).

3.4.4.2 Field Reconnaissance Vegetation Results

In addition to maintained lawn, plant species recorded at the Site and within 15 m included dock (*Rumex* sp.), dandelion (*Taraxacum* sp.), plantain (*Plantago* sp.), and Himalayan blackberry (*Rubus armeniacus*). Mature deciduous boulevard trees line Dallas Road, outside of the CCG Base. No unique or sensitive ecosystems (i.e., Garry oak ecosystem) were observed at the Site.

[2] BC CDC website queried for BC Conservation Status: Red (Extirpated, Endangered, or Threatened) OR Blue (Special Concern) and Identified SARA Schedule 1 Status and COSEWIC Status: Extinct OR Extirpated OR Endangered OR Threatened OR Special Concern and within the Capital Regional District (CRD).

3.4.4.3 Field Reconnaissance Wildlife and Wildlife Habitat Results

The Site is situated on a developed base within an urban area. Wildlife habitat is limited to minor foraging habitat within the maintained grass portion of the Site for common urban species such as American robin (*Turdus migratorius*). Other wildlife species adapted to urban environments, such as raccoon (*Procyon lotor*), may also occasionally move through the Site. During the Site visit, a gull (*Larus* sp.) was observed flying over the Site, and chipping sparrow (*Spizella passerina*) was observed in the hedgerow at the southern boundary of the CCG base. The potential for wildlife species at risk at the site are discussed in more detail in Section 3.4.3.3 considering the habitat available at the site.

3.4.4.4 Rare and Endangered Species Assessment

Vegetation at the Site is limited to maintained grass with some introduced plant species. Although rare plants occur are known to occur regionally (CDC 2018; Appendix C), the Site has been historically modified and is currently maintained as a paved area and lawn. As such, rare plants and the absence of their habitat requirements, are not expected to occur at the Site.

The Site does not overlap critical habitat or other identified areas of conservation. No known occurrences of provincially or federally listed species have been reported within 500 m of the Site (MOE 2018). Overall, the Site offers limited habitat value and terrestrial areas adjacent to the Site are not classified as critical habitat for provincially or federally-listed species at risk (MOE 2018; CDC 2018). No masked or publicly available occurrences of species and ecosystems at risk were identified at the Site (MOE 2018; CDC 2018).

The probability of federally or provincially listed species occurring in the Project area was assessed using area-specific species lists compiled from the BC CDC (Table 3), range maps for species listed on Schedule 1 of SARA, species known habitat requirements, and professional experience. The known distribution (i.e., Capital Regional District) and habitat requirements (i.e., marine vs. terrestrial; biogeoclimatic zone) of each species was then reviewed and the potential for the species occurrence within the Project area was assessed based on the mobility of the species, the proximity of known occurrences, and the apparent availability of suitable habitat. Each listed species[3] was reviewed was then assigned a low, moderate, or high potential of occurrence, based on the following definitions:

- *Low potential*: those species with a known range that does not overlap the Study Area and/or those species for which suitable habitat is not likely to be in the Study Area (e.g., grassland, estuary, tundra).
- *Moderate potential*: those species with a range that overlaps the Study Area and for which suitable habitat is likely to be present but are not known within 5 km of the Site (based on the BC CDC [2018] and professional knowledge of the Project area).
- *High potential*: those with a range that overlaps the Study Area and for which suitable habitat is likely to be present in the Study Area and are known to occur within 10 km of the Study Area.

Results and rationale likelihood of occurrence[4] and possible interactions are provided in Table 2. No listed species were considered to have high potential to occur in the Project area.

[3] Detailed assessment of listed flora was not conducted as part of the VC assessment.

[4] The BC CDC species list output was screened by Golder personnel prior to inclusion in Table 2. Species assessed as having little to no potential to occur were removed from the list. Screening decision criteria were predominantly based on habitat requirements, or lack thereof.

Table 3: BC Conservation Data Centre: Summary of Provincially and Federally Listed Species with Potential to Occur in Project Area (CDC 2018)

Common Name	Taxonomic Group	Scientific Name	Provincial Status[5]	SARA Status[6]	Notes [7] (CDC 2018; MOE 2018a)
Edwards' Beach Moth	Insect	*Anarta edwardsii*	Red-listed	Endangered	**Potential for occurrence = Low** No known habitat occurs at the Site. The closest known critical habitat for the species is approximately 15 km north on the Saanich Peninsula, however, coastal bluff meadows exist at Beacon Hill Park. The species prefers coastal sand habitats, salt-marsh, and upper beach meadows.
Monarch Butterfly	Insect	*Danaus plexippus*	Blue-listed	Special Concern	**Potential for occurrence = Low** Monarchs occur on the coast region where showy milkweed or ornamental varieties of milkweed have been planted. Milkweed may have been planted in the surrounding neighbourhood. No milkweed was observed at or near the Site**.**
Edith's Checkerspot *taylori* subspecies	Insect	*Euphydryas editha taylori*	Red-listed	Endangered	**Potential for occurrence = Low** Species prefers Garry oak meadows and grassy outcrops. Suitable habitat is not present within 500 m of the Site.
Wandering Salamander	Amphibian	*Aneides vagrans*	Blue-listed	Special Concern	**Potential for occurrence = Low** Amphibians prefer moist habitat. No drainages or potential vernal pool areas were identified at the Site and it's disturbed and maintained nature are unlikely to be suitable, however, ditches, depressions, and potential vernal drainages are present in within 500 m of the Site.
Northern Red-legged Frog	Amphibian	*Rana aurora*	Blue-listed	Special Concern	**Potential for occurrence = Low** Amphibians prefer moist habitat. No drainages or potential vernal pool areas were identified at the Site, and it's disturbed and maintained nature are unlikely to be suitable however, ditches, depressions, and potential vernal drainages are present in within 500 m of the Site.

[5] Provincial status of VC listed species provided by the BC Ministry of Environment Conservation Data Centre Species and Ecosystems Explorer (CDC 2018).

[6] Species at Risk status provided by Government of Canada Species at Risk Public Registry (SARA 2018).

[7] Notes are a combination of professional judgment, available resources, and information found during the Desktop review.

Common Name	Taxonomic Group	Scientific Name	Provincial Status[5]	SARA Status[6]	Notes [7] (CDC 2018; MOE 2018a)
Northern Goshawk, *laingi* subspecies	Bird	*Accipiter gentilis laingi*	Red-listed	Threatened	**Potential for occurrence = Low** Species nests in mature forests. Goshawks hunt in the forest, along riparian corridors, and in more open habitat. Suitable nesting and foraging habitat was not identified at the Site; however, older forests are present within 2 km of the Site.
Short-eared Owl	Bird	*Asio flammeus*	Blue-listed	Special Concern	**Potential for occurrence = Low** Species prefers open fields, marshes, and dunes. While there are open grass areas they are of a disturbed and maintained nature. As such suitable nesting and foraging habitat was not identified at the Site.
Olive-sided Flycatcher	Bird	*Contopus cooperi*	Blue-listed	Threatened	**Potential for occurrence = Low** Species is associated with forest edge habitat. Suitable habitat was not identified within the Site.
Black Swift	Bird	*Cypseloides niger*	Blue-listed	Not listed	**Potential for occurrence = Low** Migratory species that may be in the area between April and October. Prefers steep cliffs. Suitable habitat was not identified at the Site.
Western Screech-Owl, *kennicottii* subspecies		*Megascops kennicottii kennicottii*	Blue-listed	Threatened	**Potential for occurrence = Low** Species typically forages and breeds in open woods near forest edges. Suitable habitat was not identified at the Site.
Barn Owl	Bird	*Tyto alba*	Red-listed	Special Concern	**Potential for occurrence = Low** Barn owls require adequate foraging habitat for their primary prey (voles and mice), and suitable sites for nesting. Though grasses were observed at the Site, their disturbed and maintained nature reduce the likelihood of potential foraging and limited areas for nesting were identified.
Band-tailed Pigeon	Bird	*Patagioenas fasciata*	Blue-listed	Special Concern	**Potential for occurrence = Low** Species prefers mixed forests and freshwater riparian areas. Suitable habitat was not identified at the site.

Common Name	Taxonomic Group	Scientific Name	Provincial Status[5]	SARA Status[6]	Notes [7] (CDC 2018; MOE 2018a)
Vesper Sparrow, *affinis* subspecies	Bird	*Pooecetes gramineus affinis*	Red-listed	Endangered	**Potential for occurrence = Low** Migratory species that may be in the area between April and October; however, species prefer open fields and pasture. While there are open grass areas they are of a disturbed and maintained nature. As such suitable nesting and foraging habitat was not identified at the Site.
Barn Swallow	Bird	*Hirundo rustica*	Blue-listed	Threatened	**Potential for occurrence = Moderate** Migratory species that may be in the area between April and October. Nests in buildings and on vertical surfaces. Known occurrences occur within 2 km. No barn swallows were observed during site investigations and suitable structures suspected of supporting nesting do not occur within the Site.
Great Blue Heron, *fannini* subspecies	Bird	*Ardea herodias fannini*	Blue-listed	Special Concern	**Potential for occurrence = Moderate** Nests in trees and tall shrubs in rookeries or individually. Nearest known nesting site is Beacon Hill Park (1.5 km east). May fly over the Site to access foraging habitat along the marine foreshore.

Note:

Search criteria for ecosystems at risk were: flora and fauna, Capital Regional District and Cowichan Valley Regional District, ocean, riparian, stream/river, restricted to red, blue, and legally designated species. Complete results are available in Appendix C.

3.4.5 Cultural Heritage Resources

For the purposes of the assessment, Cultural Heritage Resources include structures, sites, or things that have archaeological, historical or architectural importance. Specifically, archaeological resources are defined as structures, sites, or things that, if on provincial Crown land or private land would be eligible for protection under Section 13 of the BC *Heritage Conservation Act* (HCA; Government of BC 1996). Heritage resources are structures, sites, or things that have historical or architectural importance, but would not be automatically protected under the HCA (generally post-1846 AD sites).

For clarity with respect to CEAA 2012 Section 5(1) and 5(2), for this assessment the Cultural Heritage Resources VC considers physical heritage, including any structure, site, or thing that is of archaeological, historical or architectural significance, but excludes non-physical (intangible) Indigenous cultural heritage. As there are no existing structures within the proposed Project footprint, heritage structures are not discussed further in this assessment.

3.4.5.1 Historical Background Review

The Victoria Base is located within the traditional territories of the Songhees and Esquimalt First Nations, both of which are part of the Straits Salish cultural and language group (Duff 1969; Suttles 1987, 1990). Prior to contact, the Songhees consisted of a number of relatively independent household groups, each of which had a main winter village, but who moved seasonally to undertake various subsistence activities. The Northern Straits Salish term for all Songhees local groups was Lekwungen, who are locally represented today by the Esquimalt and Songhees First Nations. According to the Fort Victoria Treaties, the present-day Coast Guard property was within the territory of a Songhees household group ("family") known as the Swengwhung (Duff 1969). Duff's (1969) map of Songhees place names does not show a Lekwungen name for the Victoria Base locality.

According to the Capital Regional District's online Regional Map (2018), the Project area was within a Garry oak ecosystem in 1800. Garry oak meadows were important to the traditional Coast Salish culture and economy, and these ecosystems were actively managed through controlled burning to promote the growth of food plants such as camas bulbs (*Camassia quamash*) and to improve forage for game animals. Camas bulbs were highly valued as a reliable form of starch, and were widely utilized and traded.

After European contact, part of the James Bay area was conveyed to the Hudson's Bay Company. Some of the area was subdivided and the remainder was used as farmland. The property along the original shoreline was owned by Beckley Farm of Victoria, and the adjacent Shoal Point property to the north of the current CCG base was a major shipyard. After being reclaimed, the present CCG property housed the Victoria Chemical Company, and the Victoria Machinery Depot Company Ltd., prior to its purchase for Coast Guard use in 1973. At that time, contaminated soils were excavated and removed from the property. This reportedly included the removal of soils from along Dallas Road on the east side of the main CCG administration building, which may have included original shoreline soils (Golder Associates Ltd. 2001). Test pits dug to test for contaminants showed that the depth of fill is about 16 to 17 feet in the equipment storage area at the south end of the property. In a 2001 personal communication, Mr. Will Hobbs of Hemmera Enviro-Chem Inc. (now Ausenco) indicated that some shell was noted in the fill, but industrial debris, such as brick, was also present (Golder Associates Ltd. 2001). It is possible that some re-deposited midden is present in fill throughout the site, but if material was dredged from the harbour, the shell could also be natural.

3.4.5.2 Archaeological Background Review

The Project is situated within the registered boundary of archaeological site DcRu-75 (Figure 3). Site DcRu-75 is a pre-contact Indigenous residential site known to contain shell midden, cultural depressions, fire broken rock, animal bone, artifacts, and ancestral human remains. DcRu-75 is a large site extending from Simcoe Street to between Montreal Street and Dock Street. According to Keddie's (1991) review of existing information for the site, the deepest archaeological deposits were probably on Camel Point and behind the adjacent small bays. Newcombe (1935, cited in Keddie 1991) noted that Camel Point was a defensive site, and Harlan Smith's 1928 unpublished notes first referred to the area as a shell-heap (midden) (cited in Keddie 1991).

Keddie (1991) observed shell midden deposits stretching over 550 metres by 160 metres between #70 Dallas Road (almost directly across Dallas Road from the SAR Project area) and #116 Dallas Road, and up St. Lawrence Street to Ladysmith Street. Subsequent archaeological work by Golder (Golder Associates Ltd. 2010) extended the site boundary southward to join with archaeological site DcRu-32, resulting in the current DcRu-75 site configuration.

The site extends westward from Dallas Road to encompass part of the Coast Guard Base property, including the proposed SAR footprint (Figure 3), although it is unclear what information was used to establish the western site boundary. Based on the shape of the boundary, it is possible that it was intended to represent the former shoreline, prior to development of the foreshore. Prior to in-filling, Camel Point extended approximately 85 metres into the harbour, and three small islands existed just offshore. The natural shoreline of the property is shown in Figures 3 and 4.

Existing borehole data indicate substantial areas of fill within the registered site boundary (SEACOR 2001). Preliminary geotechnical test pit logs provided by WSP for tests excavated at the approximate corners of the proposed SAR building support the interpretation that the building footprint sites on fill (Robin Purvis, pers. comm). An archaeological assessment of the Victoria Base in 2001 (Golder Associates Ltd. 2001) did not encounter archaeological materials, but testing was limited to hand tools and it was not possible to penetrate to adequate depth to confirm the absence of archaeological deposits.

According to the site inventory form, several artifacts have been collected from the site since 1890, including slate point fragments, perforated stone discs, and a carved antler blanket pin. Radiocarbon dates site suggest site occupation from about 2,500 to 200 years ago and artifact styles support this interpretation.

3.4.5.3 Field Assessment

On 13 June 2018 an archaeological test pitting program was carried out within and adjacent to the proposed SAR Building footprint. The scope of the field work was limited because substantial existing borehole and test pit information was available to assist with the archaeological assessment.

Notifications of the planned field work were sent to the Songhees and Esquimalt Nations on 25 May and 1 June 2018. The assessment was carried out by Rob Vincent, BA, RPCA of Golder and Wilfred George of the Songhees Nation. No Esquimalt Nation representatives were available to attend.

Four backhoe test pits (TPs) were excavated to evaluate whether archaeological materials may be affected by the proposed Project. Two TPs were located within the western half of the proposed building footprint, as indicated on the ground, one was adjacent to the west and one was to the north (Figure 4). No testing was carried out east of the existing chain link fence that bisects the building footprint, due to machine access limitations. Photos from the test pitting program are included in Appendix B.

Test pits were excavated using a John Deere 420E IT backhoe, with a 70-cm wide toothed bucket. Tests ranged in size from 220 cm x 70 cm to 320 cm x 80 cm and were excavated to depths ranging from 65 to 280 cm depth below surface (dbs), in 10 to 20 cm lifts. Sediments containing archaeological material (i.e., shell midden) were separated from other material. Approximately 80% of the archaeological deposits were raked and screened through 6 mm metal mesh, while approximately 10% of non-archaeological sediments were raked.

A small amount of disturbed archaeological shell midden was identified in TP 3. All other tests were negative for archaeological material. Historical and modern debris including saw-cut animal bone, ceramic fragments and glass was observed in all four of the TPs. The following section describes the subsurface conditions in each test.

Test Pit 1

TP 1 was placed in the southern part of the proposed building footprint, west of the existing fence, situated on a grassed area (Figure 4, UTM 10U 471441E, 5362969N). The test measured 220 cm east-west x 70 cm north-south with subsurface conditions characterized by:

- 0 – 9 cm: humic layer / root mat.
- 9 – 36 cm: compact, light brown sandy silt with abundant angular, rounded, and sub-rounded gravel and few angular cobbles. A piece of plastic was noted in this layer (fill).
- 36 – 65 cm: compact orange and brown mottled sandy silt with abundant angular, rounded, and sub-rounded gravel, and some angular cobbles (disturbed, possibly fill).
- 65+ cm: bedrock (Photo 7).

No archaeological material was identified in TP 1.

Test Pit 2

TP 2 was placed in the northern part of the proposed building footprint, west of the existing fence, on a grassed area (Figure 4, UTM 10U 471438E, 5362985N). The test measured 270 cm east-west x 70 cm north-south, with subsurface conditions characterized by:

- 0 – 12 cm: humic layer / root mat.
- 12 - 42 cm: compact, light brown sandy silt with abundant angular, rounded, and sub-rounded gravel and few angular cobbles (fill).
- 42 - 145 cm: compact orange and brown mottled sandy silt with abundant angular, rounded, and sub-rounded gravel, and some angular cobbles. Historical debris was noted, including tarred roofing material, pieces of metal, glass, and plastic (disturbed, possibly fill).
- 145+ cm: bedrock (Photo 8).

The bedrock appears to slope down from east to west, appearing at 105 cm dbs to the east and 145 cm dbs to the west. No archaeological material was identified in TP 1.

Test Pit 3

TP 3 was placed in the western part of the footprint, situated on a gravel surface (Figure 4, UTM 10U 471435E, 5362977N). In the field, the test appears to be located just outside the footprint, as indicated by the painted boundary, though it is understood that this boundary was approximated. The test measured 320 cm N/S x 80 cm east-west, with different stratigraphy noted between the north and south ends of the test. The subsurface conditions in the south part of the test were characterized by:

- 0 – 16 cm: crushed gravel (engineered).
- 16 – 49 cm: compact orange and brown mottled sandy silt with abundant angular, rounded, and sub-rounded gravel, and some angular cobbles; brick noted (disturbed, possibly fill).

- 49 – 165 cm: compact brown sandy silt with trace clay, with some angular, rounded, and sub-rounded gravel and trace sub-rounded cobbles (disturbed).
- 165+ cm: bedrock (Photo 9).

The sub-surface conditions in the north were characterized by:

- 0 – 16 cm: crushed gravel (engineered).
- 16 – 50 cm: compact orange and brown mottled sandy silt with abundant angular, rounded, and sub-rounded gravel, and some angular cobbles; brick noted (disturbed, possibly fill).
- 50 - 130 cm: compact dark brown/black sandy silt with low density broken and crushed shell (cockle, native oyster, littleneck clam, butter clam, and barnacle) and fire cracked rock. Butchered (saw-cut) bone, glass, ceramics, a button, and a glass bottle stopper were noted (disturbed, possibly fill).
- 130+ cm: bedrock (Photo 9).

Shell midden was observed as a distinct stratigraphic layer in the northern part of the test pit, with an abrupt transition from the brown sandy silt with trace clay in the southern end of the test to the disturbed midden deposits in the north (Photo 9). The presence of historical debris indicates that it is disturbed, though it is unknown whether the midden was disturbed in situ, or has been re-deposited from elsewhere.

Test Pit 4

TP 4 was placed approximately 13 m north-northwest of the footprint, south of the original shoreline before the area was infilled (Figure 4, UTM 10U 471425E, 5363001N). The test measured 230 cm north-south x 75 cm east-west, with sub-surface conditions characterized by:

- 0 – 11 cm: humic layer / root mat.
- 11 – 73 cm: compact, light brown sandy silt with abundant angular, rounded, and sub-rounded gravel with small angular boulders (possibly blast rock (fill).
- 73 – 230 cm: semi-compact orange and brown mottled silty sand with some angular, rounded, and sub-rounded gravel, and few sub-rounded cobbles. Brick, pieces of metal, butchered bone, and a piece of clay drain pipe were noted (disturbed, fill).
- 230 – 280+ cm: blue-grey clay (Photo 10).

The results of this test pit support the idea that its location is situated off the original shoreline, with fill deposits overlying marine clay. No archaeological material was identified in TP 4.

3.4.6 Land and Resource Use

The CCG base resides on federally administered lands. Currently the half of the Site is behind a fence and is not publicly available. Development of the Project will not change the current use or function of the area as it is situated on a Coast Guard base. The Project is expected to be aesthetically similar to other buildings on the CCG base.

3.4.7 Health and Safety

Public access to the Site is anticipated to be restricted. The potential for accidents and personal and property safety at the Site will be limited to construction workers, CCG base employees, and visitors to the Site. During construction activities a temporary fence will be erected to further protect public from on-site activities. The Site is flat with minimal uneven terrain. The intention of the Project is to create a permanently manned Search and Rescue facility in Victoria.

3.4.8 Sustainability and Social Aspects

The Project is limited to the building footprint and a narrow area fringing the Site. All phases of Project activities should take into consideration the following sustainable elements:

- Minimize air pollutants and greenhouse gas emissions.
- Minimize water use and potential impacts to water resources.
- Reduce, reuse, recycle material and waste (i.e., limit consumption of new materials, limit generation of waste, prepare a waste management plan, etc.).
- Protect land and ecosystems (i.e., minimize areas requiring activity, minimize unnecessary soil/habitat destruction, dispose of wastes appropriately, etc.).

An important execution gauge for this VC is the ability to minimize physical effects of the works of the Project by implementing sustainable solutions, where possible. This includes but is not limited to the removal of waste and or soil and transfer of these materials based on their nature to appropriate off-site disposal facilities.

4.0 POTENTIAL EFFECTS AND RECOMMENDED MITIGATION MEASURES

The proposed Project has the potential to affect the selected VCs. Project-related effects may be avoided or reduced through the application of appropriate mitigation measures. Potential Project-related effects on VCs and recommended mitigation measures are provided in Table 4. Prior to initiation of Project construction, mitigation measures should be detailed in a Project specific Construction Environmental Management Plan (CEMP) and implemented during construction. The CEMP and other plans discussed within Table 4 should be prepared by an appropriately Qualified Environmental Professional (QEP) informed by this assessment and considering final site designs and layout, the planned construction methods and schedule, and applicable environmental legislation, regulations, and best management practices.

Table 4: Effects Assessment and Mitigation Measures

Environmental / Ecosystem Component	Project Component(s) and Description of effects	Environmental Protection and Mitigation Measures (Numbers appearing before a measure indicate the applicable project component with which it is associated)	Residual Effects
Air Quality	*Project Component* 1) Site Preparation 2) Project Construction *Description of Effects* Air quality may be potentially negatively affected by: ■ Exhaust emissions from machinery. ■ Noise from machinery. ■ Dust generation through ground preparation and construction activities.	1,2) Equipment should be well maintained and in good working order. 1,2) Efforts should be made to minimize exhaust emissions. Equipment should use low sulphur fuels. 1,2) Idling of vehicles and equipment should be minimized. 1,2) If required, water may be used as a dust suppressant.	No adverse residual effects are expected after effectively implementing appropriate mitigation measures
Surface and Groundwater Quality	*Project Component* 1) Site Preparation 2) Project Construction *Description of Effects* Surface water and groundwater may be negatively affected by: ■ Runoff of sediment laden water into the local stormwater system or as overland flow to the marine environment could affect surface water quality. ■ Alteration to local groundwater movement patterns due to subsurface project components Note: limited alteration is proposed. ■ Potential accidental hydrocarbon or other deleterious substance (e.g., concrete and concrete products, antifreeze) spills during equipment fuelling or maintenance, hydraulic line ruptures, other equipment malfunctions, and spills from oils, lubricants or other potentially deleterious substances maintained or used on the Site.	1,2) All materials used for Project works should be clean material and substantially free of fines, organic material and deleterious substances. Installation of appropriate erosion and sediment control measures may be warranted during construction. 1,2) Ground disturbance should be restricted to the immediate Project area and stabilized when work is complete. 1,2) A Vegetation Clearing and Materials Management Plan should be developed for the Project to address handling and disposal of excavated materials. 1,2) Installation of concrete structures should be done using methods that minimize impacts to the environment. Concrete that is pre-cast and cured away from the Site is preferred. Where not feasible in place concrete pours should be done using industry approved techniques and applicable standards and best management practices measures such that there is no seepage/spillage of concrete or concrete residues into the receiving environment. 1,2) No uncured concrete or concrete wash water should be allowed to enter any surface water feature (marine water or surface drains) and concrete waste should be disposed at an appropriate facility licenses to accept such waste. 1,2) The contractor should wash, refuel and service equipment and machinery away from marine waters and drainages to prevent deleterious substances from entering watercourses. The contractor should also store fuel and other fluids away from the intertidal and watercourses. 1,2) If stormwater runoff from the Project area occurs into adjacent watercourses and waterbodies, water quality monitoring should be undertaken to document levels of TSS and turbidity. If TSS or turbidity levels exceed applicable water quality guidelines, work should be suspended and measures applied to reduce runoff. 1,2) Vehicles and equipment should be well maintained and in good working order. Machinery should arrive on-site in a clean/good condition and are to be maintained free of fluid leaks and invasive species. Vehicles and equipment should be inspected daily. 1,2) All work should be conducted in a manner that does not result in the deposit of a toxic or deleterious substance into waters with potential to be frequented by fish or other aquatic life. Refuelling and washing of machinery or equipment should not take place within 30 m of the marine foreshore or storm water drains, where feasible. 1,2) An Erosion and Sediment Control Plan should be prepared by an appropriately qualified professional and implemented prior to commencing Project activities to mitigate the potential introduction of sediment or other deleterious substances into nearby surface water sources either directly or indirectly. Installation of erosion and sediment control measures (e.g., silt fencing, filter fabric, bags, sandbags, or other sediment, trapping/diversion devices), should be placed in areas where there is potential surface runoff to aquatic receptors, prior to commencing Project activities. It is anticipated that materials stockpiling will not be required. 1,2) Work should be suspended during intense rainfall events if sediment and erosion control measures are not adequate to mitigate effects. 1,2) Appropriate spill control equipment (spill kits) should be kept on-site during the work. Operating personnel should be familiar with the contents and use of spill response equipment and the location and operation of emergency 'shut-offs'. A spill prevention plan and emergency response procedures should be developed by the contractor and posted on-site. If a spill occurs, immediately remove the spilled material and implement emergency mitigation and clean-up measures.	No adverse residual effects are expected after effectively implementing appropriate mitigation measures

Environmental / Ecosystem Component	Project Component(s) and Description of effects	Environmental Protection and Mitigation Measures (Numbers appearing before a measure indicate the applicable project component with which it is associated)	Residual Effects
Soils and Terrain	*Project Component* 1) Site Preparation 2) Project Construction *Description of Effects* Soils and terrain quality may be potentially negatively affected by: ■ Extraction of soils to prepare the Site. Dependent upon final construction design as the level of excavation may vary. ■ Potential accidental hydrocarbon or other deleterious substance (e.g., concrete and concrete products, antifreeze) spills during equipment fuelling or maintenance, hydraulic line ruptures, other equipment malfunctions, and spills from oils, lubricants or other potentially deleterious substances maintained or used on the Site. ■ Transfer of potentially contaminated material to uncontaminated areas surrounding the Site or import of potentially contaminated material from off-site sources.	1,2) Materials excavated from the Site should be disposed of in an appropriate manner. If excavation is required and soils are to be disposed off-site it should be done at an appropriately licensed waste management facility in accordance with the Vegetation Clearing and Materials Management Plan. The plan should address site-specific measures to be taken during Site preparation/ excavation and placement of soils during the Project. No materials should leave the Site without proper characterization. 1,2) Project activities should be limited to designated work areas to reduce potential effects to surrounding areas. 1,2) The contractor should wash, refuel and service equipment and machinery at appropriate facilities on asphalt where feasible to prevent deleterious substances from contacting and entering the ground. The contractor should also store fuel and other potentially deleterious fluids in appropriate secondary containment cells capable of containing 110% of the volume stored material. 1,2) An Erosion and Sediment Control Plan should be completed prior to commencing Project activities to mitigate against the mobilization of sediment or other deleterious substances. It is anticipated that materials stockpiling will not be required. 1,2) Appropriate spill control equipment (spill kits) should be kept on-site during the work. Operating personnel should be familiar with the contents and use of spill response equipment and the location and operation of emergency 'shut-offs'. A spill prevention plan and emergency response procedures should be developed by the contractor and posted on-site. 1,2) Material arriving from off-site should be screened for potentially contaminated materials and sourced from reputable sources.	No adverse residual effects are expected after effectively implementing appropriate mitigation measures
Biological Resources	*Project Component* 1) Site Preparation 2) Project Construction *Description of Effects* Wildlife, Species at Risk, and associated habitat may be potentially negatively affected by: ■ Potential displacement of wildlife by noise or physical activity. ■ Mortality during site preparation Note: due to the level of previous modification at the Site potential impacts are considered low. ■ Loss of foraging habitat. ■ Potential introduction of invasive species to the CCG base or proliferation of invasive species already present at the CCG base. ■ Loss of wildlife habitat from the release of deleterious substances. ■ Increased wildlife/human interactions as a result of poor waste and refuse management practices (e.g., food waste and scavenging).	1,2) All materials excavated from the Site should be disposed of at an appropriate waste management centre as to reduce the potential for off-site transportation of introduced plant species, in accordance with the Vegetation Clearing and Materials Management Plan. The plan should address site-specific measures to be taken during Site preparation/ excavation and placement of soils during the Project. 1,2) Vegetation clearing boundaries should be delineated in a highly visible manner prior to clearing such that vegetation outside of the boundaries is not accidentally removed. 1,2) Existing cleared areas, such as parking lots or graveled areas, should be selected as laydown areas to reduce the amount of vegetation removed or disturbance of habitat that may be frequented by wildlife. •1,2) Vehicles and equipment should be restricted to designated work and laydown areas to reduce vegetation disturbance. •1,2) Cleared areas should be revegetated with non-invasive plant species as soon as possible in the appropriate season and otherwise with vegetation similar to that removed. •1,2) To reduce the introduction of invasive plant species, equipment should be washed and free of soil and vegetation matter before arriving on the CCG Base. 1,2) Appropriate spill control equipment (spill kits) will be kept on-site during the work as described in previous sections. 1,2) If nesting raptors are observed within 200 m of the Project Area, or if nesting herons are observed within 400 m of the Project Area, no-disturbance buffers should be established under the guidance of an appropriately qualified biologist. 1,2) The Site generally does not provide suitable avian nesting habitat; however, nesting could occur on adjacent buildings, shrubs, or trees. If work activities are to occur outside of the reduced risk timing window (September 1 to February 28 [MOE 2014]), pre-disturbance nest surveys should be undertaken by a qualified biologist to identify potential nests in and adjacent to the Site. In the event that an active bird nest is observed, species-specific buffers should be applied around the nest as determined by the biologist until nesting is complete. 1, 2) Care shall be taken to protect trees in the surrounding area from accidental damage by heavy machinery or construction activities. If work activities are required near boulevard trees, protective measures could include erecting fences around trees to mark the extent of root zones, wrapping trunks in burlap and other protective measures as determined by an appropriately qualified professional. 1, 2) All equipment (including clothes, boots, hand tools and other equipment) and machinery should be thoroughly cleaned to remove potential invasive plant seeds or material prior to arriving at the Site. 1, 2) Potential wildlife attractants such as food waste, petroleum products such as grease or oils, and other construction debris should be managed and disposed of appropriately in wildlife proof containers. This practice should continue through all phases of the Project. In addition, housekeeping best management practices should be adhered to throughout the lifespan of the Project. 1,2) The Project should comply with the *BC Wildlife Act, SARA, Migratory Bird Convention Act* and other applicable laws and regulations.	No adverse residual effects are expected after effectively implementing appropriate mitigation measures

Environmental / Ecosystem Component	Project Component(s) and Description of effects	Environmental Protection and Mitigation Measures (Numbers appearing before a measure indicate the applicable project component with which it is associated)	Residual Effects
Cultural Heritage Resources	*Project Component* 1) Site Preparation 2) Project Construction *Description of Effects* ■ Displacement of, or damage to artifacts. ■ Disturbance of buried archaeological features. ■ Exposing or damaging ancestral human remains.	1, 2) Archaeological monitoring should be undertaken during all excavations, including for the SAR building footings and underground services. The scope of monitoring should be determined in consultation with a qualified professional archaeologist and First Nations, based on the nature of the planned excavations. The monitoring program should be designed to collect scientific information that will mitigate Project effects on archaeological site DcRu-75 through data collection and documentation. 1) Prior to any land disturbance, an Archaeological Chance Find Procedure should be established to provide direction to contractors in the event that suspected archaeological materials or features are encountered when an archaeological monitor is not on-site. The Chance Find Procedure should also include instructions for responding to accidental exposure of ancestral human remains. An on-site contractor orientation should be conducted to explain the Chance Find Procedure to construction personnel. The Chance Find Procedure should include provision for work stoppage and a re-evaluation of the mitigation approach in the event that significant archaeological materials or human remains are encountered.	Based on this historical disturbance to the Project area and the results of the background review and field assessment, the archaeological material in the Project area is considered to have been historically disturbed and redeposited. After effectively implementing mitigation measures, residual effects are not expected to be significant.
Land and Resource Use	*Project Component* ■ Site Preparation ■ Project Construction *Description of Effects* Land and Resource Use may be potentially negatively affected by: ■ Permanent alteration of the Project footprint. ■ Increased traffic along local roadways	The building will be designed to fit in with other buildings on CCG base. The façade is anticipated to be similar to other buildings within the CCG base. The building is being designed to allow public access to the SAR facility from Dallas Road in case of emergency. 1,2) The proposed Project footprint covers portion of the existing boulevard that are outside existing fencing. A new fence will need to be constructed after Project completion. Temporary fencing will be installed during site preparation and construction to demarcate construction areas. All fencing and work activities are proposed to occur on CCG base property. 1,2) Roadway use will be minimally impacted by Project activities. Where possible, Project related vehicle movements will preferentially access the Site through designated access areas to alleviate congestion on Dallas Road. 1,2) Construction lay down areas will be located in areas away from public lands and public access. 1,2) Vehicle movements and Project activities resulting in temporary lane closures on public roadways will use flaggers and traffic management personnel 1,2) Vehicle movements on public roadways will be limited to hours between 06:00 and 20:00	No adverse residual effects are expected after effectively implementing appropriate mitigation measures
Health and Safety	*Project Component* ■ Site Preparation ■ Project Construction *Description of Effects* Health and Safety may be potentially negatively affected by: ■ Accident or injury to construction personnel, CCG base employees, and the public.	1,2) A project specific Health & Safety Plan (HASP) should be developed prior to Project commencement. The HASP should incorporate legislated safety requirements in accordance with Project related activities. Appropriate fencing and signage will be installed to demarcate construction areas. The Project will be predominantly accessed through the CCG base.	No adverse residual effects are expected after effectively implementing the HASP. Overall, the Project will benefit the public as will enhance health and safety resources in the region.

5.0 EED DETERMINATION

Potential adverse environmental effects resulting from the Project were assessed and mitigation measures have been recommended to reduce or eliminate these potential effects on the Site's Valued Components. On the basis of this EED, it has been determined that the Project is not likely to cause adverse residual effects, significant or otherwise, at the Site provided recommended mitigation is planned and implemented.

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https://golderassociates.sharepoint.com/sites/26648g/deliverables/issued to client_for wp/18101392-004-r-rev0/18101392-004-r-rev0-eed-10sep_18.docx

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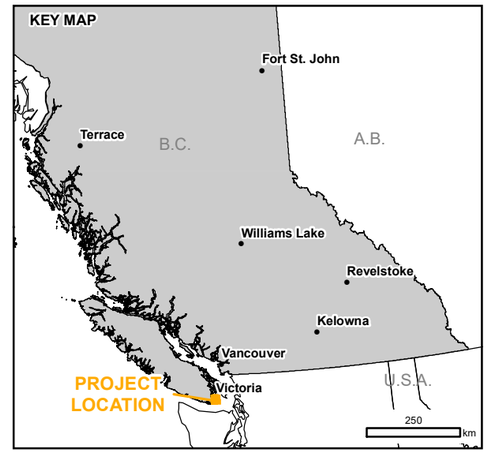
LEGEND

- PROPOSED SEARCH AND RESCUE BUILDING
- SITE BOUNDARY
- HISTORIC SHORELINE (1928)



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DATUM: NAD83, PROJECTION: UTM10

CLIENT
FISHERIES AND OCEANS CANADA

PROJECT
VICTORIA COAST GUARD BASE
ENVIRONMENTAL EFFECTS DETERMINATION

TITLE
PROJECT LOCATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-09-06
DESIGNED	JC
PREPARED	CD
REVIEWED	AR
APPROVED	IJ

PROJECT NO.	PHASE	REV.	FIGURE
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LEGEND

- PROPOSED SEARCH AND RESCUE BUILDING
- SITE BOUNDARY
- RIVER OTTER LATRINE (*Lontra canadensis*) (CRD 2018)
- INVASIVE PLANT SPECIES (BC 2018b)

RARE AND ENDANGERED SPECIES (CRD 2018; CDC 2018)

- SHARP-TAILED SNAKE HABITAT (*Contia tenuis*)
- PURPLE MARTIN HABITAT (*Progne subis*)
- GREAT BLUE HERON HABITAT(*Ardea herodias fannini*) (iMap2018)

SENSITIVE ECOSYSTEM INVENTORY (SEI 2018)

- COASTAL BLUFF
- TERRESTRIAL HERBACIOUS
- WOODLAND

0 200 400

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REFERENCE(S)

1. IMAGERY COPYRIGHT © 20180611 ESRI AND ITS LICENSORS. SOURCE: VICTORIA_2017. USED UNDER LICENSE, ALL RIGHTS RESERVED. IMAGE DATE: 20170525.
2. BC (PROVINCE OF BRITISH COLUMBIA). 2018B. INVASIVE ALIEN PLANT PROGRAM – ONLINE DATABASE THAT CONTAINS INVASIVE PLANT SURVEYS, TREATMENTS, AND ACTIVITY PLANS FOR THE ENTIRE PROVINCE OF BC. AVAILABLE AT: HTTP://MAPS.GOV.BC.CA/ESS/HM/IAPP/. ACCESSED ON JUNE 11, 2018.
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DATUM: NAD83, PROJECTION: UTM10

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PROJECT
VICTORIA COAST GUARD BASE
ENVIRONMENTAL EFFECTS DETERMINATION

TITLE
BIOLOGICAL RESOURCES

CONSULTANT
GOLDER

YYYY-MM-DD	2018-09-06
DESIGNED	JC
PREPARED	CD
REVIEWED	AR
APPROVED	IJ

PROJECT NO.	PHASE	REV.	FIGURE
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- PROPOSED SEARCH AND RESCUE BUILDING (APPROXIMATE)
- VICTORIA COAST GUARD BASE
- ARCHAEOLOGICAL SITE
- HISTORICAL SITE
- PROPERTY BOUNDARY

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1:750 METRES

REFERENCE(S)

1. ORIGINAL SHORELINE AND IMAGERY PROVIDED BY DEPARTMENT OF FISHERIES AND OCEANS CANADA.
2. ARCHAEOLOGY SITES OBTAINED FROM B.C. MINISTRY OF FORESTS, LANDS, RESOURCE OPERATIONS AND RURAL DEVELOPMENT. MARCH 31, 2018.

DATUM: NAD83, PROJECTION: UTM10

CLIENT
FISHERIES AND OCEANS CANADA

PROJECT
VICTORIA COAST GUARD BASE
ENVIRONMENTAL EFFECTS DETERMINATION

TITLE
ARCHAEOLOGICAL MID-RANGE MAP SHOWING THE LOCATION OF DcRu-075 AND THE HISTORICAL SHORELINE

CONSULTANT
GOLDER

YYYY-MM-DD	2018-09-06
DESIGNED	RV
PREPARED	CD
REVIEWED	RV
APPROVED	JB

PROJECT NO.	PHASE	REV.	FIGURE
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LEGEND

- NEGATIVE TEST PIT LOCATION - GOLDER
- POSITIVE TEST PIT LOCATION - GOLDER
- NEGATIVE TEST PIT LOCATION - WSP (GEOTECHNICAL)
- ENVIRONMENTAL SAMPLE LOCATION
- HISTORICAL SHORELINE (1928)
- PROPOSED SEARCH AND RESCUE BUILDING (APPROXIMATE)
- VICTORIA COAST GUARD BASE BOUNDARY
- ARCHAEOLOGICAL SITE BOUNDARY
- PROPERTY BOUNDARY

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REFERENCE(S)

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2. BOREHOLE LOCATIONS FROM SEACOR ENVIRONMENTAL.
3. TEST PIT LOCATIONS FROM WSP AND GOLDER ASSOCIATES.
4. ARCHAEOLOGY SITES OBTAINED FROM B.C. MINISTRY OF FORESTS, LANDS, RESOURCE OPERATIONS AND RURAL DEVELOPMENT. MARCH 31, 2018.

DATUM: NAD83, PROJECTION: UTM10

CLIENT
FISHERIES AND OCEANS CANADA

PROJECT
VICTORIA COAST GUARD BASE
ENVIRONMENTAL EFFECTS DETERMINATION

TITLE
RESULTS OF ARCHAEOLOGICAL ASSESSMENT

CONSULTANT
GOLDER

YYYY-MM-DD	2018-09-06
DESIGNED	RV
PREPARED	CD
REVIEWED	RV
APPROVED	JB

PROJECT NO.	PHASE	REV.	FIGURE
18101392	1000	A	4

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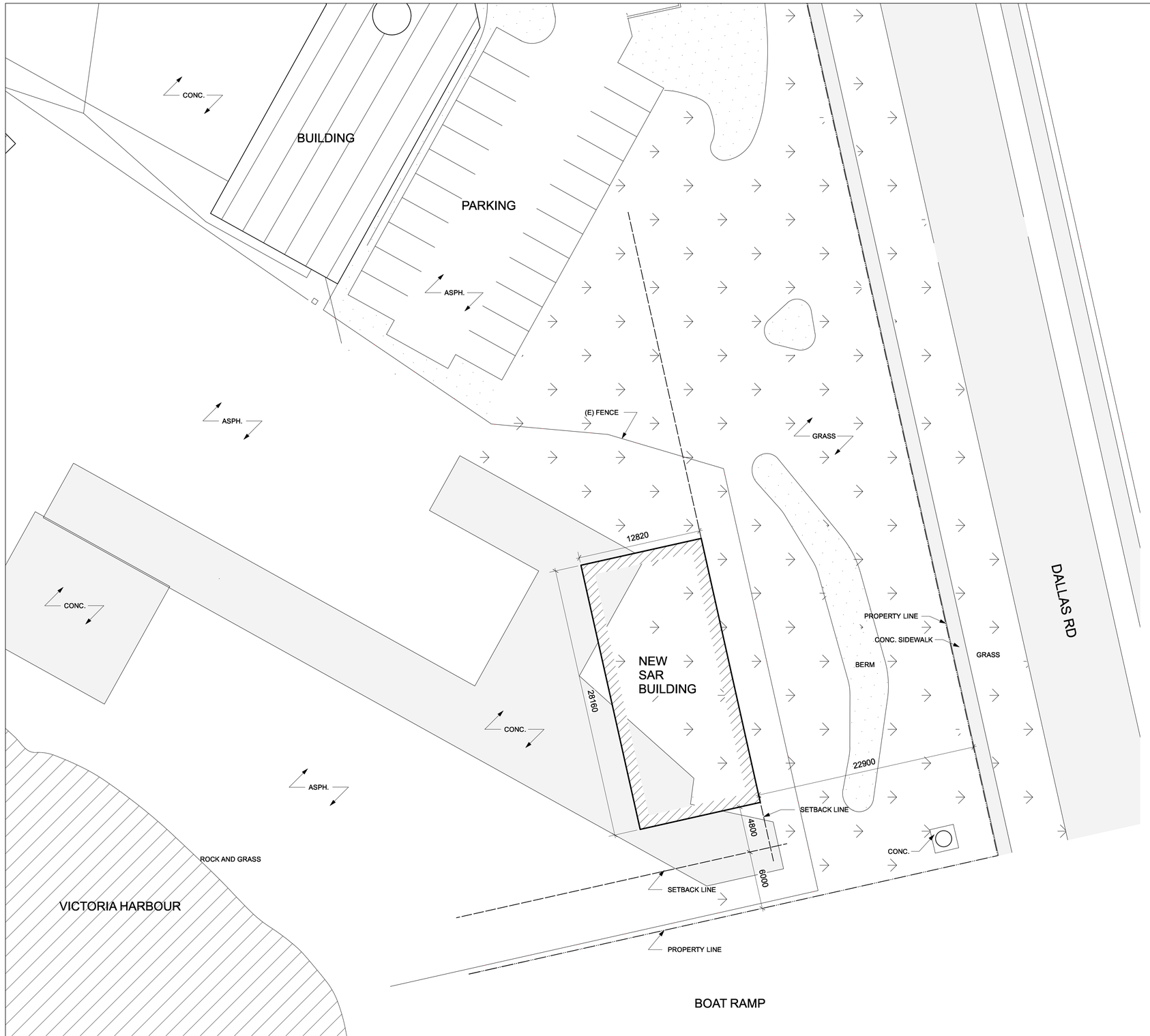
APPENDIX A

Design Drawings



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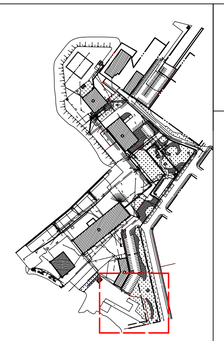

1 / A1.1 Key Plan
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Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Région de Pacifique

numberTEN architectural group

Revision/ Revision	Description/Description	Date/Date

Client/client

FISHERIES AND OCEANS, REAL PROPERTY, SAFETY AND SECURITY

VANCOUVER, BC
200-401 BURRARD ST.

Project title/Titre du projet

VICTORIA SAR STATION

4160 Marine Dr, West Vancouver

Consultant Signature Box Only

Designed by/Concept par
RH

Drawn by/Dessine par
DS

PWGSC Project Manager/Administrateur de Projets TPSGC
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PWGSC, Regional Manager, Architectural and Engineering Services/ Gestionnaire régionale, Services d'architectural et de génié, TPSGC
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SITE PLAN

Project No./No. du projet	Sheet/ Feuille	Revision no./ La Révision no.
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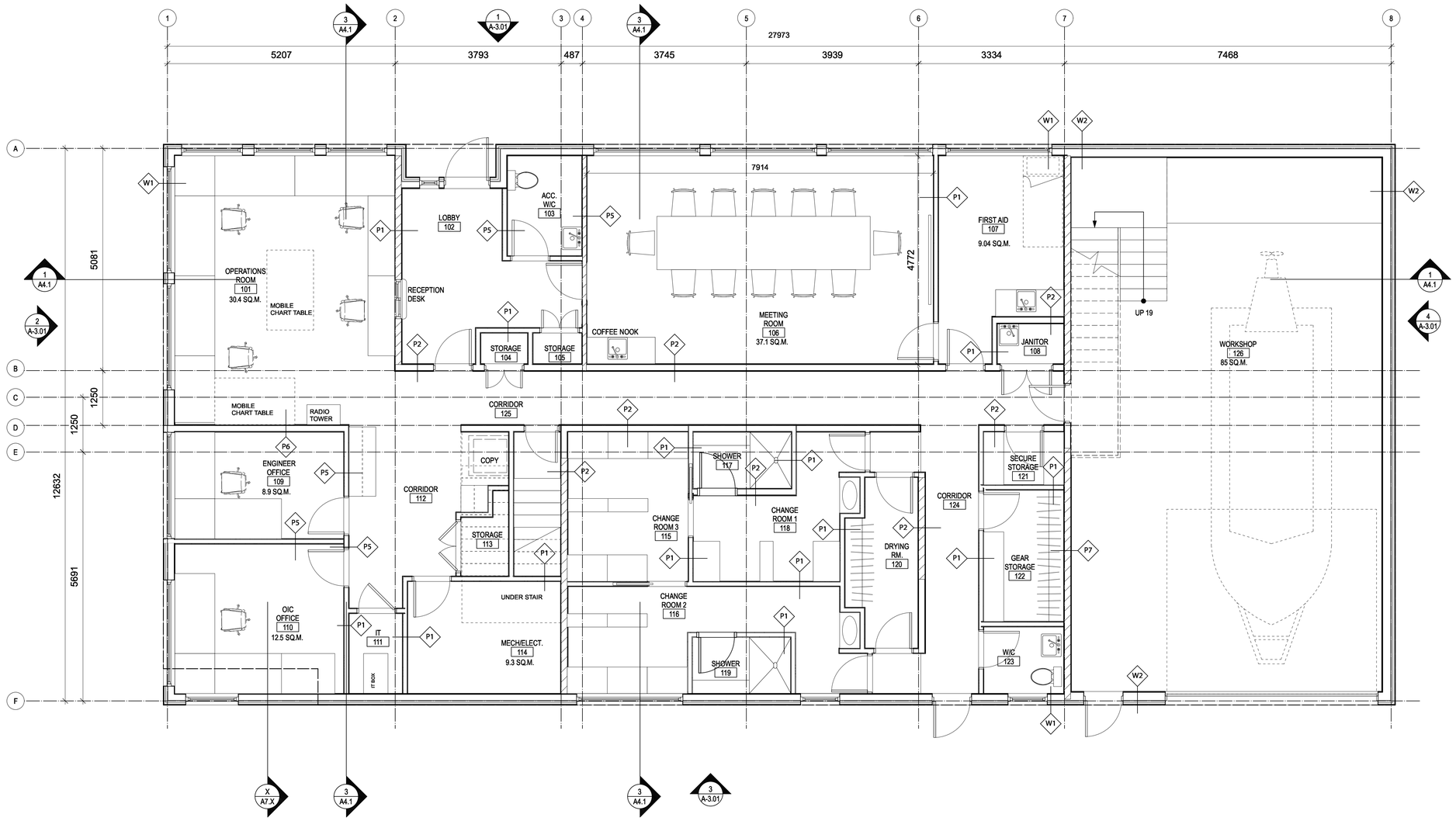
DM5XXXXXX



1 A2.1 MAIN FLOOR PLAN

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PWGSC - Arch D - 914X610

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MAIN FLOOR PLAN

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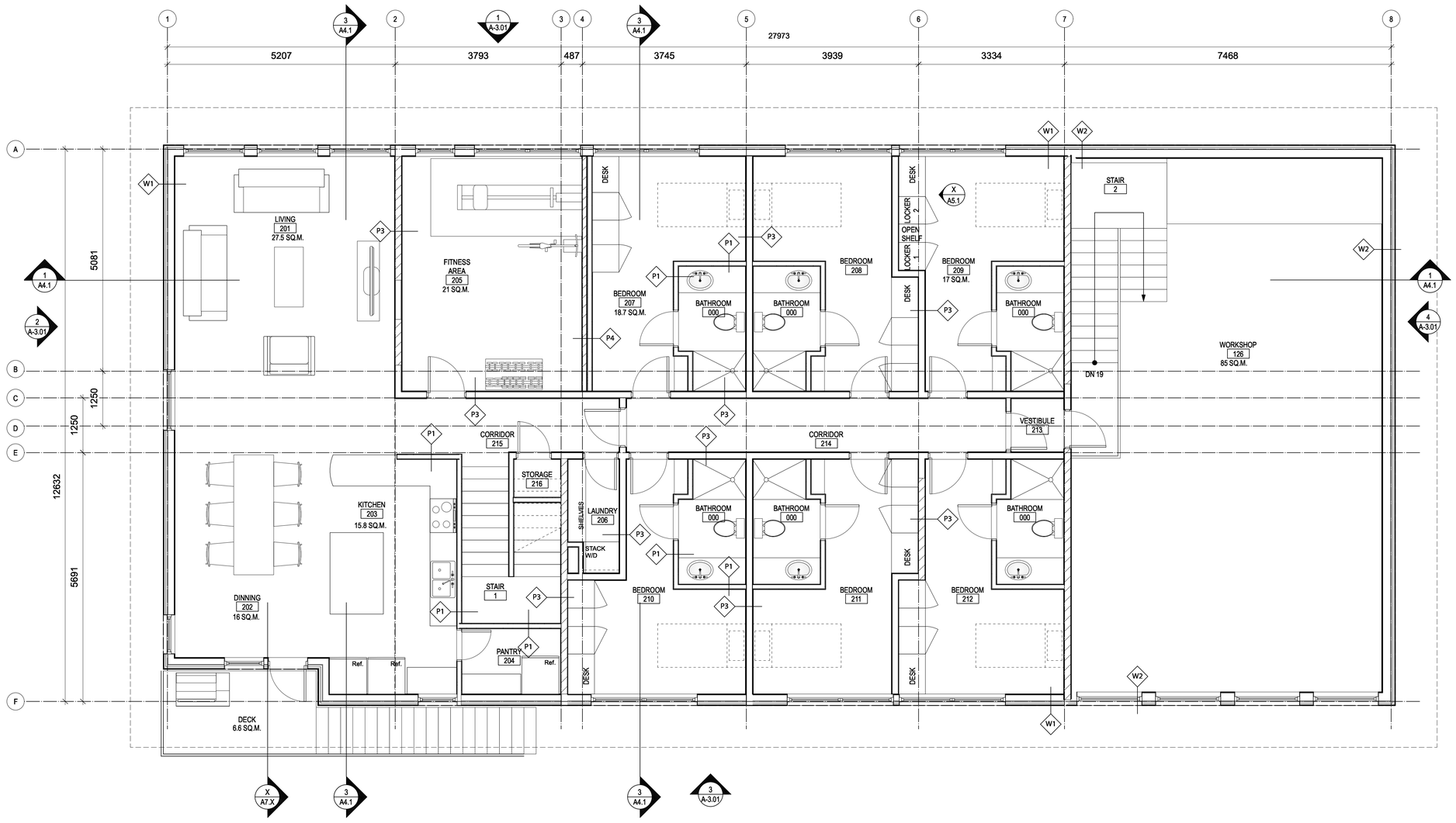
DM5XXXXXX



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SECOND FLOOR PLAN

Project No./No. du projet	Sheet/ Feuille	Revision no./ La Révision no.
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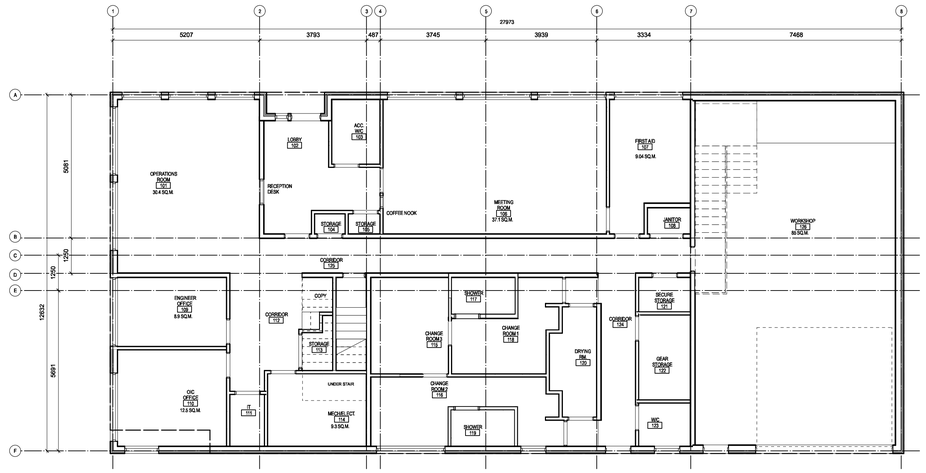
DM5XXXXXX



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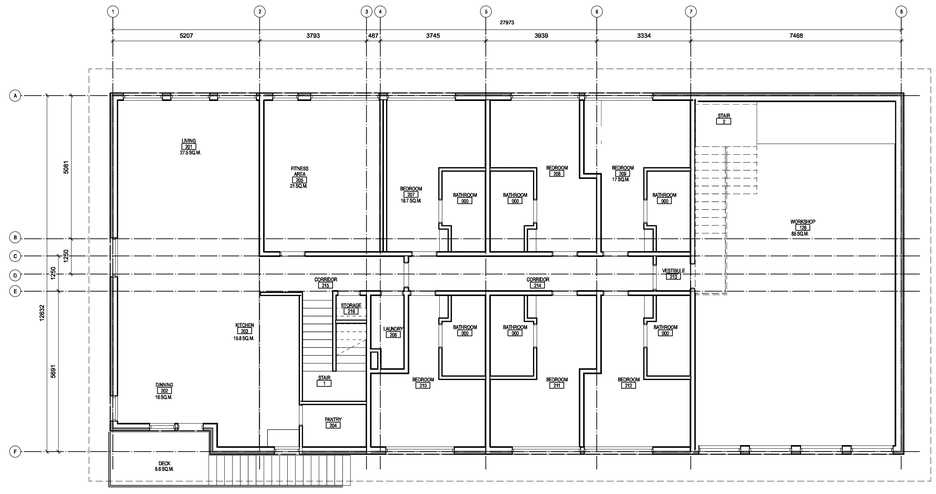

2 A2.5 SECOND FLOOR RCP

SCALE: 1:100

PWGSC - Arch D - 914X610

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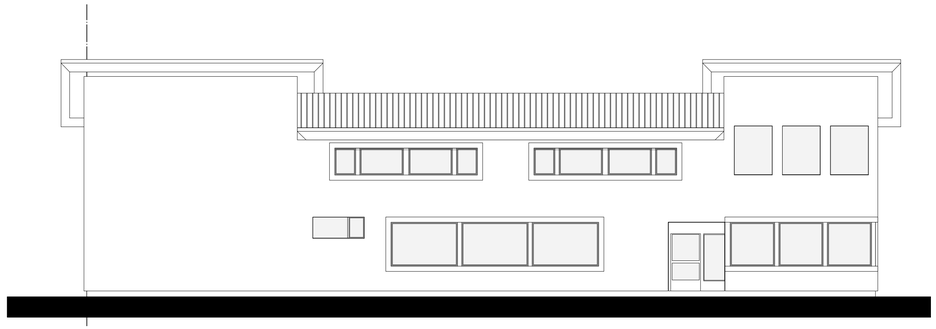
DM5XXXXXX



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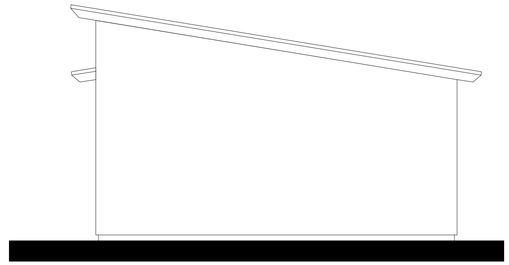

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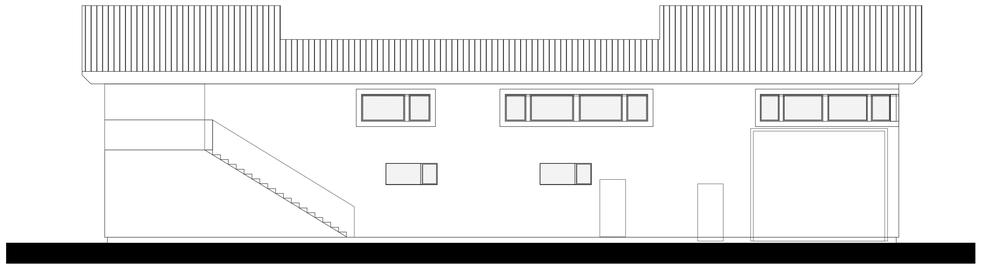

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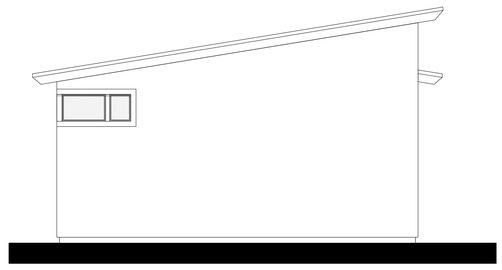

4 A3.1 SOUTH ELEVATION
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PWGSC - Arch D - 914X610

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Revision/ Revision	Description/Description	Date/Date
1	review	2018-xx-xx

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ELEVATIONS

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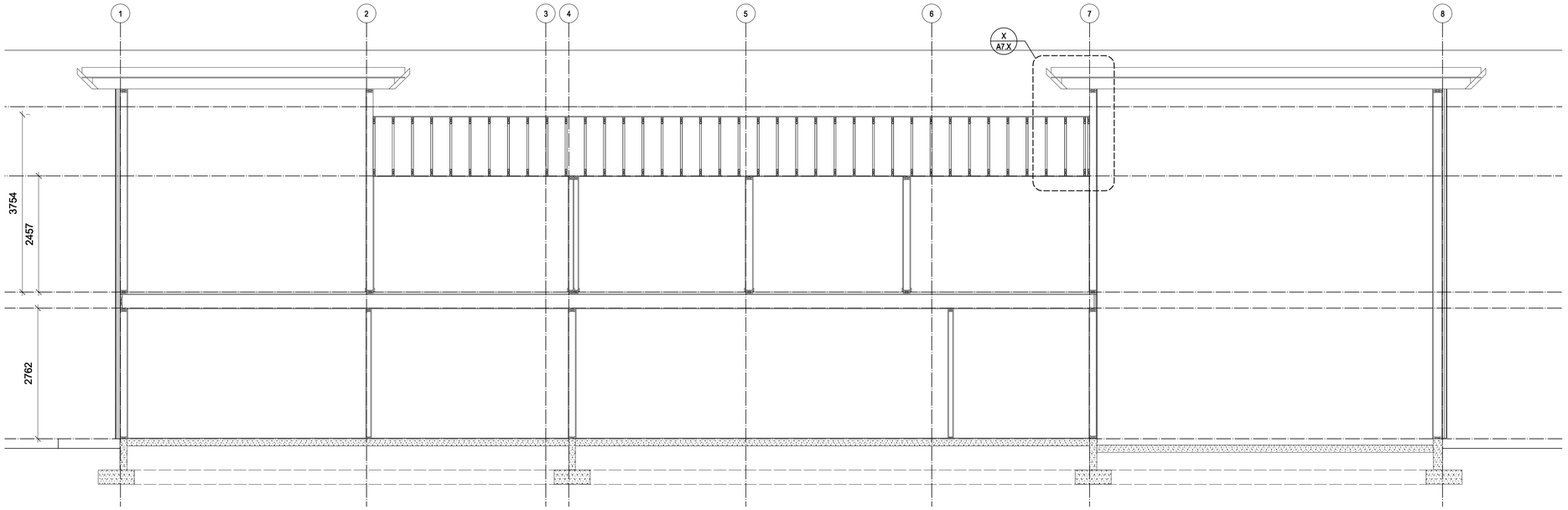

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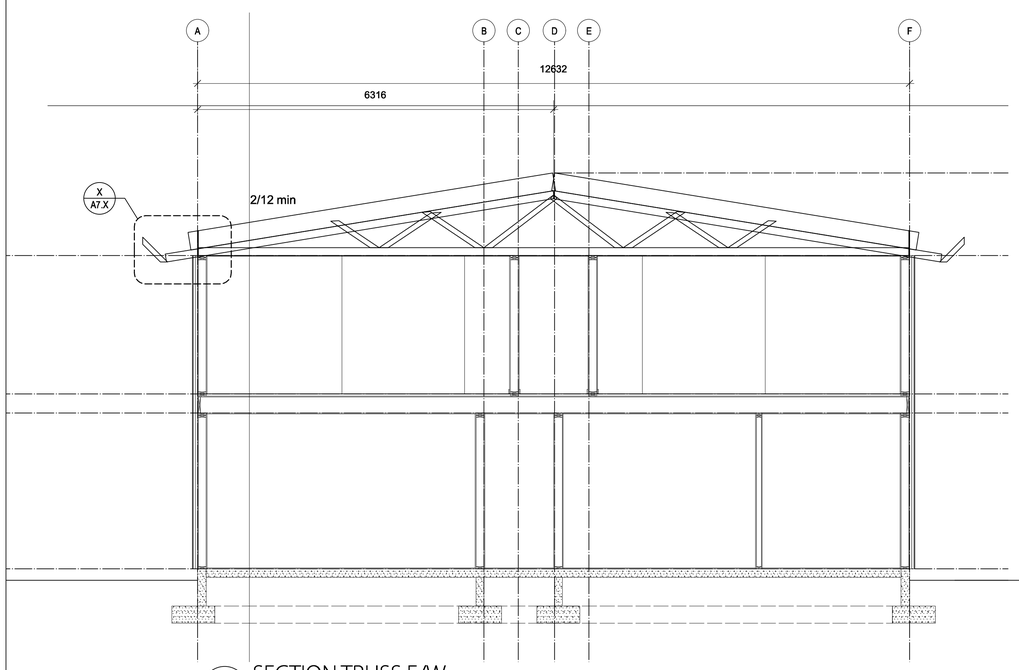

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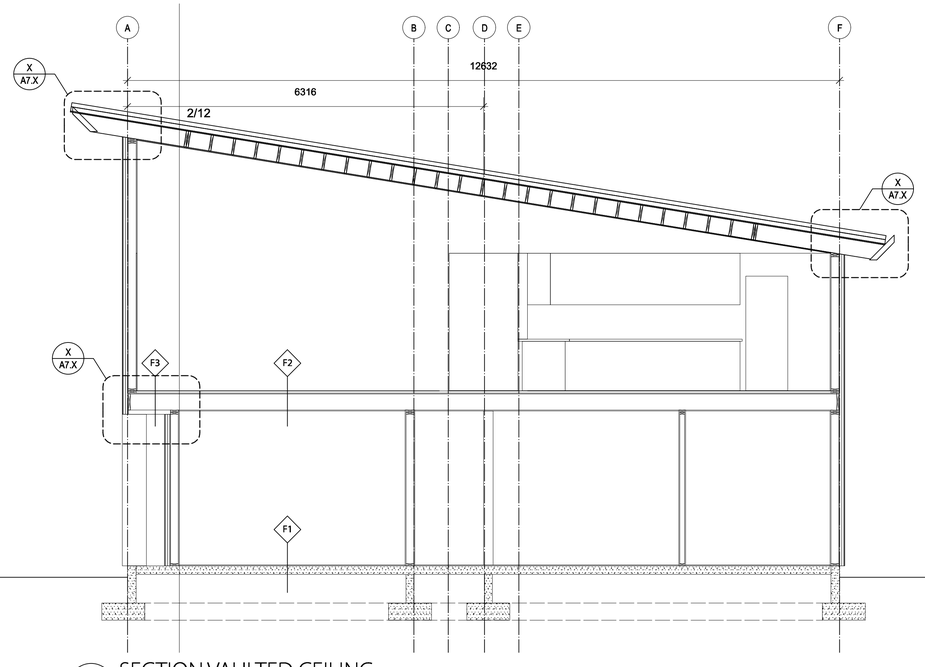

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numberTEN architectural group

Revision/ Revision	Description/Description	Date/Date
1	review	2018-xx-xx

Client/client

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SECTIONS

Project No./No. du projet	Sheet/ Feuille	Revision no./ La Révision no.
2017567	**A4.1**	

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APPENDIX B

Site Photos

Photo 1: Proposed building site location at 25 Huron Street, Victoria, BC. Photo taken at southwest corner of building lot looking north. ***Note: The spray-painted lines designate the approximate location of the proposed Project.***

Photo 2: Proposed building site location at 25 Huron Street, Victoria, BC. Photo taken at northern boundary of building lot looking south. ***Note: the buildings in the background are immediately on the southern side of the existing boundary fence (southern extent of the CCG base).***

Photo 3: The eastern portion of the proposed building location as viewed from the north looking south. One-third of the proposed Project location is outside the existing chain-link fence. The left side of the image has a berm separating the Site from Dallas Road. ***Note: The exposed dirt in the centre of the photo is the north-east corner of the Project footprint and coincides with one of the onsite geo-technical investigation locations.***

Photo 4: Asphalt materials laydown pad and navigational aids being stored immediately (15 m) northwest of the proposed Project location.

Photo 5: Project location as viewed from the south side looking northwest. Two-thirds of the site is located inside an existing chain-link fence. *Note: The site has been recently cleared and was being used as a storage area until early spring 2018.*

Photo 6: Shrub habitat near the Project location. Chipping sparrows were observed on the fence immediately south of the proposed building location.

APPENDIX C

CDC Search Results

BC Species Ecosytem Explorer - Search Results (CDC 2018)

Scientific Name	English Name	COSEWIC	BC List	Garry Oak Ecosystem	SARA	Name Category	Class (English)	BioGeoclimatic Code	Habitat Subtype	Endemic
Fauna										
Anarta edwardsii	Edwards' Beach Moth	E (Apr 2009)	Red		1-E (Feb 2011)	Invertebrate Animal	insects	CDF;CWH		N
Copablepharon fuscum	Sand-verbena Moth	E (Nov 2013)	Red		1-E (Jul 2005)	Invertebrate Animal	insects	CDF		N
Cryptomastix devia	Puget Oregonian	XT (Apr 2013)	Red		1-XX (Jan 2005)	Invertebrate Animal	gastropods	CDF;CWH	Riparian Forest;Mixed Forest (deciduous/coniferous mix)	N
Danaus plexippus	Monarch	E (Nov 2016)	Blue		1-SC (Jun 2003)	Invertebrate Animal	insects	BG;CDF;CWH;ESSF;ICH;IDF;MS;PP	Pasture/Old Field;Cultivated Field;Hedgerow;Meadow;Grassland;Sagebrush Steppe;Urban/Suburban	N
Euchloe ausonides insulanus	Large Marble, *insulanus* subspecies	XT (Apr 2010)	Red	Y	1-XX (Jun 2003)	Invertebrate Animal	insects	CDF;CWH	Pasture/Old Field;Meadow;Grassland;Deciduous/Broadleaf Forest;Sand Dune	N
Euphydryas editha taylori	Edith's Checkerspot, *taylori* subspecies	E (May 2011)	Red	Y	1-E (Jun 2003)	Invertebrate Animal	insects	CDF;CWH	Vernal Pools/Seasonal Seeps;Pasture/Old Field;Meadow;Grassland	N
Euphyes vestris	Dun Skipper	T (Apr 2013)	Red	Y	1-T (Jun 2003)	Invertebrate Animal	insects	CDF;CMA;CWH;ESSF;IDF;IMA;MH;PP	Vernal Pools/Seasonal Seeps;Meadow	N
Haliotis kamtschatkana	Northern Abalone	E (Apr 2009)	Red		1-E	Invertebrate Animal	gastropods	CDF;CWH	Intertidal Marine;Pelagic	N
Hemphillia dromedarius	Dromedary Jumping-slug	T (May 2014)	Red		1-T (Jan 2005)	Invertebrate Animal	gastropods	CDF;CWH	Conifer Forest - Moist/wet	N
Hemphillia glandulosa	Warty Jumping-slug	SC (Apr 2013)	Red		1-SC (Jan 2005)	Invertebrate Animal	gastropods	CDF;CWH	Riparian Forest;Deciduous/Broadleaf Forest;Conifer Forest - Moist/wet;Mixed Forest (deciduous/coniferous mix)	N
Nearctula sp. 1	Threaded Vertigo	SC (Apr 2010)	Blue		1-SC (Jul 2012)	Invertebrate Animal	gastropods	CDF;CWH	Deciduous/Broadleaf Forest;Mixed Forest (deciduous/coniferous mix)	N
Plebejus saepiolus insulanus	Greenish Blue, *insulanus* subspecies	E (May 2012)	Red	Y	1-E (Jun 2003)	Invertebrate Animal	insects	CDF;CWH	Riparian Forest;Riparian Shrub;Pasture/Old Field;Meadow;Grassland;Deciduous/Broadleaf Forest;Riparian Herbaceous;Gravel Bar	Y
Prophysaon coeruleum	Blue-grey Taildropper	T (Apr 2016)	Blue	Y	1-E (Dec 2007)	Invertebrate Animal	gastropods	CDF;CWH	Conifer Forest - Moist/wet;Mixed Forest (deciduous/coniferous mix)	N
Accipiter gentilis laingi	Northern Goshawk, *laingi* subspecies	T (Apr 2013)	Red		1-T (Jun 2003)	Vertebrate Animal	birds	CDF;CWH	Estuary;Riparian Forest;Pasture/Old Field;Cultivated Field;Hedgerow;Meadow;Conifer Forest - Mesic (average);Conifer Forest - Dry;Conifer Forest - Moist/wet;Mixed Forest (deciduous/coniferous mix);Krummholtz	N
Aneides vagrans	Wandering Salamander	SC (May 2014)	Blue		1-SC (Feb 2018)	Vertebrate Animal	amphibians	CDF;CWH	Riparian Forest;Talus;Shrub - Natural;Conifer Forest - Moist/wet;Shrub - Logged	N
Ardea herodias fannini	Great Blue Heron, *fannini* subspecies	SC (Mar 2008)	Blue	Y	1-SC (Feb 2010)	Vertebrate Animal	birds	CDF;CWH	Estuary;Swamp;Marsh;Vernal Pools/Seasonal Seeps;Riparian Forest;Lake;Pasture/Old Field;Cultivated Field;Hedgerow;Intertidal Marine;Meadow;Deciduous/Broadleaf Forest;Conifer Forest - Mesic (average);Conifer Forest - Moist/wet;Mixed Forest (deciduous/coniferous mix);Marine Island;Beach;Urban/Suburban;Pond/Open Water;Reefs;Eelgrass Beds;Riparian Herbaceous;Mudflats - Intertidal;Sheltered Waters - Marine	N
Asio flammeus	Short-eared Owl	SC (Mar 2008)	Blue	Y	1-SC (Jul 2012)	Vertebrate Animal	birds	BG;BWBS;CDF;CWH;ICH;IDF;MS;PP;SBPS;SBS;SWB	Estuary;Marsh;Pasture/Old Field;Cultivated Field;Hedgerow;Meadow;Grassland;Urban/Suburban;Pond/Open Water;Riparian Herbaceous;Alpine/Subalpine Meadow;Alpine Grassland	N
Brachyramphus marmoratus	Marbled Murrelet	T (May 2012)	Blue		1-T (Jun 2003)	Vertebrate Animal	birds	CDF;CWH;MH	Kelp Bed;Riparian Forest;Stream/River;Lake;Rock/Sparsely Vegetated Rock;Conifer Forest - Mesic (average);Conifer Forest - Moist/wet;Subtidal Marine;Sheltered Waters - Marine	N
Chrysemys picta pop. 1	Painted Turtle - Pacific Coast Population	T (Nov 2016)	Red		1-E (Dec 2007)	Vertebrate Animal	turtles	CDF;CWH;MH	Bog;Fen;Swamp;Marsh;Riparian Forest;Riparian Shrub;Lake;Urban/Suburban;Pond/Open Water;Riparian Herbaceous;Gravel Bar;Industrial	N
Contia tenuis	Sharp-tailed Snake	E (Nov 2009)	Red	Y	1-E (Jun 2003)	Vertebrate Animal	reptiles	CDF;CWH	Caves;Sub-soil;Rock/Sparsely Vegetated Rock;Talus;Meadow;Conifer Forest - Dry;Garry Oak Coastal Bluffs	N
Contopus cooperi	Olive-sided Flycatcher	SC (May 2018)	Blue		1-T (Feb 2010)	Vertebrate Animal	birds	BWBS;CDF;CWH;ESSF;ICH;IDF;MH;MS;PP;SBPS;SBS;SWB	Bog;Fen;Swamp;Riparian Forest;Conifer Forest - Mesic (average);Conifer Forest - Moist/wet;Mixed Forest (deciduous/coniferous mix);Pond/Open Water	N
Eschrichtius robustus	Grey Whale	SC/E/NAR (May 2004)	Blue		1-SC (Jul 2005)	Vertebrate Animal	mammals		Subtidal Marine;Sheltered Waters - Marine;Pelagic	N
Eumetopias jubatus	Steller Sea Lion	SC (Nov 2013)	Blue		1-SC (Jul 2005)	Vertebrate Animal	mammals	CDF;CWH;MH	Kelp Bed;Intertidal Marine;Subtidal Marine;Marine Island;Reefs;Eelgrass Beds;Sheltered Waters - Marine;Pelagic	N

BC Species Ecosytem Explorer - Search Results (CDC 2018)

Scientific Name	English Name	COSEWIC	BC List	Garry Oak Ecosystem	SARA	Name Category	Class (English)	BioGeoclimatic Code	Habitat Subtype	Endemic
Hirundo rustica	Barn Swallow	T (May 2011)	Blue		1-T (Nov 2017)	Vertebrate Animal	birds	BAFA;BG;BWBS;CDF;CWH;ESSF;ICH;IDF;IMA;MH;MS;PP;SBPS;SBS;SWB	Estuary;Bog;Fen;Swamp;Marsh;Riparian Forest;Riparian Shrub;Stream/River;Lake;Pasture/Old Field;Cultivated Field;Hedgerow;Meadow;Grassland;Shrub - Natural;Sagebrush Steppe;Deciduous/Broadleaf Forest;Conifer Forest - Mesic (average);Conifer Forest - Dry;Conifer Forest - Moist/wet;Mixed Forest (deciduous/coniferous mix);Urban/Suburban;Pond/Open Water;Riparian Herbaceous;Antelope-brush Steppe;Gravel Bar;Shrub - Logged;Industrial	N
Megascops kennicottii kennicottii	Western Screech-Owl, *kennicottii* subspecies	T (May 2012)	Blue	Y	1-T	Vertebrate Animal	birds	CDF;CWH;MH	Riparian Forest;Pasture/Old Field;Hedgerow;Conifer Forest - Mesic (average);Conifer Forest - Dry;Conifer Forest - Moist/wet;Mixed Forest (deciduous/coniferous mix);Urban/Suburban	N
Patagioenas fasciata	Band-tailed Pigeon	SC (Nov 2008)	Blue	Y	1-SC (Feb 2011)	Vertebrate Animal	birds	CDF;CWH;ICH;IDF;MS;SBS	Riparian Forest;Pasture/Old Field;Cultivated Field;Deciduous/Broadleaf Forest;Conifer Forest - Mesic (average);Conifer Forest - Moist/wet;Mixed Forest (deciduous/coniferous mix);Hot Spring;Urban/Suburban;Warm Spring;Cold Spring	N
Pituophis catenifer catenifer	Gopher Snake, *catenifer* subspecies	XT (May 2012)	Red	Y	1-XX (Jan 2005)	Vertebrate Animal	reptiles	CDF;CWH	Cultivated Field;Rock/Sparsely Vegetated Rock;Talus	N
Pooecetes gramineus affinis	Vesper Sparrow, *affinis* subspecies	E (May 2018)	Red	Y	1-E (Dec 2007)	Vertebrate Animal	birds	CDF	Pasture/Old Field;Cultivated Field;Hedgerow;Grassland;Urban/Suburban	N
Rana aurora	Northern Red-legged Frog	SC (May 2015)	Blue		1-SC (Jan 2005)	Vertebrate Animal	amphibians	CDF;CWH;MH	Bog;Fen;Swamp;Marsh;Riparian Forest;Riparian Shrub;Stream/River;Lake;Meadow;Deciduous/Broadleaf Forest;Pond/Open Water;Riparian Herbaceous;Gravel Bar	N
Tyto alba	Barn Owl	T (Nov 2010)	Red	Y	1-SC (Jun 2003)	Vertebrate Animal	birds	BG;BWBS;CDF;CWH;ICH;IDF;PP	Marsh;Riparian Forest;Riparian Shrub;Pasture/Old Field;Cultivated Field;Hedgerow;Meadow;Grassland;Sagebrush Steppe;Mixed Forest (deciduous/coniferous mix);Urban/Suburban;Riparian Herbaceous;Antelope-brush Steppe;Gravel Bar	N
Flora										
Bartramia stricta	rigid apple moss	E (Nov 2009)	Red	Y	1-E (Jun 2003)	Nonvascular Plant		CDF;CWH	Garry Oak Coastal Bluffs	N
Entosthodon fascicularis	banded cord-moss	SC (May 2015)	Blue	Y	1-SC (Aug 2006)	Nonvascular Plant		CDF;CWH;ICHdm;ICHdw	Garry Oak Maritime Meadow	N
Syntrichia laevipila	twisted oak moss	SC (Nov 2014)	Blue	Y	1-SC (Jul 2005)	Nonvascular Plant		CDFmm	Garry Oak Woodland	N
Balsamorhiza deltoidea	deltoid balsamroot	E (Apr 2009)	Red	Y	1-E (Jun 2003)	Vascular Plant	dicots	CDFmm;CWHxm	Rock/Sparsely Vegetated Rock;Grassland;Mixed Forest (deciduous/coniferous mix);Sand Dune;Beach;Garry Oak Woodland	N
Bidens amplissima	Vancouver Island beggarticks	SC (Nov 2001)	Blue		1-SC (Jun 2003)	Vascular Plant	dicots	CDFmm;CWHdm;CWHms;CWHxm	Estuary;Marsh;Beach;Mudflats - Intertidal	N
Camissonia contorta	contorted-pod evening-primrose	E (Apr 2006)	Red		1-E (Dec 2007)	Vascular Plant	dicots	CDFmm	Sand Dune	N
Carex tumulicola	foothill sedge	E (Mar 2008)	Red	Y	1-E (Feb 2010)	Vascular Plant	monocots	CDFmm	Bog;Fen;Swamp;Marsh;Meadow;Grassland;Garry Oak Woodland	N
Castilleja levisecta	golden paintbrush	E (Nov 2007)	Red	Y	1-E (Jun 2003)	Vascular Plant	dicots	CDFmm	Garry Oak Maritime Meadow	N
Castilleja victoriae	Victoria's owl-clover	E (Apr 2010)	Red	Y	1-E (Jul 2012)	Vascular Plant	dicots	CDFmm	Vernal Pools/Seasonal Seeps;Garry Oak Vernal Pool	N
Cephalanthera austiniae	phantom orchid	E (Nov 2014)	Red		1-T (Jun 2003)	Vascular Plant	monocots	CDFmm;CWHdm;CWHxm	Conifer Forest - Mesic (average);Mixed Forest (deciduous/coniferous mix)	N
Epilobium densiflorum	dense spike-primrose	E (May 2005)	Red	Y	1-E (Aug 2006)	Vascular Plant	dicots	CDFmm	Meadow;Garry Oak Vernal Pool	N
Epilobium torreyi	brook spike-primrose	E (Apr 2006)	Red	Y	1-E (Dec 2007)	Vascular Plant	dicots	CDFmm	Meadow;Grassland;Conifer Forest - Dry;Garry Oak Woodland;Garry Oak Vernal Pool	N
Hosackia gracilis	seaside bird's foot lotus	E (Nov 2010)	Red	Y	1-E (Jun 2003)	Vascular Plant	dicots	CDFmm	Rock/Sparsely Vegetated Rock;Garry Oak Maritime Meadow	N
Juncus kelloggii	Kellogg's rush	E (May 2003)	Red	Y	1-E (Jan 2005)	Vascular Plant	monocots	CDFmm	Stream/River;Garry Oak Vernal Pool	N
Lasthenia glaberrima	rayless goldfields	E (Mar 2008)	Red	Y	1-E (Feb 2010)	Vascular Plant	dicots	CWHmm	Vernal Pools/Seasonal Seeps;Meadow;Garry Oak Vernal Pool	N
Limnanthes macounii	Macoun's meadow-foam	T (Nov 2004)	Red	Y	1-T (Aug 2006)	Vascular Plant	dicots	CDFmm;CWHxm	Meadow;Deciduous/Broadleaf Forest;Garry Oak Vernal Pool;Garry Oak Maritime Meadow	Y
Lomatium grayi var. *grayi*	Gray's desert-parsley	T (Nov 2008)	Red	Y	1-T (Feb 2011)	Vascular Plant	dicots	CDFmm;CWHxm	Cliff;Rock/Sparsely Vegetated Rock;Talus;Conifer Forest - Dry;Garry Oak Woodland	N
Lupinus densiflorus var. *densiflorus*	dense-flowered lupine	E (May 2005)	Red	Y	1-E (Aug 2006)	Vascular Plant	dicots	CDFmm	Cliff;Garry Oak Maritime Meadow	N
Lupinus lepidus	prairie lupine	E (Apr 2009)	Red	Y	1-E (Jun 2003)	Vascular Plant	dicots	CDFmm;CWHmm;CWHxm	Rock/Sparsely Vegetated Rock;Meadow;Garry Oak Maritime Meadow	N
Lupinus oreganus var. *kincaidii*	Kincaid's lupine	XT (Nov 2008)	Red	Y	1-XX (Feb 2011)	Vascular Plant	dicots	CDFmm	Rock/Sparsely Vegetated Rock;Grassland;Garry Oak Woodland	N
Lupinus rivularis	streambank lupine	E (Nov 2002)	Red		1-E (Jan 2005)	Vascular Plant	dicots	CDFmm;CWHdm;CWHxm	Stream/River;Meadow;Urban/Suburban;Mudflats - Intertidal;Garry Oak Woodland	N
Meconella oregana	white meconella	E (May 2005)	Red	Y	1-E (Aug 2006)	Vascular Plant	dicots	CDFmm;CWHxm	Rock/Sparsely Vegetated Rock;Deciduous/Broadleaf Forest;Garry Oak Coastal Bluffs	N
Microseris bigelovii	coast microseris	E (Apr 2006)	Red	Y	1-E (Dec 2007)	Vascular Plant	dicots	CDFmm	Vernal Pools/Seasonal Seeps;Rock/Sparsely Vegetated Rock;Meadow;Garry Oak Coastal Bluffs	N

BC Species Ecosytem Explorer - Search Results (CDC 2018)

Scientific Name	English Name	COSEWIC	BC List	Garry Oak Ecosystem	SARA	Name Category	Class (English)	BioGeoclimatic Code	Habitat Subtype	Endemic
Minuartia pusilla	dwarf sandwort	E (May 2004)	Red	Y	1-E (Jul 2005)	Vascular Plant	dicots	CDFmm	Vernal Pools/Seasonal Seeps;Meadow;Grassland;Conifer Forest - Dry;Garry Oak Vernal Pool	N
Orthocarpus bracteosus	rosy owl-clover	E (May 2004)	Red	Y	1-E (Jul 2005)	Vascular Plant	dicots	CDFmm	Pasture/Old Field;Meadow;Grassland;Garry Oak Maritime Meadow	N
Plagiobothrys tenellus	slender popcornflower	T (Nov 2008)	Red	Y	1-T (Feb 2011)	Vascular Plant	dicots	CDFmm	Meadow;Grassland;Conifer Forest - Dry;Garry Oak Woodland;Garry Oak Coastal Bluffs	N
Psilocarphus elatior	tall woolly-heads	E (May 2018)	Red	Y	1-E (Jun 2003)	Vascular Plant	dicots	CDFmm;CWHvh	Meadow;Garry Oak Vernal Pool	N
Ranunculus alismifolius var. *alismifolius*	water-plantain buttercup	E (Apr 2009)	Red	Y	1-E (Jun 2003)	Vascular Plant	dicots	CDFmm	Bog;Vernal Pools/Seasonal Seeps;Stream/River;Meadow;Garry Oak Vernal Pool	N
Ranunculus californicus	California buttercup	E (Nov 2008)	Red	Y	1-E (Feb 2011)	Vascular Plant	dicots	CDFmm	Rock/Sparsely Vegetated Rock;Garry Oak Maritime Meadow;Garry Oak Coastal Bluffs	N
Sanicula arctopoides	bear's-foot sanicle	T (Nov 2015)	Red	Y	1-E (Jun 2003)	Vascular Plant	dicots	CDFmm	Meadow;Grassland;Garry Oak Maritime Meadow	N
Sanicula bipinnatifida	purple sanicle	T (May 2001)	Red	Y	1-T (Jun 2003)	Vascular Plant	dicots	CDFmm;CWHxm	Rock/Sparsely Vegetated Rock;Deciduous/Broadleaf Forest;Garry Oak Woodland;Garry Oak Maritime Meadow	N
Sericocarpus rigidus	white-top aster	SC (Apr 2009)	Red	Y	1-SC (Jun 2003)	Vascular Plant	dicots	CDFmm;CWHxm	Rock/Sparsely Vegetated Rock;Meadow;Mixed Forest (deciduous/coniferous mix);Garry Oak Woodland	N
Silene scouleri ssp. *scouleri*	coastal Scouler's catchfly	E (May 2003)	Red	Y	1-E (Jan 2005)	Vascular Plant	dicots	CDFmm	Garry Oak Woodland;Garry Oak Maritime Meadow;Garry Oak Coastal Bluffs	N
Tonella tenella	small-flowered tonella	E (Nov 2003)	Red	Y	1-E (Jul 2005)	Vascular Plant	dicots	CDFmm	Vernal Pools/Seasonal Seeps;Rock/Sparsely Vegetated Rock;Talus;Conifer Forest - Dry;Garry Oak Woodland	N
Triphysaria versicolor ssp. *versicolor*	bearded owl-clover	E (Nov 2011)	Red	Y	1-E (Jun 2003)	Vascular Plant	dicots	CDFmm	Rock/Sparsely Vegetated Rock;Meadow;Garry Oak Vernal Pool	N
Triteleia howellii	Howell's triteleia	E (May 2003)	Red	Y	1-E (Jan 2005)	Vascular Plant	monocots	CDFmm	Meadow;Deciduous/Broadleaf Forest;Conifer Forest - Dry;Garry Oak Woodland;Garry Oak Coastal Bluffs	N
Uropappus lindleyi	Lindley's microseris	E (Mar 2008)	Red	Y	1-E (Feb 2010)	Vascular Plant	dicots	CDFmm	Cliff;Meadow;Deciduous/Broadleaf Forest;Conifer Forest - Dry;Garry Oak Coastal Bluffs	N
Viola praemorsa var. *praemorsa*	yellow montane violet	E (Nov 2007)	Red	Y	1-E (Jun 2003)	Vascular Plant	dicots	CDFmm;CWHxm	Pasture/Old Field;Meadow;Garry Oak Woodland	N
Zeltnera muehlenbergii	Muhlenberg's centaury	E (Mar 2008)	Red	Y	1-E (Feb 2010)	Vascular Plant	dicots	CDFmm	Vernal Pools/Seasonal Seeps;Meadow;Garry Oak Woodland;Garry Oak Maritime Meadow	N

Search Criteria
BC Conservation Status:Red (Extirpated, Endangered, or Threatened) OR Blue (Special Concern)
AND Identified Wildlife Status:True OR SARA Schedule 1 Status:True OR Provinicial Wildlife Act Status:True OR Migratory Bird Conventions Act:True OR CITES:True
AND COSEWIC Status:Extinct OR Extirpated OR Endangered OR Threatened OR Special Concern
AND MOE Regions:1- Vancouver Island (Restricted to Red, Blue, and Legally designated species)
AND Regional Districts: Capital (CRD)

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APPENDIX C

Victoria Search and Rescue Station Geotechnical Summary Report.

WSP Canada- October 16 2018

VICTORIA SEARCH AND RESCUE STATION

Geotechnical Summary Report

760 Enterprise Crescent
Victoria, BC V8Z 6R4
Canada

T: +250-475-1000
wsp.com

October 16, 2018

WSP Project # 181-06235-00

Department of Oceans and Fisheries
Integrated Technical Services
200 Kent St, Stn. 7W060
Ottawa, ON
K1A 0E6

Attention: **Shelley Boudreau, Director, Marine Engineering**

Subject: **Victoria Search & Rescue Station Geotechnical Summary Report**

Dear Madam:

1. INTRODUCTION

WSP Canada Inc. (WSP) was engaged by the Department of Fisheries and Oceans Canada (DFO) to provide engineering services for the proposed Search and Rescue Station on the Canadian Coast Guard, Victoria District Base in Victoria, BC. WSP's scope included a geotechnical site assessment and providing geotechnical recommendations for the proposed construction of a two-story Search and Rescue Station at the above referenced site.

WSP provided an inter-disciplinary proposal on 16 April 2018 that was accepted on 23 April 2018 by Shelley Boudreau of the DFO.

2. PROJECT INFORMATION

The Canadian Coast Guard Victoria District Base, Search and Rescue Station Site (the site) is located near the intersection of Huron Street and Dallas Road in Victoria, BC as shown in Figure 1: Site Location Plan attached in Appendix A.

The site is located within the Canadian Coast Guard Base in the south most corner of the property. The site is bound to the north by a staff parking lot, to the east by Dallas Road, to the south by the boat ramp at 187 Dallas Road. The ocean is approximately 30 m away to the west. The site was flat and generally vegetated with grass. Gravel was present at surface on the south corner of the proposed building location.

Architectural drawing issued by Number Ten Architectural Group on April 12, 2018 show the proposed Search and Rescue Building will consist of a two-story building. The building is proposed to be approximately 280 x 128 m. This building will be designed to be post disaster and will be able to withstand ground motions associated with the 1:2475 design earthquake.

3. SCOPE OF GEOTECHNICAL WORK

Our scope of geotechnical work was set out in our proposal and was to include:

- Review published and available in-house geotechnical information including geological mapping, aerial photography and historical projects within the general location;
- Conduct a BC one call and a private utility locate to ensure the project site is clear of existing utilities;
- Carry out a site assessment comprising test pits (and potentially boreholes if results of test pits were inconclusive);
- Prepare this geotechnical report to summarize and discuss the finding of the site work and give recommendations with respect to civil and structural design;
- Recommendations for seismic performance and site class; and
- Provide additional geotechnical input including field reviews during construction.

4. BACKGROUND INFORMATION

GEOLOGICAL MAPPING

Surficial geological mapping by British Columbia Geological Survey[1] notes the site is located in an area of fill material overlying bedrock or thin natural soils overlying bedrock. The natural soils are shown to be Victoria clay typically less than 5 m thick. Bedrock mapping[2] shows the bedrock beneath the site to be Colquitz gneiss described as a "quartz-feldspar gneiss."

HISTORICAL AERIAL PHOTOGRAPHY

Historic aerial photography available on VicMap[3] shows no significant changes on the site between 2005 and the current date. Historical photographs obtained by WSP for previous projects in the area shows a generally consistent site that dates back to 1946.

[1] Monahan P A & Levson V M. (2000) Quaternary Geological Map of Greater Victoria, Trim sheets (92B.043, 044, 053 & 052), Scale 1:25,000 BC Geological Survey
[2] Muller J E (1980) Geology Victoria Area Map 92B/NW, Scale 1:100,000. Geological Survey of Canada
[3] City of Victoria (2017). VicMap Retrieved on 6 June 2018 from http://vicmap.victoria.ca/SilverlightViewer/Viewer.html?Viewer=Victoria

5. FIELDWORK

WSP carried out a shallow subsurface assessment on 22 May 2018 that consisted of four test pits excavated by a backhoe provided by Michell Excavation of Victoria, BC. The test pit locations are shown on Figure 2: Test Pit Location Plan which can be found in Appendix A. The test holes were advanced until bedrock was confirmed. The encountered ground conditions varied somewhat from north to south and are summarized on the test pit logs in Appendix C.

The ground conditions encountered to the south can be summarized as:

- Topsoil or gravel surfacing to approximately 0.3m bgl; over
- Coarse shotrock fill to approximately 1m bgl; over
- Bedrock

The ground conditions encountered to the north can be summarized as:

- Topsoil to approximately 0.3m bgl; over
- Brown sand to approximately 0.5 to 0.8m bgl; over
- Variable fills including construction waste and organics to approximately 2.3 to 2.9m bgl; over
- Bedrock

Groundwater was not encountered in any of the test pits. The test pits to the south had stable pit walls during excavation. The northern test pits walls were unstable during excavation and experienced caving. All test pits were backfilled with the excavated materials.

The test pit logs are appended

6. GEOTECHNICAL COMMENTS AND RECOMMENDATIONS

GENERAL

The following geotechnical comments and parameters are related to the information that was available to WSP at the time of writing this report. We understand that the information will be used by the DFO to develop a construction methodology for the site preparation.

The site-specific assessment work carried out by WSP as outlined above indicates that the site is underlain by fill materials ranging from 1 to 3 m below ground surface overlying bedrock. We understand that the proposed building will be a slab on grade two storey building.

WSP must carry out field reviews during construction to verify the assumptions made in this report.

SEISMIC SITE CLASSIFICATION / SEISMIC HAZARD

Information on the Natural Resources Canada website (2015 hazard calculator) provides a peak ground acceleration (PGA) value of 0.582g for the site. Based on the results of the of our test pits the fill materials present would lead to a Site Class F being assigned. However, should the recommendations provided in this report be followed then the engineered fill above bedrock would lead to a Site Class D being assigned. Should the foundation loads be taken directly down onto bedrock then this classification could be relaxed further.

Based on the CRD regional mapping tool, the site contours suggest that the site grade is around 3.5 m above datum. The City of Victoria "Tsunami Readiness" guidance indicates that the site is anticipated to have a maximum water level in the order of 3 m following a magnitude 9.0 earthquake.

SITE PREPARATION

All organic soils and fill should be removed from the proposed building footprint. All debris and organic material should be removed from the project footprint. The excavation should extend laterally minimum 1 m beyond the edge of the proposed building footprint (and allow for the necessary engineered fill slope required to bedrock).

The exposed subgrade (which based on our test pits will be bedrock) should be reviewed by WSP prior to placement of all fill materials or foundation elements. The fill should be placed on a relatively flat surface and this may require the contractor to locally hoe-ram the bedrock to create a level surface.

An effective erosion and sediment control plan should be in place prior to excavation and monitored for its effectiveness during construction.

ENGINEERED FILL

Engineered fill where required to support any foundation elements should consist of well graded, 75 mm minus crushed rock placed in maximum 300 mm loose lifts and compacted to 95% of Modified Proctor Maximum Dry Density. In-place density testing should be performed to verify that this density has been achieved prior to the placement of additional fill or foundation elements. WSP can provide this service, if professional sign-off is required for the geotechnical discipline. The engineered fill should extend at least 1 m outside the building foundation footprint and have side slopes no steeper than 1.5(H):1(V).

BEARING RECOMMENDATIONS

Provided the above recommendations are followed, serviceability (SLS) and factored ultimate (ULS) bearing pressures of 150kPa and 225kPa, can be assumed for footings on engineered fill, respectively.

BURIED UTILITIES

Consideration should be given to the potential ground movement during a severe seismic event and the effect this may have on buried utilities leading to the building. If the building is to be post-disaster status then it may be prudent that the overall design allows for a utility corridor that is outside the fill area or is treated in the same 'excavate and replace' methodology as described above for the building foundations.

7. FUTURE GEOTECHNICAL WORK

We anticipate the following geotechnical work after the submission of this report:

- Correspondence and clarification with the Contractor and client; and,
- Field reviews during construction, to verify our assumptions made in this report.

We have not allowed for letters of assurance in our proposal; however, we can provide these if requested.

8. CLOSURE

This report was prepared in accordance with our service contract with the Department of Fisheries and Oceans for this project and the attached Terms of Reference for Geotechnical Reports.

This document represents an electronic version of the original hard copy document, sealed, signed and dated by Russell Scott, M.Sc., P. Eng. and retained on file. The content of the electronically transmitted document can be confirmed by referring to the original hard copy on file.

Yours sincerely

WSP Canada Inc.

Prepared by:

Robin Purvis, EIT
Geotechnical Engineer

Reviewed by:

Don Kaluza, P.Eng.
Senior Geotechnical Engineer

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
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40972

Russell Scott, M.Sc., P.Eng.
Senior Geotechnical Engineer

Appendix A – Site Location Plan
Appendix B - Test Pit Location Plan
Appendix C – WSP Test Pit Records
Appendix D – WSP Site Photo Record
Appendix E – Terms of Reference for Geotechnical Reports

APPENDIX

A SITE LOCATION PLAN

Base drawing from CRD Atlas. Retrieved on May 23 2018 from https://maps.crd.bc.ca/Html5Viewer/?viewer=public

PROJECT: VICTORIA SEARCH AND RESCUE STATION

CLIENT: DEPARTMENT OF FISHERIES AND OCEANS CANADA

TITLE: SITE LOCATIONS

DATE: JUNE 2018

DESIGN BY: SD

DRAWN BY: RP

CHECKED BY: RS

SCALE: NTS

PROJECT No.: 181-06235-00

FIGURE NO.: 1

WSP Canada Inc.
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APPENDIX

B TEST PIT LOCATION PLAN

Legend

Test Pit

Base drawing from CRD Atlas. Retrieved on May 23 2018 from https://maps.crd.bc.ca/Html5Viewer/?viewer=public

PROJECT: VICTORIA SEARCH AND RESCUE STATION

CLIENT: DEPARTMENT OF FISHERIES AND OCEANS CANADA

TITLE: TEST HOLE LOCATIONS

DATE: JUNE 2018
DESIGN BY: RP
DRAWN BY: RP
CHECKED BY: RS
SCALE: NTS
PROJECT No.: 181-06235-00
FIGURE NO.:

WSP Canada Inc.
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APPENDIX

C TEST PIT RECORDS

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Victoria Search and Rescue Station
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17 Huron Street
Victoria, BC

TP18-01
Pg 1 of 1
Project No: 181-06235-00

Depth (m)	Depth (ft)	Description	C	N	Type/ Sample # / Recovery	Water Level
		FILL - grey GRAVEL, coarse grained, angular, some sand, dry				
		FILL - grey GRAVEL, fine to coarse grained, angular, some cobbles, some sand, some boulders				
1	2					
	4	Weathered BEDROCK				
		End of hole at 1.2m in bedrock				
2	6					
	8					
3	10					
	12					
4	14					
	16					

10 20 30 40 50 60 70 80 90

C: Condition of Sample
Good
Disturbed
No Recovery

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:
DCPT Blow/300 mm

Plastic Limit (%) ▶—● Liquid Limit (%)
Moisture Content (%)
Ground Water Level
Shear strength in kPa (Torvane)
PP Pocket Penetrometer (compressive strength in kPa)
Shear strength in kPa (Unconfined)
Shear strength in kPa (Field vane)
Remolded strength in kPa
Percent Passing # 200 sieve

Drill Method: Test Pit
Date Drilled: 5/22/2018
Logged by: RP
Checked by: RS

SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.

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Victoria, BC

TP18-02

Project No: 181-06235-00

Depth (m)	Depth (ft)	Description	C	N	Type/ Sample # / Recovery	Water Level
		FILL - brown organic SILT, some sand, some rootlets, dry to moist				
		FILL - brown SAND, some gravel, fine to coarse grained, subrounded to subangular, some silt, dry				
0 - 1	0 - 2	FILL - dark brown sandy SILT, some organics, some zones of plastic clay, some construction waste, trace wood, trace metal, trace asphalt				
1 - 2	2 - 6					
2 - 3	6 - 10					
3	10	End of hole at 2.9m on assumed bedrock				
4	12 - 16					

10 20 30 40 50 60 70 80 90

C: Condition of Sample
Good
Disturbed
No Recovery

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:
DCPT Blow/300 mm

Plastic Limit (%) ▶ ● ◀ Liquid Limit (%)
Moisture Content (%)

- Ground Water Level
- Shear strength in kPa (Torvane)
- PP Pocket Penetrometer (compressive strength in kPa)
- Shear strength in kPa (Unconfined)
- Shear strength in kPa (Field vane)
- Remolded strength in kPa
- Percent Passing # 200 sieve

Drill Method: Test Pit
Date Drilled: 5/22/2018
Logged by: RP
Checked by: RS

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17 Huron Street
Victoria, BC

TP18-03

Project No: 181-06235-00

Depth (m)	Depth (ft)	Description	C	N	Type/ Sample #	Recovery	Water Level
		FILL - brown organic SILT, some sand, some rootlets, dry to moist					
	2	FILL - grey GRAVEL, fine to coarse grained, angular, some cobbles, some sand, some boulders					
1							
	4	Weathered BEDROCK					
		End of hole at 1.3m in bedrock					
	6						
2							
	8						
	10						
3							
	12						
4							
	14						
	16						

10 20 30 40 50 60 70 80 90

C: Condition of Sample
Good
Disturbed
No Recovery

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:
DCPT Blow/300 mm

Plastic Limit (%) ▶ ● ◀ Liquid Limit (%)
Moisture Content (%)

- Ground Water Level
- Shear strength in kPa (Torvane)
- PP Pocket Penetrometer (compressive strength in kPa)
- Shear strength in kPa (Unconfined)
- Shear strength in kPa (Field vane)
- Remolded strength in kPa
- Percent Passing # 200 sieve

Drill Method: Test Pit
Date Drilled: 5/22/2018
Logged by: RP
Checked by: RS

SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.

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17 Huron Street
Victoria, BC

TP18-04

Project No: 181-06235-00

Depth (m)	Depth (ft)	Description	C	N	Type/ Sample # / Recovery	Water Level
		FILL - brown organic SILT, some sand, some rootlets, dry to moist				
	2	FILL - brown SAND, some gravel, fine to coarse grained, subrounded to subangular, some silt, dry				
1	4	FILL - dark brown sandy SILT, some organics, some zones of plastic clay, some construction waste, trace wood, trace metal, trace asphalt				
2	6					
	8	End of hole at 2.3m on assumed bedrock				
3	10					
	12					
4	14					
	16					

10 20 30 40 50 60 70 80 90

C: Condition of Sample
Good
Disturbed
No Recovery

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:
DCPT Blow/300 mm

Plastic Limit (%) ▶ ● ◀ Liquid Limit (%)
Moisture Content (%)

- Ground Water Level
- Shear strength in kPa (Torvane)
- PP Pocket Penetrometer (compressive strength in kPa)
- Shear strength in kPa (Unconfined)
- Shear strength in kPa (Field vane)
- Remolded strength in kPa
- Percent Passing # 200 sieve

Drill Method: Test Pit
Date Drilled: 5/22/2018
Logged by: RP
Checked by: RS

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APPENDIX

D SITE PHOTO RECORD

PHOTO TABLE

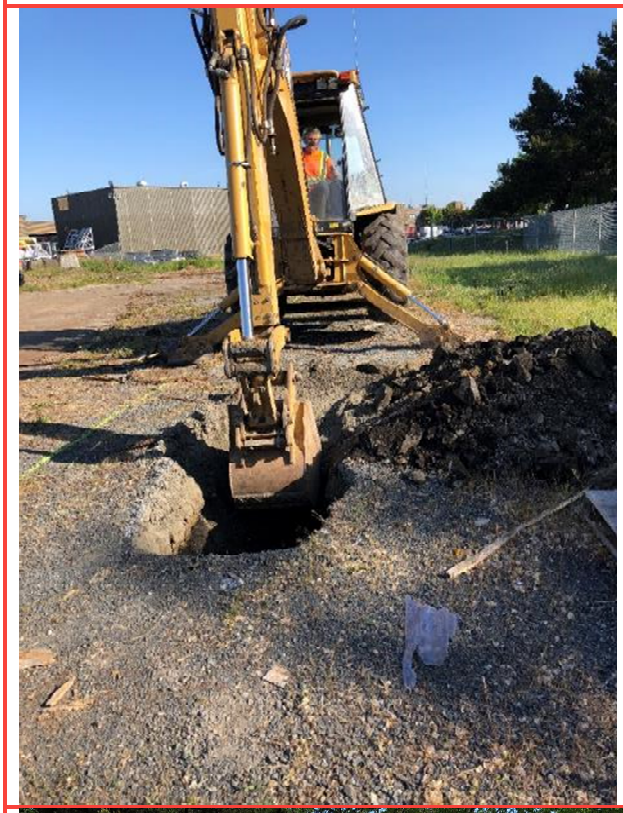
Photo	Description
	Photo 1: TP18-01 test pit location
	Photo 2: TP18-02 test pit location

Photo 3: TP18-01 terminated at 1.2m in bedrock

Photo 4: TP18-02 terminated at 2.9m in bedrock

Photo 5: TP18-03 terminated at 1.3m in bedrock

Photo 6: TP18-04 terminated at 2.3m in bedrock

APPENDIX

E TERMS OF REFERENCE FOR GEOTECHNICAL REPORTS

TERMS OF REFERENCE FOR GEOTECHNICAL REPORTS ISSUED BY WSP CANADA INC.

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